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# THE STARGAZER

Newsletter of the Rappahannock Astronomy Club No. 1, Vol. 1 May–July 2012

## Welcome to the *New* RAClub StarGazer Newsletter

By Jerry Hubbell, President, RAClub

Welcome to the newly reconstituted Rappahannock Astronomy Club's (RAClub) *StarGazer* newsletter! Although it's been a few years since our club has had a newsletter, the name maintains continuity with the previous incarnation and also a sense of tradition.

With the increasing use of the Internet, our website (www.raclub.org), and the club's Yahoo group (tech.groups.yahoo.com/group/rac_group/), it's no surprise a dedicated newsletter fell out of favor. While our Internet tools undoubtedly provide a necessary service and will continue to do so, after using these tools over the past 18 months, I felt something was missing. It finally occurred to me that while the RAClub Internet presence is indispensable, the club membership would benefit from a more intimate, more traditional way of receiving club information. I felt we needed one concise place where we could get a good overview of the members' astronomical activities and provide some much-needed acknowledgement of their fine work. I wanted an *electronic* document that would serve as summary and an enduring historical record of our club's activities. The *StarGazer* will become the first place prospective and new members can go to see the caliber and breadth of work we do on a quarterly basis. It will also serve as a good handout at outreach activities and give our membership a document we *(continued on page 8)*

### Welcome to New RAClub Members (Jan–July)

- David Buckwalter
- Joseph Fordham
- David Johannsen
- David Marlow
- Ernest Mudd
- Shannon McCurdy
- Jessica & Chris Roberts
- Wayne Shields
- David Tillman

## Major Outreach Event—Venus Transit

By Linda Billard

On June 5, cloudy skies did not deter nearly 200 enthusiastic visitors of all ages from joining RAClub members at John Lee Pratt Park in Stafford County in an attempt to view Venus's transit of the Sun. The transit, which occurs only twice a century, was visible beginning at 6:04 p.m. This was the last chance to see it for 105 years.

**At 6:04 pm, to everyone's delight, the clouds parted as if on cue just in time for the beginning of the transit—Don Clark**

The event is rare because Venus does not regularly coincide with the Earth's path because of a slight difference in the tilt of their orbits. Seventeenth-century astronomers used transits such as this one to measure the distance of the Earth to the Sun, resulting in the first realistic depiction of the size of the solar system.

The day had been lovely, with low humidity, bright sunshine, and only a few fluffy cumulus clouds floating by…until about 5:30 pm. Perversely, the sky became almost entirely overcast. However, as if on cue, at 6:04, just as the ingress of Venus across the disk of the Sun began, the Sun broke through the clouds long enough to allow *(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 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 on the 2nd Wednesday of the 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 at 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/

***RAClub Officers***
Jerry Hubbell President
Glenn Holliday Vice-President
Tim Plunkett Treasurer
Bart Billard Secretary
***Points of Contact***
Jerry Hubbell Public Outreach
Glenn Holliday Scout Clinics
David Abbou School Programs
Glenn Holliday Star Parties
Leigh Gettier Beginners
Scott Busby Yahoo Group Admin
Glenn Holliday, Jerry Hubbell Web/Image Editors
Don Clark Internet Administrator
Tim Plunkett Librarian
Glenn Holliday Equipment Loan
Jerry Hubbell Astrophotography

## Calendar of Upcoming Events

| | |
|---|---|
| Talk & Star Party, Warrenton Public Library | Aug 1 |
| Club Meeting, Fredericksburg Library | Aug 8 |
| Star Party, Caledon State Park, King George | Aug 11 |
| *Club Picnic, Caledon State Park, King George | Aug 11 |
| Star Party, Westmoreland State Park, Westmoreland | Aug 25 |
| Star Party Caledon State Park, King George | Sep 8 |
| Club Meeting, Fredericksburg Library | Sep 12 |
| *Star Party Belmont Observatory, Orange | Sep 15 |
| Star Party, Stratford Hall, Westmoreland | Oct 6 |
| Club Meeting, Fredericksburg Library | Oct 10 |
| Star Party, Caledon State Park, King George | Oct 13 |
| Star Party, Lake Anna State Park, Spotsylvania | Oct 20 |
| Concert & Talk, University of Mary Washington | Oct 20 |

