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The StarGazer

Newsletter of the Rappahannock Astronomy Club

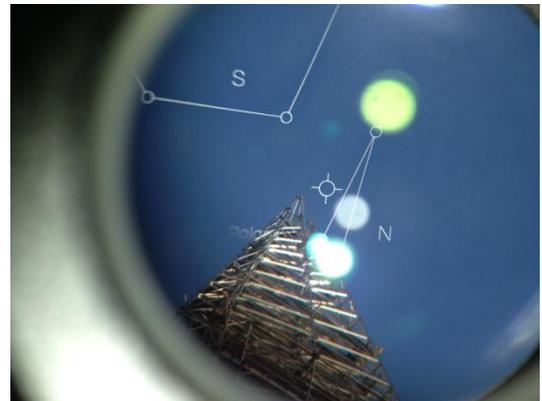
No. 1, Vol. 2 May 2013–July 2013

Astronomy Night on the National Mall Brings the Universe Down to Earth

By Terry Barker and Linda Billard

We had a terrific night in Washington, DC, on Friday, June 14. Terry Barker, Linda and Bart Billard, and Jerry Hubbell participated in the third Annual [Astronomy Festival on the National Mall](#), sponsored by Hofstra University and supported by NASA and the Smithsonian Air and Space Museum. This was the first time RAClub was invited to participate in this astronomical extravaganza featuring optical and radio telescope observations, exhibits, hands-on activities, and a multimedia presentation, and gave the public a chance to mingle with real astronomers.

Our little RAClub group joined local volunteers from the National Capital Astronomers, the Northern Virginia Astronomy Club (NOVAC), the Astronomical Association of Greenbelt, the Goddard Astronomy Club, Project Jove (radio observations of the Society of Amateur Radio Astronomers Jupiter), setting up telescopes on the Mall, northeast of the Washington Monument near the corner of 15th Street and Constitution Avenue.



Washington Monument Through Mount Finder (Source: Debbie Green)



Getting Set Up (Source: Linda Billard)

We brought five telescopes to the event (including the club's solar scope). What a great location this was, attracting a good portion of the attendees from the tourists who just happened to be walking by...saw a crowd on the mall...and decided to investigate.

This free public stargazing was organized by Dr. Donald Lubowich, Coordinator of Astronomy Outreach at Hofstra University. He also runs Hofstra's very successful NASA-funded *Music and Astronomy Under the Stars* program, which takes telescopes to concertgoers on Long Island, New York City, Newport, Rhode Island, at Tanglewood in Massachusetts, and at the Ravinia Music Festival outside Chicago.

"Bringing Hofstra's program to the National Mall and partnering with astronomical organizations gives us a very special opportunity to encourage children to pursue their interest in science or math and to promote public understanding of science," said Dr. Lubowich. "Gazing at the rings of Saturn or the Moon's craters and mountains captures the imagination, no matter how old you are."

(continued on page [8](#))

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 \$15 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 closest 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.

The StarGazer

May 2013–July 2013

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[Editor: Linda Billard](#)

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Website: www.raclub.org

Yahoo Group:

http://tech.groups.yahoo.com/group/rac_group/

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[Jerry Hubbell](#) Astrophotography

Calendar of Upcoming Events

Star Party, Caledon	August 10
Club Picnic, Belmont Observatory*	August 17
Star Party, Caledon	August 29
Club Meeting, Maury School	September 18
Star Party, Caledon	September 28
Club Meeting, Maury School	October 16
Star Party, Caledon	October 26

Recent Outreach Events Completed

Star Party, Caledon State Park, King George	May 4
Star Party, Post Oak Middle School, Spotsylvania	May 17
Star Party, Caledon State Park, King George	June 1
Astronomy Festival, National Mall, DC	June 14
Star Party, Caledon State Park, King George	June 29

*Includes brief meeting. Members only

President's Corner

One of the things I like best about summer nighttime observing is that the temperature is mostly pleasant, as long as the mosquitoes stay away, and the seeing can be the best that it can be all year. Typically, the sky during the summer is rather hazy and not as transparent as in the cold of winter. The added moisture stabilizes the atmosphere, enabling us to use higher magnifications on those bright planets and on the Moon. Check out Scott's "Astronomy Math" below to see what is really possible. Saturn has been at its peak this past quarter and is still favorably placed early in the evening right after twilight. Venus and Mercury were fine sights this quarter also in the twilight of the evening.

Welcome to New RAClub Members (May–July)

❖ John Ulrich

This quarter's *StarGazer* has a new look. The attractive new colors and fonts give you a "preview" of the club's new website, which the Communications Committee is moving ahead on and hopes to complete soon. Before telling you about the great articles in this issue, I would like to welcome new member John Ulrich to the club. I know he will enjoy his time with us at meetings and star parties.

This newsletter's lead article is about a very cool national outreach event sponsored by Hofstra University. At the Astronomy Night on the National Mall, several RAClub members joined members of other Washington area clubs to set up telescopes at the Washington Monument for a busy night of observing the Moon and Saturn—with several thousand visitors. Because this year seems to be the year of the comet, Linda has written an excellent article about comet ISON. Joe Fordham makes his newsletter debut with his first article about using binoculars for serious observing. I have provided an article about how you can enhance your enjoyment of your astronomical pursuits by sharing your knowledge and experience with others, and it doesn't even have to take a lot of time!

In addition to the synopses of this quarter's presentations, there's a short article about the remarkable amateur supernova hunter Tim Puckett, and Bart has reviewed a couple of book selections that may interest you. And finally, don't forget about the excellent imaging our club members are capable of—check out the Image of the Quarter. Congratulations go to Ben for a job well done!

I hope you enjoy this installment of the *StarGazer*. Don't forget to send your article ideas to Linda.

