http://www.raclub.org/

The StarGazer

Newsletter of the Rappahannock Astronomy Club No. 2, Vol. 6 August 2017–October 2017

From the Editor: Special Edition: Eclipse Experiences

By Linda Billard

Many RAC members traveled to the path of totality to witness the 2017 Eclipse of the Sun on August 21. It was the first total eclipse in the United States since 1991, the first on the mainland since 1979, and the first to cross the entire country since *1918*!

This issue of the *StarGazer* serves as an informal journal of the recollections and photographic records of members who watched the eclipse at various locations across the country (see map). Although we all watched the same event, each person had his/her own personal context. All who viewed totality found the experience entirely worth the traffic jams and crowds. And, for some who saw it for the first time, it was impetus to begin thinking about how to get to the viewing area for the next one in 2024.

I hope you enjoy reading about our experiences, seeing the accompanying pictures, and clicking the links to relive the event through our videos.

Path of Totality Showing RAC member locations (adapted from map created by Fred Espernak, http://mreclipse.com/)

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 closest to the new 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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Jerry Hubbell, Astrophotography
Myron Wasiuta Mark Slade Remote Observatory (MSRO)

Calendar of Upcoming Events

Star Party, Caledon State Park	November 11
Star Party, Caledon State Park	December 16
Star Party, Caledon State Park	January 20*

Recent Outreach Events Completed

RAC Picnic, Belmont	August 12
Eclipse Outreach, Porter Library, Stafford	August 21
Meet the Moon, Wilderness Elementary	October 24
Meet the Moon, Porter Library, Stafford	October 28

*Tentative. Please visit raclub.org to confirm date.

President's Corner

Hello all and welcome to another great newsletter. I want to thank all the members for providing their observations and awe-inspiring photographs. The club has several events coming up, including star parties on November 11 and December 16 at Caledon State Park in King George. The club also participated in the dedication of the Mark Slade Remote Observatory (MSRO) on Oct 21. Myron Wasiuta spoke about the late Mark Slade and his love for astrophotography as well as the work that has been done to get the observatory operational. Please visit the MSRO page linked from the raclub.org homepage. I hope you all enjoy reading all the great stories included below and another thanks goes out to Linda for putting all this together.

Clear Skies, Scott Lansdale

Club News Briefs

- **NEW MEETING LOCATION:** RAC now meets in Room 2 of the Fredericksburg branch of the Central Rappahannock Regional Library at 1201 Caroline Street. Please be sure to check the website for info on presentations.
- **NEXT CALEDON STAR PARTY:** Weather permitting, come on out to Caledon State Park on November 11 for our next star party.
- **MSRO:** Myron Wasiuta poured an additional pier to support a third telescope, which is located outside the observatory in an open area and protected with a roll-off box. Currently, it supports Myron's Celestron C14 telescope. He, Bart Billard, and Jerry Hubbell tested it recently in an attempt to view an occulation of a star by Neptune's moon Triton. For details, see the article in this issue of the newsletter.

Astronomy Math: Relationship of Wavelength, Frequency, and Energy by Scott Busby

To understand why *frequency*, *wavelength*, and *energy* all relate to the color of light, you need to understand the meaning of each of these terms. Here's a quick summary:

- **Wavelength (λ)** Wavelength is the distance between adjacent peaks or valleys of a wave. It is not the total length of the wave, because a wave may contain many oscillations, but rather the physical distance between neighboring oscillations in the electric and magnetic fields that make up a light wave.
- **Frequency (f)** Frequency always has units of number of events in a given time, with time usually represented in seconds. For waves (including light), frequency has units of cycles per second, but the term "cycles" is not included explicitly in common practice. This leaves no units in the numerator, making the unit of frequency "per second" or 1/s. This unit is called the hertz (Hz).
- **Energy (E)** Light waves are made up of tiny bundles of electric and magnetic fields called photons. Picture a photon as a tiny wave packet that behaves like an individual "particle" of light—the smallest unit of light that can exist. The energy of a photon is directly proportional to the frequency of the waves that make up the photon written as $E \propto f$. This means that a photon of blue light has more energy than a photon of red light because blue light has a higher frequency than red light.