## Recent Outreach Events Completed

| | |
|---|---|
| Star Party, Caledon Natural Area, King George | May 19 |
| Venus Transit (Pratt Park, Stafford) | Jun 5 |
| Star Party, Caledon Natural Area, King George | Jun 16 |
| Talk & Star Party, Marshall, VA, Public Library | Jul 30 |
| Talk & Star Party, Bealton Public Library | Jul 31 |

*members only

## Visiting Professional Observatories

By Jerry Hubbell

**Chamberlin Observatory 20-inch Alvin Clark refractor**

One of the things I enjoy doing when planning family vacations in other cities or states is to make a list of interesting places to visit and see. Top places on my list are related to my hobbies—interesting general aviation airports, aviation museums, science museums, and, of course, astronomical observatories.

Four years ago, when my family and I planned our trip to Denver and the surrounding area, I made a point to include two specific activities: glider flight training in Boulder and a visit to the University of Denver's historic Chamberlin Observatory. Ever since visiting the University of Virginia's Leander McCormick Observatory's 26-inch Alvin Clark refractor while in college, I have enjoyed seeing these very large refractors. The Chamberlin Observatory has a recently restored 20-inch Alvin Clark–Saegmuller refractor. The views through this telescope are exquisite. During our visit during the first week of August in 2008, my family and I went on a very nice tour and heard an introductory talk by the observatory director, Dr. Robert Stencel. We then viewed various deep sky objects and, at the end of the observing session, were treated to a spectacular view of Jupiter.

**University of Denver's Chamberlin Observatory housing the Alvin Clark 20-inch refractor**

I have visited the University of Virginia's Fan Mountain Observatory several times over the past few years. Located about 15 miles southwest of Charlottesville, this observatory houses several interesting telescopes, including the 1.0-meter (40-inch) Baker-Schmidt astrometric reflector and the 0.8-meter (31-inch) Tinsley reflector. Both allow precision astrometry, spectroscopic observations of stellar objects, and infrared imaging.

The observatory support group, Friends of the Leander McCormick Observatory (FLMO), sponsors a twice-a-year public open house event in the spring and fall at Fan Mountain. You can also see the Alvin Clark 26-inch refractor at the Leander Observatory, typically on the first and third Friday of each month (weather permitting). I have been a member of FLMO for the past year and would suggest that this is one of the better avenues for supporting this and other observatories. These groups help to preserve the classic observatories throughout the United States.

The Fan Mountain Observatory also hosts two other interesting telescopes. The Optical Guidance Systems (OGS) 0.6-meter (24-inch) Rapid Response Robotic Telescope (RRRT) *f*/8.0 Ritchey-Chrétien is designed to perform follow-up photometry and polarimetry of astronomical transient phenomena, including near-Earth objects (NEO), Blazars, supernovae, and exo-planets. It is similar to the Sierra Stars Observatory Optical Mechanics (OMI) Nighthawk CC06 0.61-meter (24-inch) classical Cassegrain telescope that amateurs can use remotely via the Sierra Stars Observatory Network (SSON). Fan Mountain also has the 0.3-meter (10-inch) Cooke Astrograph refractor that is used as a very wide-field (10-degree) instrument with photographic plates.

**Fan Mountain Station of the Leander McCormick Observatory (left) located 15 miles southwest of Charlottesville, Virginia, and the Leander McCormick Observatory (right) located in Charlottesville, Virginia, on the western edge of the University of Virginia grounds**

The 26-inch Alvin Clark refractor at the Leander McCormick Observatory is a near twin to the US Naval Observatory refractor in Washington, DC. This latter observatory also hosts an open house for the public to tour and view through its 26-inch Alvin Clark refractor housed there.

If you are traveling to the midwestern and western United States, several very famous observatories are available to tour, including the University of California's Lick Observatory near San Jose, the Lowell Observatory near Flagstaff, and the University of Chicago's Yerkes Observatory. There is also the Mount Lemmon Observatory north of Tucson. Glenn Holliday visited the Arizona Sky Center at Mount Lemmon Observatory, attending an astronomy camp there in October 2010. His report is available on the RAClub.org website.