Until next time, Clear Skies!—*Jerry Hubbell*

Astronomy Math: Matching Eye to Telescope

by Scott Busby

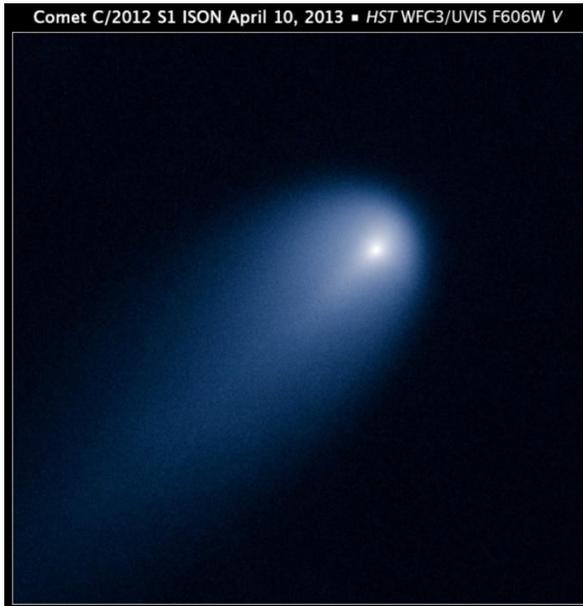
The [Dawes Limit](#) determines the smallest separation between two stars that the telescope can resolve, as described in [Resolving Power](#). For a person to see that separation, the telescope needs to magnify the separation to one the eye can resolve, which is 2 minutes of arc, or 120 arc-seconds. So then we have Magnification \times Resolving Power = 120 arc-seconds, and since resolving power is $P_R = 120/D_o$, then

$$M \times P_r = \frac{M \times 120}{D_o} = 120, \text{ which reduces (quickly) to } M_{\max} = D_o$$

Wow. Do you see what this is saying? The maximum magnification of the telescope can be found by simply looking at the diameter of the scope in mm. So, if I look at the front of an 8-inch scope, it says "D=203mm"—I know the maximum magnification is 203. Or, if I look at the front of my ETX where it says "D=90mm," I know the maximum magnification is 90. If I look at my Meade 6600 6-inch scope where it says "D=152mm," I know the maximum magnification for that scope is 152. This is very handy to know.

ISON—Dazzle or Dud?

by Linda Billard



ISON taken by Hubble Space Telescope (Source: NASA)

He voiced concern that “the initial announcements by professional astronomers concerning ISON’s potential future brightness (“Brighter than the Full Moon”, etc.) were wildly excessive, as was the idea that the comet would be obvious to the general public in the daytime sky as it rounded the Sun in late November. This claim was totally unjustified from the word go.”

Part of what alerted astronomers that Comet ISON could be unusual was how bright it was despite how far away it was when Novichonok and Nevski found it—6.7 astronomical units (AU)—coupled with its close approach of 0.012 AUs (1.1 million kilometers, accounting for the solar radius) from the surface of the Sun at perihelion. Though relatively bright for its distance around the time of its discovery, it brightened little in the ensuing months, plateauing at magnitude 15 from winter through spring 2013. Only amateur astronomers equipped with larger telescopes saw anything of the tiny comet.

In an interview with [Universe Today](#), Bortle put the prospects for Comet ISON in context. He pointed out that, “Comets coming into the near-solar neighborhood from the Oort Cloud for the very first time tend to behave rather differently....” They often show early activity far from the Sun, which is misleading in predicting subsequent behavior. Only when such comets reach about 1.5 to 2.0 AUs from the Sun do they reveal their true brightness and development characteristics. “When [comets are] discovered far from the Sun...astronomers [have been] misled time and again into announcing that a grandiose display is in the offing, only to have the comet ultimately turn out to be a general disappointment.”

Bortle, however, isn’t ready to say ISON is a dud just yet. “With this comet’s exceedingly small perihelion distance, the ultimate situation is less clear,” and ISON is “really difficult to predict at the moment.”

At best, comets are unpredictable even for the experts. Unfortunately, media hype tends to pump up even the most carefully worded hypotheses of astronomers. And so it is with Comet C/2012 S1 ISON.

Artyom Novichonok and Vitali Nevski discovered ISON on September 21, 2012, while conducting the International Scientific Optical Network (ISON) survey. Since then, the media has been doing what it does best—spreading the word without much attention to the details. But, as they say...the devil is in the details.

Will Comet ISON perform up to expectations? Depends on whose expectations you’re measuring against. John Bortle, veteran comet hunter and observer, has tried to keep his estimates conservative and warned about inflated predictions in a [Sky & Telescope](#) post and an email interview with [Universe Today](#) on what to expect.

Animated View of ISON’s Path

For a fascinating animated view of ISON’s path into and out of our solar system, visit NASA’s [STEREO \(Solar Terrestrial Relations Observatory\) site](#). Scientists have created a clever two-panel video to show the path both from above and from the side. STEREO consists of two space-based observatories—one ahead of Earth in its orbit, the other trailing behind. Its primary purpose is to observe the structure and evolution of solar storms as they blast from the Sun and move out through space. However, the STEREO spacecraft are expected have a spectacular view of ISON as it passes the Sun.

So, will it be a fine binocular comet (like PANSTARRS) or the “comet of the century”? Will it survive its perihelion on November 28?

John Bortle’s Current Best Guess

Comet ISON is now behind the Sun and will not return to morning skies until late August. In early October, it should reach +10th magnitude, well placed in the eastern sky, and become visible with binoculars and small telescopes. On the morning of October 14, expect a beautiful conjunction of Mars, Regulus, and ISON.

Comet ISON should first become faintly visible to the naked eye under dark skies about November 10, about 3 weeks before it reaches perihelion. It will brighten steadily to 2nd magnitude (about as bright as the stars of the Big Dipper) or 3rd magnitude before disappearing in morning twilight.

Do not expect a bright or long tail before perihelion on November 28 when

ISON flies less than 1 solar diameter (684,000 miles) above the surface of the Sun. The comet will briefly surge to magnitude -6 or six times brighter than Venus. Under very clear skies, and carefully blocking the Sun, skywatchers may see, with the naked eye or binoculars, a small spot of light with a stubby tail.