Many problems in astronomy require converting between the frequency and the wavelength of a light wave. This is made easy by the fact that all light waves or photons traveling through the vacuum of space have the same speed, irrespective of their wavelength, frequency, or energy. Surprisingly, that speed does not depend of the motion of the light source or the observer. The speed of light in a vacuum is 3×10^8 m/s and is represented by the letter c.

Given the constancy of the speed of light, the peaks of a shorter-wavelength wave will travel past a point more frequently than the peaks of a longer-wavelength wave, because the distance between the peaks is less than for the long-wavelength wave. So long as the speed of the waves is the same, longer wavelength must correspond to lower frequency.

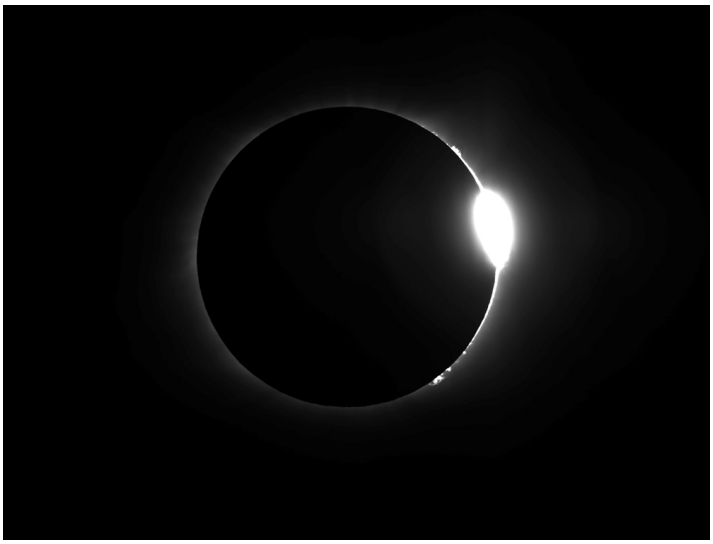
This analysis means that the only thing that determines the frequency of a light wave is its wavelength and that the wavelength and frequency are inversely proportional (that is, one is bigger if the other is smaller). Expressing this using the proportionality relationships $\lambda \propto f^{-1}$ or $\lambda \propto 1/f$. Remember that " $\propto$ " means "is proportional to" or "equals a constant times." In this case, the constant is the speed of light (c), so the equation relating wavelength and frequency is—

$$\lambda = c/f \text{ or } f = c/\lambda \text{ or } \lambda f = c$$

2017 Total Eclipse of the Sun—Pendleton, SC

By Scott Busby

In my lifetime, I have seen at least three partial eclipses of the Sun. The 2017 eclipse was to be my first total solar eclipse. Having spent the last 10 years as a serious amateur astronomer, I wasn't going to let this one slip by—especially since the path of totality was within easy travel distance from my home in Spotsylvania, VA.



Diamond Ring Effect. Credit: Scott Busby

In May 2017, I began scouting for potential locations that (1) would allow me to set up telescopes in a relatively open space with access to AC power and (2) offer some security to protect any of my unattended gear. My plan was to set up the night before, do an accurate polar alignment, and be ready to go the next day with astro-camera and laptop computer. Using Goggle Maps, I scouted along the path of totality, mostly in South Carolina since it was a reasonable drive of about 7 hours. Because the 2017 total solar eclipse would bring observers from far and wide, I knew accommodations would be at a significant premium for those slow in planning ahead. My preference was to find a bed and breakfast that would accommodate my wife and me close enough to other attractions to occupy my less than enthusiastic spouse. My discovery was a small B&B near Pendleton, SC, near the home of the Clemson Tigers, the current NCAA Football Champions.

The B&B was a small, single-occupancy, converted farmhouse owned by an older retired couple. 2017 was to be their last year to host a B&B, and they were moving away at the end of August. In fact, Debbie and I would be their last official guests. That's why I didn't mention a name. The B&B was situated on about 10 acres, part of which was an old pecan grove. Their neighbor on the adjacent property was a private pilot who had built a 1,500-foot asphalt runway and a hanger to house his homebuilt light plane. He offered me the runway area as an excellent spot to set up equipment and view the eclipse.