The best way to begin planning your observatory visit is to locate the observatory's website. You can use a search term such as "astronomical observatory Denver" to locate professional observatories near your city of interest. Generally, if the observatory hosts tours, the website will include information on visiting. Email the observatory contact listed on the website to get more details about touring and observing opportunities. You can get information on the available tour dates and any special activities that may be going on during your time in your city of choice.

By visiting professional observatories, you will gain an appreciation of the history and work that was and is being done at these observatories, and how they have managed (for the most part) to maintain their relevance in today's high-tech world. Many of these observatories have upgraded their instrumentation and observing programs to best use the optics available. Many have also been taken over by foundations, which maintain and bring these telescopes back from the edge to serve as public outreach facilities and to help maintain the vital link to the general public that all professional observing programs require. Joining one of these foundations is one of the best ways to make sure these facilities are available to our kids and grandkids in the future.

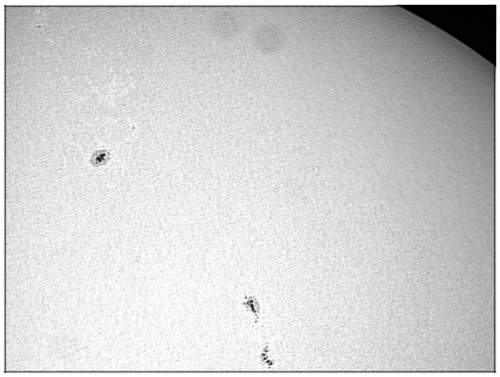
***News Clip:* Minor Planet Observations Reported to ALPO**

Jerry Hubbell reports observations to the International Astronomical Union (IAU) Minor Planet Center on a regular basis. As a member of the Association of Lunar & Planetary Observers (ALPO), he also sends these reports to the minor planet section director of ALPO, who compiles observations for the previous year and reports them the following spring. This year, Jerry is the only member to report CCD observations—the rest are visual observation reports. The report lists 30 observations of 8 minor planets he made with his 0.2-m Ritchey-Chrétien (I24) and the 0.81-m Ritchey-Chrétien at Mt. Lemmon Sky Center (G84). For more information on how to contribute your observations, visit the ALPO website.

## *Observing and Equipment Tips*

***Tip*: Observing/Imaging the Sun (Jerry Hubbell)**

When observing the Sun with a standard telescope (one not designed only for solar observing), you need to provide a broadband white-light filter designed to cut 99.9999 percent of the light. There are basically two choices—a glass or Mylar type filter. While these filters are good for observing sunspots and other relatively dark features on the surface of the Sun, you cannot see the detailed granularity that large-diameter telescopes can resolve. If you want to see the granule features on the Sun's surface, you need to increase the relative contrast of these features. You can do this by using a very narrow band filter (≤ 10 nanometers [nm] bandwidth). A relatively inexpensive filter for this purpose is called a Solar Continuum filter and is produced by Baader Planetarium. It is centered at a wavelength of 540 nm (green) and has a bandwidth of 8 nm. You will get the best views if you use a broadband white-light solar filter coupled with a narrow band green filter. Only in this way can you see the subtle granules and sunspot striations on the Sun's surface with your non-dedicated telescope. Stay safe while observing the Sun!



**Sunspots using a 0.13-m APO refractor with a Solar white-light glass filter and the narrow band Solar Continuum filter, June 3, 2012—Jerry Hubbell**

***Tip*: Point-and-Look for Alt/Az Mounts (Bart Billard)**

With the availability of planetarium apps on smart phones, it might be time to upgrade from star-hopping to "point-and-look" star gazing. Point-and-look usually lets me skip the discomfort of my straight-through finder. You can find a good how-to at Rob Nabholz's website on manual setting circles for Dobsonians. Although my original variation omitted the digital level for finding altitude, digital level prices have dropped significantly since Rob made his system. You can now add a point-and-look capability to your Dob for much less.

You need a computer with a planetarium program and a way to use it at your telescope. Choose a program that gives current altitude and azimuth coordinates. The best one is one for a computer you already have, e.g., Starry Night for a laptop computer or one of the smartphone, tablet, or PDA applications listed in the summary of Michael Masters' presentation. For an elevation scale, digital levels with approximately 0.1-degree accuracy are available online or at Sears. You may need to make an adjustable mount to attach the level to your telescope tube. A level with a magnetic base will attach to telescopes with steel tubes. For rac_group members, I posted a pdf file for printing an azimuth scale. For a larger scale, copy the file to a flash drive and take it (and scissors) with you to Staples or another local copy center. They can print it on wider paper if you need a bigger scale for your telescope. Trim around the circular border before having the scale laminated. Trim the lamination to within ¼" of the edge and drill a center hole. The azimuth scale slips over the bolt in the center of the top baseplate, and a wing nut holds it in place. The top baseplate rotates while the scale stays fixed via the bolt's connection with the ground board. Just add a pointer to the baseplate in a convenient location for reading the scale.