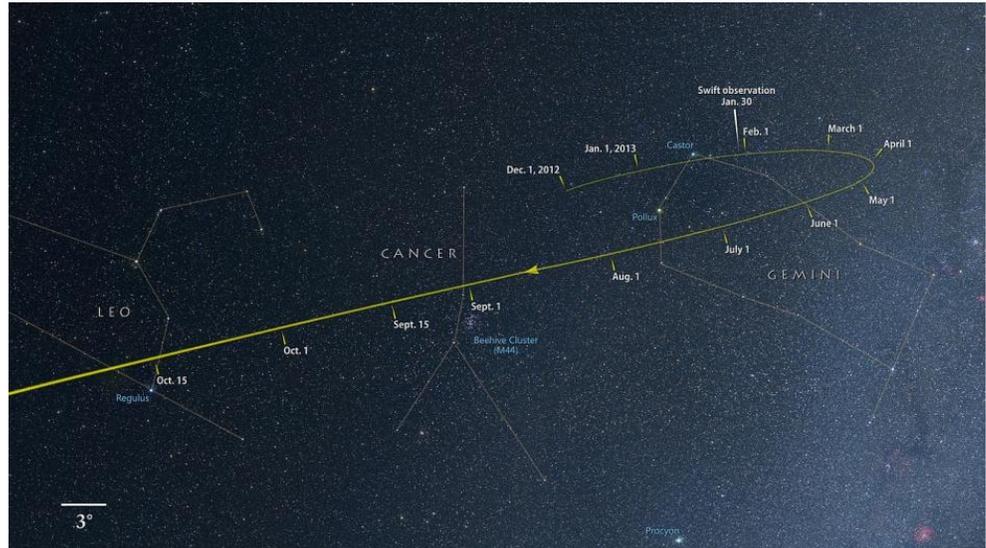
ISON will quickly leave the Sun’s vicinity and fade, but the best show should be in early December as it approaches Earth. Although its head is likely to dim rapidly, the comet’s tail will grow longer and become a dramatic sight in the morning sky before Christmas. Bortle suspects the comet could disintegrate during its close solar encounter, freeing up even more dust to fuel the tail but causing the head to ultimately fade from sight.

The grand finale occurs December 10–14, when it will loom like a large fluffy feather floating on the eastern horizon in the dawn sky. ISON passes closest to Earth the day after Christmas but will be fading quickly. Throughout its passage, professional and amateur astronomers will coordinate their observations in a [special campaign](#) to study every aspect of the comet’s development. The largest and smallest telescopes will have their eyes glued to this 3-mile wide spinning hunk of dusty ice. Let’s hope for a great show.

Serious Binoculars for Serious Astronomical Observing

By Joe Fordham as told to Linda Billard

Binoculars have always been a convenient tool for stargazing. Light and portable (compared with a telescope), they offer beginners a relatively inexpensive way to get started learning the sky. For more experienced amateurs (and professionals), they offer an extra tool for locating and examining objects and for use when a telescope isn’t a good option. Although I’ve had several telescopes, I particularly appreciate the convenience and relative inexpense of binoculars.



Path of ISON to Late October 2013 (Source: NASA)

So, how did I get started in astronomy? With binoculars, of course! My father and grandfather always carried binoculars for nature watching, hunting, and fishing. When I tried using them on the night sky, I found a new hobby! Although I've had several telescopes over the years, I've used binoculars consistently (and independent of the telescopes). They've allowed me to pursue my hobby even when traveling extensively for work. Binoculars work well from a suitcase and are ready to use in seconds.



Fujinon 16x70 (Source: Google Images)

freedom, allow me to comfortably use binoculars that are too heavy to handhold. The resolution of steady (mounted) binoculars is roughly twice as good as handheld. The zero gravity chair allows me to be outrageously comfortable while viewing the whole sky to the zenith. I also own Nikon Action Express (AE) 8x40s for nature. The Nikon AEs are cheaper (about \$120 new) and provide good quality views while handheld.



Garrett Optical 20x110 and Universal Astronomics Millenium Mount (Source: Google Images)

What do I use now? I started out with a cheap “hobby killer” telescope and borrowed binoculars. One of my first purchases was a pair of Celestron 10x50 rubber-armored binoculars for fishing, scuba diving, and astronomy. I still have those trusty 10x50s, but they're not used much because of their lower quality/weight ratio. Currently, my binoculars of choice are Fujinon 16x70 and Garrett Optical 20x110 with a Universal Astronomics Millenium parallelgram mount and a “zero gravity” chair for astronomy. The Fujinon's are very good quality, providing impressively accurate views. The Garrett Optical binoculars gather a lot of light for fainter objects. The UA Millenium mount, with its steady 5 degrees of

Why binos and not a telescope? My comfort with binos developed with my travels, and also because, for young people, binos are cheaper than telescopes. However, binocular magnification is comparatively low, which is problem for planets and light pollution. Now that I rarely travel for my job, I have purchased a Takahashi TSA102 telescope with a DM6 Discmount and a Sky Commander digital setting circle. However, I continue to use binoculars and investigate new and improved products.

What are some of my favorite targets or types of targets? I go for galaxies with the 20x110s using the parallelgram mount. Any target at night is fair game for the Fujinon binos. In general, the large field of view and comfort of using both eyes with binoculars is a great way to become more familiar with the cosmos.

What are some of my favorite observing locations? Dark sky mountaintops give the feeling of being lifted to the heavens compared with life at lower elevations near a city. On the ocean at night, it is extremely dark but you rarely use optical magnification because of the wave motion. Where's the best place I've been? Nothing beats dark skies. New Zealand's South Island had the advantage of being beautiful all day and all night. Siberia had very little light pollution and low humidity. The drawback is temperatures of -40 degrees at night accompanied by a constant voice in your head trying to convince you

that the dark sky view of the comet is worth freezing.

By the way, binoculars are good for close-ups as well as distant objects. My son has Pentax Papilio 6.5x21 binos, which are close to a handheld microscope, with an 18-inch near focus. This little Pentax is good for zoos and museums.

What's next on my shopping list? My next purchase may be a pair of Canon “stabilized” binoculars. Image-stabilized binoculars have a mechanism to decrease apparent motion of the view caused by binocular movement. Higher power binoculars magnify, but the image shift is also greater even with small movements of your hands. Image stabilization technology ensures instant adjustment of the image to compensate for the motion.



Papilio 6.5x21 for Close-Ups of Nature (Source: Good Images)

Tim Puckett and POSS—Hunting Supernovae

by Linda Billard

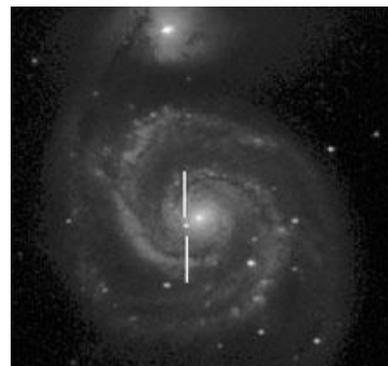


Tim Puckett (Source: Sky and Telescope)

Tim Puckett is a remarkable amateur astronomer and astrophotographer. For more than 30 years, he has observed and photographed the sky, most of that time spent searching for supernovae—exploding stars.