To set up, I level the mount without the telescope in place. Add adjustable feet as described on the setting circles website, or insert shims under the low foot after finding a placement that is level crosswise between the other two feet. The shim method requires more patience on a grass surface than on concrete or asphalt. With the digital level, calibration requires finding only one object. It helps to use a compass with a magnetic declination adjustment to point the mount North where the azimuth reading should be zero. The wing nut lets you adjust to this reading. Next, locate and center a star or other object and immediately note the azimuth given by the planetarium software. Readjust the azimuth scale to this reading and you are ready to go.

# Highlights of Recent RAClub Presentations

## May 2012—Digital Single-Lens Reflex (DSLR) Astrophotography Basics

**Ranny Heflin** described features of DSLR cameras helpful in taking pictures of the night sky. Compared with film cameras, zooming in on a live image of a star and boosting the sensitivity with a high ISO setting makes focusing much easier. When the camera is pointed up at the sky, having an LCD screen that folds out and turns is a lot more comfortable than looking up through a finder.

**M31, December 9, 2010—Ranny Heflin**

Some camera models have full-size (35 mm) imagers, and some are made for astrophotography by using a different filter in front of the imager. These respond better to the Hα light of emission nebulas. Ranny can even program his camera to take a sequence of images and include dark frames after each. He has only 2 years of astronomy experience and 1-1/2 years in astrophotography, so he encouraged the audience to learn how easy it is to capture images like those in his presentation.

You can get started with as little as a camera with a wide-angle lens and a tripod. Wide views and exposures under 40 seconds produce images without streaking from Earth's rotation. Ranny finds it easier to get crisp images with fixed-focus lenses than with zoom lenses. He also covered piggyback photography with the camera riding a telescope and taking and stacking video of the Moon and bright planets. Video crop mode increases the frame rate by providing the center 640 by 480 pixels, while HD video mode shows more of the full image and is helpful in finding the target. Ranny was asked whether the DSLR models modified for astrophotography could take good daytime shots. He said he used the white balance and white shift settings to compensate for the difference in response with the astrophotography filter. You can find Ranny's presentation on the Club website.

## June 2012—Outfitting the Compleat Astronomer: Update

**Michael Masters** presented an update of a program originally presented in April 2010—his take on "everything you need to observe in style and comfort." It covers lessons learned from years of observing and nature photography. He showed pictures of a variety of equipment and tools, describing why you might need them, the advantages of what he found works, and disadvantages of what he found less useful.

Examples for setting up include a compass with declination adjustment to help align the mount to true north and a carpenter's pitch level to adjust the polar axis of an equatorial mount to the local latitude, both stored in a horse tack box, a robust heavy-duty plastic container that also can store electronics. Sleeve potholders are useful for cushioning counterweights when transporting them. He recommended Coleman Dynasty or Tailgater folding tables and Shake Enders vibration absorbers for tripod feet to cut the settling time of the mount. After trying out several different adjustable-height chairs, he settled on the Stardust chair—more secure because hooks hold the seat in place instead of friction.

Michael noted green lasers can be convenient as finders but not work in all conditions. Cold weather can be a problem, and the air can be too clear to see the beam. He noted the concern to avoid illuminating aircraft, which has been publicized recently. For powering equipment, Michael talked about assuring enough capacity to last the night. He recommended 33 ampere-hour sealed lead-acid, absorbed glass mat (SLA AGM) batteries available at Batteries Plus. He also suggested using 1.5-volt AA lithium batteries, which last longer than alkaline cells.

For "Tools You Didn't Know You Needed Until It Was Too Late," he recommended two-color flashlights, tools and spare parts, magnifying glasses, eyeglass cords, and eyeglass repair kits. An eye patch helps you keep one eye dark-adapted while looking at charts or using the computer. Accessories such as focal reducers, field

flatteners, diopter correctors, Binoviewers, and TeleVue Paracorrs for reducing the coma of fast Newtonian telescopes were also discussed.

Michael mentioned a number of charts and atlases, with the strongest recommendation for *Night Sky Observer's Guide* by George Kepple and Glen Sanner. He talked about three astronomy software options, The Sky Six, Starry Night, and MegaStar 5. The graphics of the latter are not as fine as The Sky or Starry Night, but he finds it very useful, with the best database and ability to build lists. It can control telescopes.

He showed a number of options for keeping warm. One of his preferences is rag wool: for example, rag wool fingerless mittens or glove mitts, or rag wool or fleece balaclavas. Michael's tip for insects is to avoid sprays near optics; use towelettes with insect repellant instead. Michael also showed a number of optics cleaning supplies. He avoids dusters that use propellants instead of compressed air because they can leave a residue on optics.

A new topic in the presentation was the results of Michael's survey of "astronomy apps" for tablets, iPhones, etc. Sky Safari was a favorite for iPhones and iPads. Finally "Michael's rules for choosing astronomy gear" are: Don't buy something larger than you can transport, heavier than you can lift, or that requires a mortgage to finance. He advocates consistent use of checklists because Murphy's Law of Forgotten Gear applies: "Whatever you leave at home will be needed that very night for the first time ever!"

## July 2012—Home Observatory

**Scott Busby** presented a talk on choosing and constructing a home observatory. He began by asking "Why would you want a home observatory?" The reasons are often personal to the individual but one obvious reason is that it gives you a place to maintain a permanent setup—allowing more time for actual observing and photography. He also pointed out the advantages of a protected environment, perhaps not heated but at least out of the wind. Scott also said that he personally finds the solitude therapeutic after a difficult workday (or week).

He then discussed the pros and cons of dome construction versus roll-off roofs. Domes provide more dew protection but less floor space because of their shape. Some astronomers like to see the whole sky so a dome can be more confining—you can only see a slice of the sky at a time. In Scott's case, dew protection was a requirement because his location gets very damp at night. Consequently, he chose a dome. However, he pointed out that roll-off options look more like garden sheds and so are less likely to violate your homeowners' association's rules.

Although Scott was able to purchase the dome structure from fellow RAClub member Myron Wasuita, he researched the vendors anyway. Apparently, there are many vendors out there, including Technical Innovations, Sky Shed, Sirius, and Astrohaven. If you have the skills (or friends with the skills), you can also build from scratch.

Scott described his planning process, which included site, size, and materials considerations. He made careful drawings using PowerPoint to ensure he considered all options. He admits that although he was constructing a 10-foot diameter dome, he designed the platform to accommodate the next size larger—just in case he decided to upgrade to the larger size. One mistake he made was not to build the conduit into the pier—hindsight is 20-20.

Finally, he described the process of having the concrete poured to support the pier, building the deck, and transporting the building (in pieces) from Myron's place to his. At the time of this presentation, he had not yet put the dome over the deck but had tried out the telescope on the pier. However, the following weekend, he completed construction and took the picture shown at right—somehow the rainbow is appropriate.

## *(continued from page 1)…Welcome to the RAClub StarGazer Newsletter*

…can point to when we want to share our work with our friends and families. Finally, the *StarGazer* will become a document we can look forward to receiving in our email every quarter. I hope this gives you a good feel for what the *StarGazer* is all about. It in no way diminishes the fine work that Michael Masters and Scott Busby do every day on the website and yahoo group. For me, the *StarGazer* is the third element of a triumvirate of services that we can finally put into place that will improve our outreach materials and keep a concise, high-quality, historical record of our club activities.

As our newsletter editor, Linda Billard is tasked with maintaining the high standards in data gathering and historical record keeping that will become a hallmark of the *StarGazer* in the future. Bart Billard has also volunteered to help as part of his duties as club Secretary. Please support them in their efforts!

In the near future, I will be appointing a five-member club communications committee to provide input on the operation of the website, yahoo group, and newsletter. These committee members will be your prime contact for any suggestions and improvements you want to see going forward. Thanks for your support, and I look forward to seeing all your fine astronomical work in the *StarGazer*!