Initially, his primary interest was comets, and working mostly solo, he used the 60-cm Ritchey-Chrétien and 50-cm folded reflectors he built himself. However, with the development of the automated technology of the [LINEAR Program](#), Puckett changed his focus to search for supernovae. He was looking for comets when he and others chanced upon Supernova 1994I (see photo at below) in the Whirlpool Galaxy. That discovery was only the first of hundreds by Puckett's volunteer observers in the years to come.

Puckett is now the sponsor and primary investigator of the [Puckett Observatory World Supernova Search \(POSS\)](#). The popularity of POSS has grown—the team now encompasses 20 volunteer amateurs of all ages (high school to retired) from all over the world (United States, Canada, Italy, Greece, India). The team uses four dedicated telescopes to record candidate galaxies and analyzes the resulting images looking for supernovae. Collectively, the team has discovered more than 270 supernovae since 1994. Their discoveries are reported to the [IAU's CBAT](#), allowing professional astronomers to confirm and further analyze the photographs and data.



Supernova 1994I in the Whirlpool Galaxy (Source: Tim Puckett)

The team's discoveries include a new breed of supernova labeled Type Iax. Previously, supernovae were divided into core-collapse or Type Ia categories. The latter were the complete disruption of a tiny white dwarf. The new type, Iax, is fainter and less energetic than Type Ia. Researchers have concluded that although both come from exploding white dwarfs, Type Iax supernovae may not completely destroy the white dwarf. No Type Iax has appeared in elliptical galaxies, which are filled with old stars. This suggests they come from young star systems. Professional astronomers, based on a variety of observational data, including that from POSS, have concluded that a Type Iax supernova comes from a binary star system containing a white dwarf and a companion star that has lost its outer hydrogen, leaving it helium dominated. The white dwarf collects helium from the normal star. Researchers aren't sure what triggers a Type Iax. It's possible that the outer helium layer ignites first, sending a shock wave into the white dwarf. Alternatively, the white dwarf might ignite first owing to the influence of the helium shell. Whatever the cause, it appears that in many cases, the white dwarf survives the

explosion, unlike with a Type Ia supernova, where the white dwarf is destroyed. The professionals calculate that Type Ia supernovae are about a third as common as Type Ia supernovae. The reason so few have been detected is that the faintest are only one-hundredth as bright as a Type Ia supernova—quite a challenge for observers, amateur or otherwise.

Tim Puckett now treats POSS like a second job. His “real job” is with [Apogee Imaging Systems](#) as an astronomy sales engineer, but he combines traveling to attend conventions with scanning his team's observations, and recruiting POSS volunteers. In addition, Puckett's photos of comets and deep-sky objects have been published in books and magazines in several countries, including Great Britain, Japan, Italy, Germany, Australia, and South Africa. His work has also been featured on ABC, NBC, CBS, FOX, CNN, BBC, The Discovery and Learning Channels, and Good Morning America.

In recognition of Puckett's contributions to the field of astronomy, asteroid PUCKETT = (32096) = 2000 KO38 was named in his honor. In 2012, Puckett received the American Astronomical Society's Chambliss Amateur Achievement Award, presented for an achievement in astronomical research made by an amateur astronomer. The award citation reads: "To Tim Puckett for his Puckett Observatory World Supernova Search program that has discovered more than 200 supernovae."

Longtime collaborator Alex Langoussis, amateur astronomer and professor at Emory University, describes his experiences working with Puckett as follows: “Since 1998, I've had the privilege of working with Tim Puckett and the Puckett Observatory Supernova Search, looking for exploding stars in distant galaxies.” Each clear night, several automated telescopes image more than 1,000 galaxies in the course of the evening. “The next day, volunteers like myself analyze the images, comparing them with those in our archives, seeking out the ‘new stars’.” Langoussis has more than 24 supernovae discoveries to his credit.

Astronomy Night on the National Mall Brings the Universe Down to Earth (continued from page 1)

Starting at 5 pm., visitors of all ages were able to view sunspots. We provided views of the Sun through both the club's solar scope and the NexStar (with filter). Jerry also tried an interesting experiment, pointing his mount alignment scope at the top of the Washington Monument. The photo that leads this article was taken through the scope by a visitor using her iPhone who later sent the resulting pictures to Jerry. After dusk until 11 p.m., all telescopes provided views mostly of the first-quarter Moon and Saturn. Light pollution made viewing dimmer objects difficult, but the seeing was excellent so the visitors were treated to a beautiful viewing night.

Representatives from some of the nation's foremost astronomical and educational institutions were on hand to answer questions about careers in science, celestial objects and events, and the latest astronomical discoveries, including the American Astronomical Society, Astronomy Outreach Foundation, Goddard Space Flight Center, the Goldstone Apple Valley Radio Telescope (bringing radio astronomy to classrooms), Hubble Space Telescope, International Dark Sky Association, Johns Hopkins University, National Science Foundation Division of Astronomical Sciences, the University of Maryland, and the US Naval Observatory.



Bart Manning the Solar Scope (Source: Linda Billard)

All told, we had more than a dozen telescopes set up from 5 pm to 11 pm, and an estimated 1,500–2,000 visitors dropped by and waited patiently in line to look. Terry reports, “I know I had a constant stream of people looking through my 4-inch Celestron from about 7 to 11. I talked to so many people that my voice was hoarse toward the end.”

Terry decided investigate how the people found out about the event. He began asking people, and concluded that about a third of them were on a mailing list from either Hofstra or UM. Another third found out through Meet Up Groups or just browsing the Internet. The rest just saw a crowd when they were passing by—the larger the crowd got, the more people were attracted to the event. Terry says, “I managed to attract a few people myself, by virtue of the t-shirts that Linda had made for us that showed the RAClub logo on the front and had large text on the back with the name of the event. As I walked around a little, looking for something for dinner, people noticed the shirt and asked me about it.” Typical “walk-ins” (or in this case “ride-ins”) were a couple on mountain bikes returning home after playing volleyball on the Mall. They stopped to talk to Linda, asking what was going on. “When I explained, they said ‘cool’ and asked if I would keep an eye on their bikes. I said I would but pointed out that with all the expensive equipment around, all the astronomers were pretty vigilant anyway. They stayed for several hours,” she said.

Bart gets the award for drawing the most enthusiastic response from the crowd—a man started yelling to his companions “Get over here and see this—you’re not going to believe it! And I’m not going to tell you what it is.” It was, of course, Saturn.