## *(continued from page 1)…Major Outreach Event—Venus Transit*

…the eight telescopes trained on it to register Venus coming into view as a small black "bite" out the edge of the bright disk. Many of the visitors were able to see this view, which lasted several minutes before the clouds moved in again. Later on, several more peeks of Sun allowed a few more people to see this unusual event. Glenn Holliday, RAClub Vice President and organizer of the event, estimated there was only a total of 5-10 minutes of viewing. However, it was clearly a successful event, with many visitors staying the entire 2-1/2 hours, hoping for a view and peppering RAClub members with questions on everything from eclipses to dark energy.

**Video image of Venus well into its transit of the Sun, June 5, 2012—Jerry Hubbell**

RAClub President Jerry Hubbell had begun setting up his equipment at 4 pm when the clouds were not such an issue, in hopes of photographing the transit. He planned to do some initial imaging with his main telescope during ingress, with his finder scope providing the wide field view for everyone to see. After taking a few good videos of the ingress, he planned to allow everyone to look through the main telescope. The clouds put a damper on that plan, so "Plan B" was to concentrate on getting images with the finder scope while allowing visitors to look through the larger scope during those fleeting moments when the transit was in view.

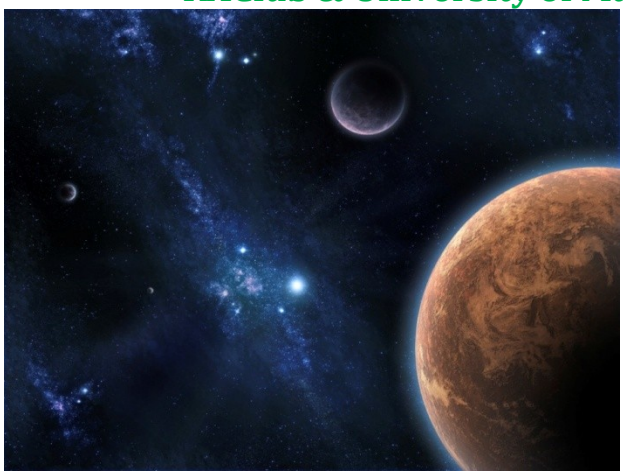
The event in Pratt Park was just one of many such gatherings. Hawaii was considered the best location to watch the transit; astronauts watched from the International Space Station; and the Hubble telescope used the reflection of the Sun on the Moon to capture it. Hubble cannot look at the Sun directly, so astronomers pointed the telescope the Moon, using it as a mirror to capture reflected sunlight. In addition, it allowed astronomers to isolate the small fraction of the light that passes through Venus's atmosphere. Imprinted on that light are the fingerprints of the planet's atmospheric makeup. These observations mimic a technique used to sample the atmospheres of giant planets outside our solar system as they pass in front of their stars. Astronomers already know the chemical makeup of Venus's atmosphere, and that it shows no signs of life. However, the Venus transit tested whether this technique could detect the very faint fingerprints of an Earth-like planet, even one that might be habitable

for life, outside our solar system that similarly transits its own star. Venus is an excellent proxy because it is similar in size and mass to our planet.

Press coverage of RAClub's Transit of Venus event can be found at FreeLanceStar.com and the Fredericksburg Patch. This coverage led to at least one unusual request to participate in another upcoming event. October 20, the University of Mary Washington Philharmonic Orchestra will perform Gustav Holst's suite "The Planets." Director Kevin Bartram has asked the club to present a brief pre-concert talk on the planets, provide slides to accompany the music, and have members available in to lobby to talk about the club. This unique event will begin at 6:30 pm in Dodd Auditorium on the Mary Washington campus.

## *—Upcoming Special Event—*

## RAClub & University of Mary Washington Philharmonic



### The Planets by Gustav Holst

**Pre-Concert Presentation**—Jerry Hubbell, President Rappahannock Astronomy Club

**Concert**—University of Mary Washington Philharmonic, Kevin Bartram, Director

**Date**: October 20, 2012
Presentation 6:30 pm, Concert 7 pm

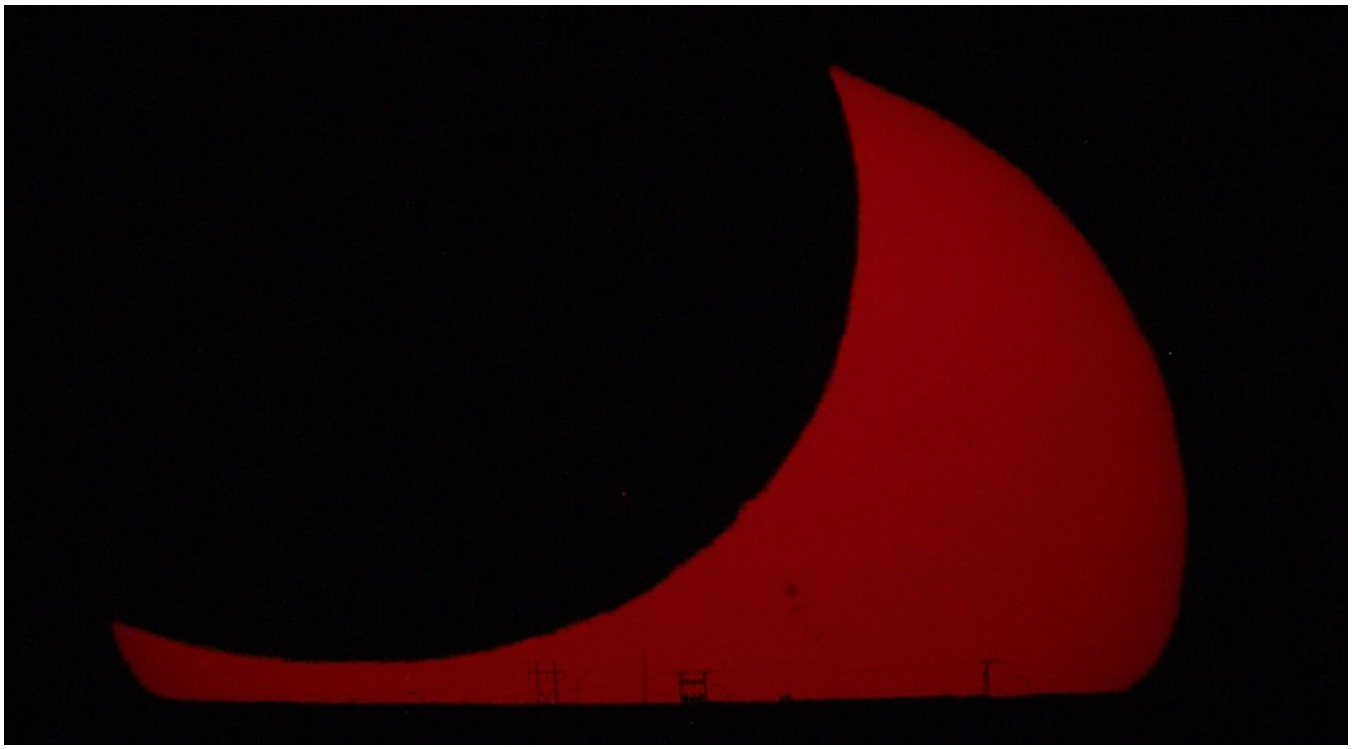
**Location**: Dodd Auditorium, University of Mary Washington

The orchestra will perform Holst's seven-movement suite. Each movement is named for a planet in our solar system (Earth is excluded), and each has a subtitle, e.g., Mars, the Bringer of War.

Kevin Bartram, the orchestra's director, has asked RAClub to make a short presentation on the planets preceding the concert, provide some visuals to be shown during the concert, and have some members present in the auditorium lobby to talk about the club.

This a great opportunity for the club to meet more of the Fredericksburg community, let them know what we're doing, and encourage them to join us!

## Image of the Quarter



**The Sun and Moon set on the ridgeline west of Albuquerque NM on May 20, 2012. Power lines near Interstate 40, about 13 miles distant, are outlined by the sinking Sun and bring a surreal scene back to Earth—Ranny Heflin**

**Equipment:**
Hap Griffith modified 18mb Canon 60D 1/60sec ISO 400
Orion Full-Aperture Solar Filter
Orion ED80T CF Refractor f/6
Televue 2X Powermate (f/12)

**Comment:** While working in El Paso, I drove to Albuquerque NM to take pictures of the Annular Eclipse. I shot around 250 pics of the eclipse. Watching my first eclipse was a spiritually uplifting event—Ranny Heflin