Astronomical Mentoring—How You Can Share Your Knowledge With Beginners of All Ages

by Jerry Hubbell

In this age of rapid travel, the Internet, and remote social interaction, it is sometimes hard to slow down and consider the simple benefits of sharing your individual knowledge and experience with those who are new to a subject. We all value our pet projects along with spending valuable time with our families. But sharing ourselves with others one-on-one is another excellent way to enrich our own lives and the lives of those with whom we share our experiences. Mentoring newcomers of all ages is a rewarding way to reinforce our knowledge of a subject—and so it is when we share our astronomy knowledge and experience.

It really doesn’t take all that much time, just a will to do it and a willing student who will spend the time listening and learning. It can easily start with volunteering to give a presentation or two at our club meetings—I am sure that most members have a particular interest that would make an excellent subject for a talk at the next astronomy club meeting. It is always fun to respond to the curiosity of others have about what you are doing and their desire to learn more about it through their questions during and after the talk. In addition, although it can sometimes be initially uncomfortable, being challenged and questioned about our thinking on a subject can be very rewarding too.

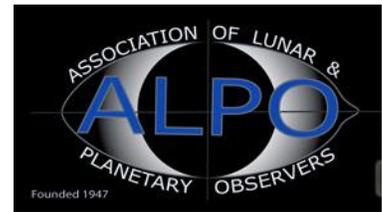


If you are a beginner, there are other opportunities to gain the benefit from those who offer their time mentoring others. If you wonder how to get started, there are many groups you can join outside of your local astronomy club. One of the benefits of joining any of the several astronomical associations, including the [American Association of Visual Star Observers](#) (AAVSO), the [Association of Lunar and Planetary Observers](#) (ALPO) and the [Astronomical League](#) (AL), is that they offer a curriculum for their membership to enroll in to learn about variable stars, or the solar system, or other astronomical topics. Some offer classes in both

basic and more advanced topics such as the [AAVSO's CHOICE](#) program. CHOICE stands for the Caroline Hurlless Online Instituted for Continuing Education in Astronomy and provides instruction in *Visual Observing Basics*, *CCD Photometry*, and *Creating a Variable Star Observing Program*, among other topics.

I was privileged to be invited by AAVSO's Mike Simonsen to participate in the CHOICE pilot program by attending the first class given by Mike in May 2011. These classes, conducted via an online forum hosted by the AAVSO, consist of reading material, discussion of the topics for that week introduced via questions from the instructor, and then a quiz at the end of the week. Typically, there is a test at the end of the class and a project that is due to demonstrate your knowledge of the subject. At the completion of the class, the instructor (Mike in my case) chooses a deserving student to instruct the next instance of the class. I was chosen to give the first student-led class after my successful completion of Mike's class. Even though I had just learned about the topic (how to create a variable star observing program), I found I was able to approach the task with very little trepidation. I came away from that experience with an increased knowledge and confidence not only in how to create a variable star observing program, but also how to interact with a class full of students. Even though I did not consider myself an expert in the subject, if there was a question I couldn't answer, we would work together to research and discover the answer for ourselves through contacts with the experts at the AAVSO or via online searches.

The ALPO also provides materials and access to experts in solar system objects that are a great resource, not only for personal discovery, but also as a great source of material to use in teaching others about the Moon and planets. Although it does take a little time to do the research, having access to all the great information on the Internet, learning about the objects we observe, and sharing that knowledge really brings a level of pleasure to our hobby that goes beyond personal satisfaction—it helps to foster the general feeling that we are contributing to the overall “wellness” of the astronomy hobby.



It is easy to get started on your own mentoring project. Start by researching a topic that really interests you. Something that is a little off the beaten path is always good, but it can also be a mainstream subject. Anything you can do to provide information, not only on what the professionals are doing on your chosen topic, but also, if possible, how you are personally doing work on this topic (observations you are planning or are actively engaged in), really adds value. Once you are comfortable with the information, create a presentation and volunteer to give it at our astronomy club meeting. I try to solicit presentations from our members starting in the summertime for next year's schedule, so the time is ripe for you to volunteer.

If you have developed or discovered a new observing technique or a new challenging object to observe that you want to share with others, you can also use the opportunity of our monthly star parties to work with one, two, or several members to demonstrate and share what you have learned. This is a great way to work with your peers in sharing your thoughts and the results of your work for the benefit of all who are interested. Remember, you don't have to be an expert in the area you are working in—that's not necessarily the point. The point is to provide information on a topic of interest to our membership and share it to foster comments, questions, dialogue, and in a perfect world, active work in the topic area on an amateur astronomer level. Doing so creates a greater awareness of what's possible to do as an amateur astronomer.

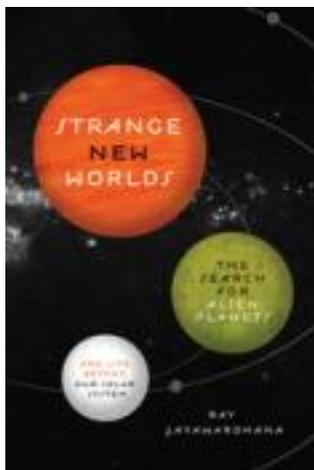
Please consider mentoring others as a great way not only to challenge yourself but also to increase your personal knowledge of your favorite astronomy topics through your interaction in the classroom, or in the field, with your fellow members. I look forward to seeing everyone's presentation topics for next year's meetings.

Astronomy Reading Room

By Bart Billard

There are thousands of books out there on astronomy and related subjects and not nearly enough hours in the day to even make a dent. However, in this occasional feature, I'll give you my opinion on a few as I read them with the hope that it helps you find books you will enjoy and helps you avoid those that are a waste of your time.

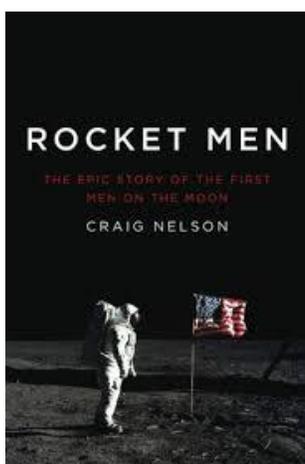
Strange New Worlds—The Search for Alien Planets and Life Beyond Our Solar System by Ray Jayawardhana (Princeton University Press, 2011)



Jennie McCormick, an amateur astronomer in Auckland, New Zealand, got started contributing to professional inquiries by monitoring cataclysmic variable stars. One night, when her targets were not well-placed, she looked for something else to observe and wound up taking part in the discovery of an exoplanet. As an amateur astronomer, I was inspired by this story, which I found in *Strange New Worlds* by Ray Jayawardhana, a noted science writer and professor, and Astrophysics Chair in Observational Astrophysics at the University of Toronto. As a graduate student looking for dust disks around 10-million-year-old stars, Jayawardhana was among the first researchers to obtain an image of one of these disks.

This type of nonfiction appeals to me—it's substantive writing that explains the science (avoiding equations without oversimplifying) and, at the same time, tells interesting stories of discovery. *Strange New Worlds* is a recent example. It tells about the evolving understanding of our solar system and the quest to know whether it is unique or common in the universe. Jayawardhana surveys the current methods of detecting and characterizing planets orbiting other stars, explaining how the methods work, describing their early successes, and comparing advantages and disadvantages of each. You can find Jennie McCormick's story in the first 7 pages of chapter 5. If you enjoy that passage, I am sure the book will not disappoint you.

Rocket Men—The Epic Story of the First Men on the Moon By Craig Nelson, Viking, 2009 (Penguin Audio compact disc version, 2009)



"...[T]he progress of missile engineering has followed essentially the same path: The first ship blows itself up on the pad. The next refuses to ignite. The next lifts off, climbs a few inches, then collapses in on itself. The fourth shoots at a right angle straight across the field. Attempt five blows itself up on the pad. Six refuses to ignite..."

I first listened to the audiobook version of *Rocket Men* while commuting to work recently. I found it interesting and entertaining, and gained an appreciation for the magnitude of the engineering enterprise that was the Apollo program, the 10-year effort that put the first and only men on the Moon. At its peak, the program relied on 12,000 companies and 400,000 employees. A section in the middle of the book, sandwiched between a description of the whole program and the Apollo 11 mission, provides historical context. It includes the 20th-century development of rockets intended to travel into space, the military role in developing them as weapons during the World War II, and the Cold War and missile race between the United States and the Soviet Union. Along the way, there are examples of the development path described in the quote above, in which a missile program suffered half a dozen or more failures before succeeding. The Corona

surveillance satellite succeeded on the 14th try! After five Ranger failures, two Lunar Orbiter failures, and failures of Surveyors 2, 3, and 4, Surveyor 5 finally landed in the Sea of Tranquility and radioed back data on the soil composition in September 1967. A geologist used the findings to accurately predict what Armstrong and Aldrin would find on the Moon, but his article's publication came after the astronauts returned with their own samples. Given the usual pattern of rocket development and the lack of information on how suitable the soil of the Moon would be for landing there, I could appreciate the remarkable achievement once again when the climactic moment was reached: "The Eagle has landed."

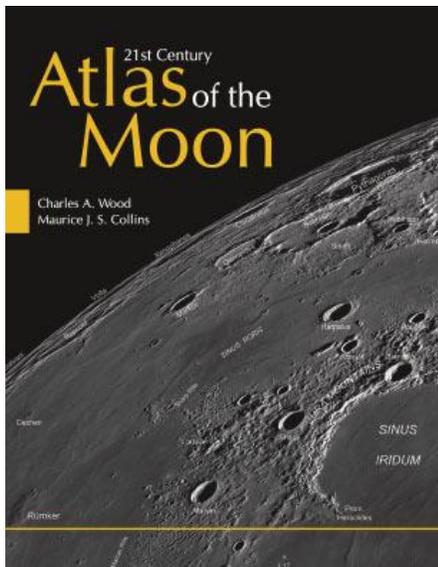
However, when I reread part of the print version of the book and looked at some of the reviews, I became aware of flaws I missed in listening to the audiobook. More than once Nelson uses "escape velocity" when he means orbital velocity and "commandeered" when he means commanded. The chimpanzee Ham's capsule "was supposed to travel 1,970 miles per second." (7 million miles per hour? I don't think so.) Craig Nelson is an author and former publisher, not a scientist. His book suffers from insufficient fact checking and editing. Although it may be OK as a historical account, some of the reviewers take the author to task even on the basic facts, so I'm not sure I would recommend it before reading one of the many other books on the subject, some written by (or with) the astronauts themselves.

Highlights of Recent RAClub Presentations

Abstracted from Bart Billard's Meeting Minutes

May 2013—Open Forum on New Astronomy Gear

Jerry Hubbell began our second open forum on new astronomy gear and discussion of what members have been doing lately. He showed us a pair of 15x70 Oberwerk binoculars, which he said are about the limit (weight-wise) for handheld stargazing. Terry Barker said he had also purchased a pair at a NEAF conference 5 years ago for \$90. He said this year, he had bought a fixture made of 1/2-inch gas pipe for holding binoculars while you sit and observe. Jerry also showed a new finder, is a smaller variation on a Telrad that has options for three different lighted pointers. He also passed around two new books: *Sketching the Moon* by Richard Handy et al., and *Atlas of the Moon* by Charles Wood and Maurice Collins. The latter uses high-resolution images from the Lunar Orbiter; Jerry said he likes to check his images against the corresponding Lunar Orbiter images.



Atlas of the Moon by Wood & Collins (Source: West Virginia University Press)

Terry showed us an Ottewell astronomical calendar that was available at NEAF at a good discount (it is also available from Amazon), some 3D postcards, a red screen for smartphones, some magazine samples, and two books he picked up at NEAF. Ben Ashley talked about upgrading equipment to get into astronomical imaging. He now has an ExploreScientific 127-mm apochromatic triplet refractor on an Atlas mount and a Kodak chip. Ben has had some success purchasing used equipment in like-new condition. He said he has found learning to image is proving to be a long journey. For example, getting proper focus has been difficult. One lesson recently learned is to set a small region of interest on one star so that the chip only reads out a small number of pixels and provides him more rapid response to adjustments. Ben also showed a box for marine batteries from an automotive store that he modified with a fuse, a set of cigarette lighter outlets, and wires with circular lugs to screw onto the battery terminals. Scott Lansdale said he uses something similar to provide power for his laptop when he takes his VLF antenna with him to events like star parties.

Melvin McDaniel talked about graduating from using binoculars to trying out a telescope. He had recently borrowed the club's 6-inch Orion equatorial mount telescope. Melvin said he was learning to do polar alignment, at times succeeding well enough to only need to adjust the right ascension axis to track what he was viewing. He has started using a planisphere and the book *Night Sky* to find objects and is starting to learn to find deep space objects. We talked some about using the setting circles. It seemed like the need to use the slow motion control to move about once aligned makes setting circles more useful when moving among a group of objects in one limited part of the sky.



Tele Vue DIOPTRIX Astigmatism Correcting Lens (Source: Highpoint Scientific)

prescription. He said that it was an improvement over wearing glasses while looking through the eyepiece, but was not as easy to change eyepieces with it.

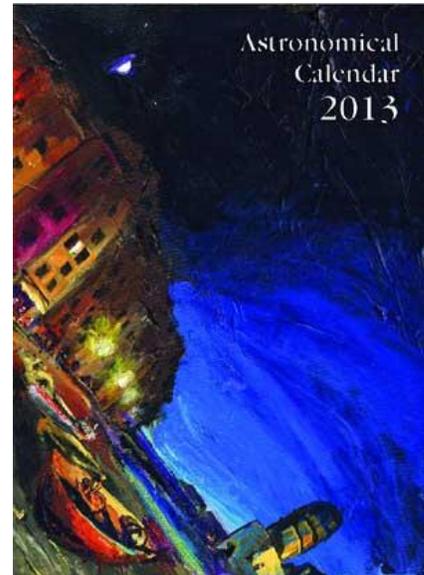
George Clarke said he finally got his Skypod scope up. The pier took quite a while. That and some other activities limited his viewing activities. Linda and Bart talked about trying out some imaging with the club StarShoot Solar System camera. So far, they have tried practicing with it inside, then some imaging of the Sun and Moon. Clouds have twice caused complications with the attempts to get the Sun. Bart said they still have to learn more about processing the images. Another problem imaging the Sun is glare. George said he made a disk of styrofoam to go around the front end of his telescope as a sunshade.

June 2013—Neutron Stars

Joe Francis' program was "Neutron Stars." He began by noting that he had presented programs on other stellar evolution topics (black holes and supernovae). Preparing them helped motivate him to learn about the subject in more depth. Joe said that in the short time since those earlier presentations, his research for this one uncovered new information calling for revisions of some things he had said earlier.

Neutron stars are one of several types of supernova remnants. Their composition is about 90-percent neutrons at extremely high temperature, up to a trillion degrees. The pressure supporting them against gravitational collapse is the result of a quantum mechanical effect of the allowable states of the neutrons called "quantum degeneracy pressure." Neutron stars are about 1.4 to 3.2 solar masses with radii of only about 12 kilometers. The density is equivalent to about a billion tons in a teaspoon. Because neutron stars are so small compared with the cores of the stars from which they come, rotation speeds as high as 716 revolutions per second have been detected.

Joe explained that for a star in the range of 4 to 8 times the mass of the Sun, the fusion process in the core reaches the stage of forming iron-56, which cannot fuse with any other element nor can it split without absorbing energy. It is



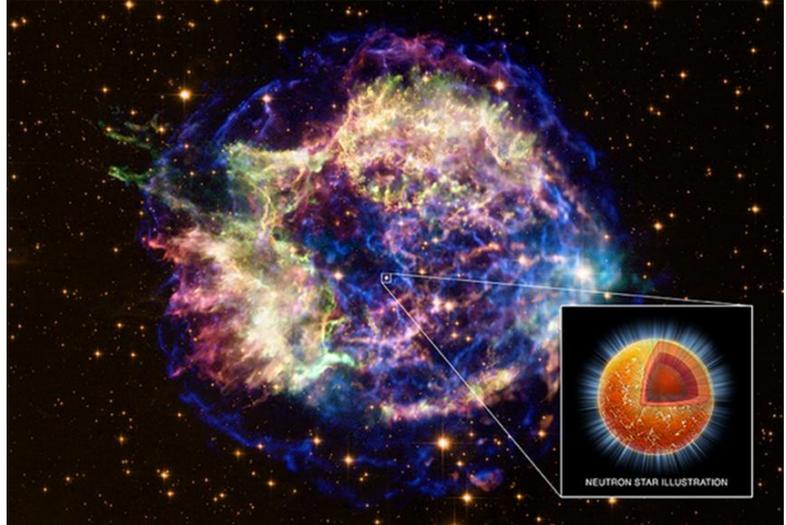
Ottewell Calendar (Source: Universal Workshop)

Joe Fordham mentioned his Garrett binoculars and a pair of recently acquired Fujinon 16x70 binoculars. He noted the Fujinon binoculars do not focus at all close up, to the point where they are no good for seeing the back yard. For the family and viewing the birdfeeder, he also got a pair of Nikon Action Extreme binoculars. Joe found for really close focusing, the 6x21 Pentax Papilio binoculars are the ultimate. (See *article on binoculars in this issue.*) They focus as close as 15 inches. He also went to NEAF and won a hat (not the telescope) as a raffle prize. Joe had also bought a Televue Dioptrix eyepiece attachment for his astigmatism

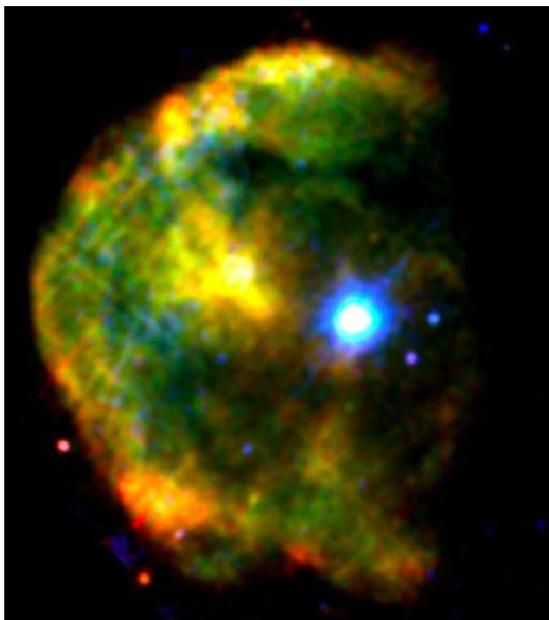
bad news for the star when fuel to maintain the pressure that balances gravity thus starts running out. When the iron in the core builds up to about 1.8 solar masses, the star's core suddenly collapses, with the outer parts first falling in and then bouncing back to form a supernova explosion. These explosions are so energetic that elements heavier than iron are formed from some of the gravitational energy released in the collapse. In the collapsing core, protons combine with electrons to form neutrons.

Joe described a second mechanism for forming neutron stars. White dwarfs that accrete matter from a companion star and reach 1.38 solar mass form Type Ia supernovae and leave behind a neutron star. Joe mentioned that he found a new type of supernova is now also being recognized that involves stars of more than 130 solar masses. For this new type, the collapse starts when oxygen fuses, and the process is so energetic that nothing is left behind in the core.

Because higher mass stars are rarer, estimates indicate only 1 in a 1,000 stars in our galaxy is a neutron star; however, only 2,000 of the estimated 100 million are known. Most are radio pulsars. From their starting temperatures of about a trillion degrees, they are still many thousands of degrees after several billion years. When asked what these stars emitted, Joe guessed they emitted energetic x-rays, which Glenn confirmed with a quick Internet search. An interesting mystery is why some neutron stars move at high speeds, up to 1,500 kilometers per second; scientists are puzzled about what mechanism could accelerate so much mass.



Supernova Remnant Cassiopeia A (Source: X-ray: NASA/CXC/xx; Optical: NASA/STScI; Illustration: NASA/CXC/M.Weiss)



Magnetar 1E 2259+586 (Source: ESA/XMM-Newton/M. Sasaki et al.)

Joe discussed various exotic phenomena associated with neutron stars. *Pulsars* result when the neutron star's high magnetic field is not aligned with its rotation axis and the rotation has moved the field rapidly enough to produce a beam of radio emission that sweeps across us. The brightest pulsars produce radiation at all wavelengths. The energy radiated eventually slows down the rotation rate. Most of the known neutron stars are pulsars. While a typical pulsar's field strength is on order 1 trillion Gauss, some neutron stars, dubbed *magnetars*, have extremely strong magnetic fields. Atoms in such fields are cylindrical in shape. Magnetars have fields 1,000 times stronger and produce weird effects, including splitting photons apart. Scientists are uncertain about the mechanism for forming the high magnetic fields.

Joe concluded with guesses about what eventually happens to neutron stars. Possibilities include pairs of them merging into a black hole or one with a stellar companion accreting enough matter to collapse to a black hole. Some may cool off until they are no longer visible, and some may fly off at high velocity. There are some theories that the collision of two neutron stars could form gold or other heavy elements.

July 2013—Engineering a Scientific Observing Program: Getting the Best from Yourself and Your Equipment

Jerry Hubbell presented “Engineering a Scientific Observing Program: Getting the Best from Yourself and Your Equipment.” He began with some examples of images illustrating what you can accomplish with a 5-inch refractor. In an image of the Moon, he pointed out some smaller features and said craters of 1–2 miles diameter could be detected and craters more than 3 miles in diameter could be measured. He related how he was impatient to get started when he first tried astronomical imaging, and the disappointing results taught him the key is having the patience to “[t]ake the time to learn your equipment and practice the skills to operate it before trying them out under the stars.”

Jerry said that you should think of the investment in astronomical imaging as including the investment you make in developing the skills and knowledge needed to operate it as well as the cost of the hardware. It is best to strive for a balance between these investments, so that you don’t exhaust resources on one component that would end up being limited by the other components. He also suggested buying equipment you can afford might be rephrased as “buying equipment you can afford to break.” Buying something expensive that you wind up breaking while learning to use it is not a good balance between the investment in time and the investment in equipment.



Clavius Taken with 5" Refractor (Source: Jerry Hubbell)

To provide a systematic approach for choosing the right balance and learning the necessary skills, Jerry advocated thinking about the astronomical imaging system (AIS) as encompassing all the standards, operating and maintenance procedures, and documentation, as well as the equipment itself and the software and databases, needed for your particular observing program (OP) (for example, measuring minor planets and calculating their orbits). The way he does this is by developing an observing program design basis (OPDB) that describes the goals, requirements, and specifications to design and build the AIS and also meet the requirements and performance of the OP. Jerry said his initial OPDB was to build a program that let him learn about scientific astrophotography and how to develop his own specific science goals once he reached a minimum level of knowledge and skill. Terry Barker asked about focusing aids that go on a telescope. Jerry said they are helpful. He mentioned one type, a Bahtinov mask, that produces diffraction spikes that cross the star in the image. As the telescope approaches best focus, one spike moves opposite the other two. At best focus, the odd spike passes through the center of the “X” made by the other two. Ben Ashley said that alternatively, computer programs can measure the full width at half maximum (FWHM) of a star as a function of focus position on either side of best focus, and then analyze the results to find where the trends meet as an indication of the best focus position.

Jerry’s final topic was the citizen scientist phenomenon and opportunities for the amateur astronomer. For example, the [American Association of Variable Star Observers](#) (AAVSO) provides opportunities for any amateur to contribute to the science of variable stars. It also has training programs and other educational opportunities for amateurs to learn and help build interest in doing science. Jerry also gave information about the [Minor Planet Center of the International Astronomical Union](#), the [Association of Lunar and Planetary Observers](#) (ALPO), and the [British Astronomical Association](#). As an example of submissions, he showed an asteroid light curve he measured using an online remote telescope and submitted to ALPO. He had a list of other opportunities for professional–amateur collaboration, including the [Lowell Amateur Research Initiative](#) (LARI). LARI has a number of projects to which amateurs can contribute. Jerry had joined one involving observation of asteroids, and he asked Bart Billard to describe one he joined. It involves examining light curves of stars obtained in the Trans-Atlantic Exoplanet Survey

(TrES). Participants potentially could discover new variable stars, and there are indications the original TrES data analysis might have missed some transits that individuals examining the data might be able to pick up.

Melvin McDaniel asked about how the Moon feature heights in the examples Jerry showed were measured. Jerry said the heights were derived from the angle of the Sun and the shadow lengths. The [Lunar Terminator Visualization Tool](#) (LTVT) software (freeware) helps with the measurement by mapping the image onto a sphere and then adjusting for orientation so the feature appears as if viewed from above. John Ulrich asked about using a visual digital SLR camera with a telescope and what kind of quality to expect from a 5-inch Schmitt-Casegrain. Jerry recommended using the camera's video mode and processing the result with software that automatically finds the best-quality frames and "stacks" them to form a single image. He said, "You'll be surprised what you can get." He mentioned [RegiStax](#) and [AVIstack](#) as good software choices that are also freeware.

Image of the Quarter



Crescent Nebula (NGC 6888)

I went out on Saturday night (July 6) to iron out free play and binding issues I had introduced into my mount during its reconstruction and tuning....I also had some time to shoot this image of the Crescent Nebula in Cygnus. The object is very dim, one I have never been able to see visually and deserves a longer exposure time than the hour I put into it. The cloudy areas across the image are denser regions of mostly hydrogen in the Milky Way—*Ben Ashley*