By the way, my youngest son Aaron wanted to tag along, and the B&B accommodated. We arrived the day before the eclipse. After we settled in, I unloaded my gear and identified the optimum spot for a full view of the eclipse from beginning to end. Our host informed me that there would be a small group of friends from his church also visiting to view the eclipse. He promised that he would make sure they didn't bother me while I was focused on getting good eclipse images. The equipment I brought with me was a Losmandy G-11™ on which I mounted a Takahashi TOA 150™ refractor and a side scope, a Takahashi FS78™ refractor. I would use a ZWO ASI1600MM camera offering a good 16MP CMOS chip that would give me a full disk image of the Sun. Image capturing was done with a laptop with the ZWO proprietary SW SmartCap™. As evening fell, I had a good north sky view, and polar alignment was quick and easy using a QHY Polemaster™.

On the morning of the eclipse, I completed my setup and ran some test images on the ASI1600 of the full disk of the Sun with the appropriate solar filters installed. The 150 would be the imaging scope, and the FS78 would be for visual observation. Of course we also had the appropriate "certified safe" solar glasses for the full experience. At around noontime, our host prepared a huge potluck spread, and the guests of the host began to arrive bringing food and yes, lots of kids. It didn't take very long before the inquisitive adults and children started ogling the old guy

busily attending to a huge telescope. The questions came like a deluge and mostly settled on how to safely view the eclipse. Among the most intrigued was the local church pastor whose flock made up most of the visitors. We had a good discussion of the universe, God's creations, the miracle of Sun-Earth-Moon relationship, and the glorious natural beauty of a total eclipse. Fortunately, I also had the Club's personal solar telescope (PST) and flitted back and forth between it and the FS78 with the adults and children. What a great teaching experience—especially explaining how the Hydrogen Alpha telescope worked.

The weather was promising up to about 2 hours before the beginning of transit. High fluffy cumulous clouds began to close in, with a few towering cumulous in the distance. I monitored the wind aloft to determine cloud direction and potential interference. I'd been tracking the Sun with my setup and was prepared as the first indication of the Moon's approach became obvious in the PST. The PST was a great tool to see the Moon's encroachment on the solar disk before it actually arrived. I used the PST to time the start of my imaging. I had considered a full-motion video but realized I didn't have the disk storage to capture the entire event. I decided to do short videos at 1-minute intervals.

As the dark disk of the Moon began its transit, I recorded while distinctly aware of the clouds slowly increasing in size. Every now and then, wisps of clouds would race across the Sun's image on the laptop, but only briefly. The towering cumulous became threatening. As the Moon was about 1/3 into its transit, I was at my track limit on my mount and had to do a meridian flip. My son helped manage the cables as we repositioned the table, laptop, and other paraphernalia on the opposite side of the telescope. Reestablishing the solar disk, I resumed my imaging session. As totality became imminent, the clouds parted and cleared, leaving us with a full view of the remaining eclipse sequence. My son positioned a ladder near the scope, awaiting my command to remove the solar filter at the point of reaching totality.

Totality in Pendleton, SC. Credit: Scott Busby

From that point on the wonder of a full total solar eclipse manifest itself. Imaging was right on, with only minor adjustment of exposure to highlight solar prominences popping out along the Sun's rim. I was so engrossed with imaging that my wife had to yell at me to get my head out of the computer and look up. As I looked up, the full glory of totality struck me. I was so overwhelmed by the appearance of the corona and its visible streamers that I jumped up and did a little jig on the runway letting out a loud "Woo hoo!" At that moment, I realized that I needed to get my DSLR, which I was going to use for some quick snaps with a 200-mm lens. For whatever reason, the camera timed out and needed a restart. I quickly abandoned that idea and returned to my regular imaging because totality was soon to end and I wanted to capture the diamond ring effect. I was so enthralled by what I had just witnessed and the successful images I had captured, that any additional imaging of the Moon's transit away from totality became anticlimactic. I should also mention that during totality, the pastor and his congregation erupted in song singing "How Great Thou Art." Goosebumps I tell ya!

What a great experience, the Great 2017 North American Total Solar Eclipse. I'm already thinking about the next one coming in 2024. I know this is a bit long, but it was the whole experience leading up to, during and afterwards that I wanted to share. The perk in all of it was the total eclipse of the Sun, albeit not in Nova Scotia.

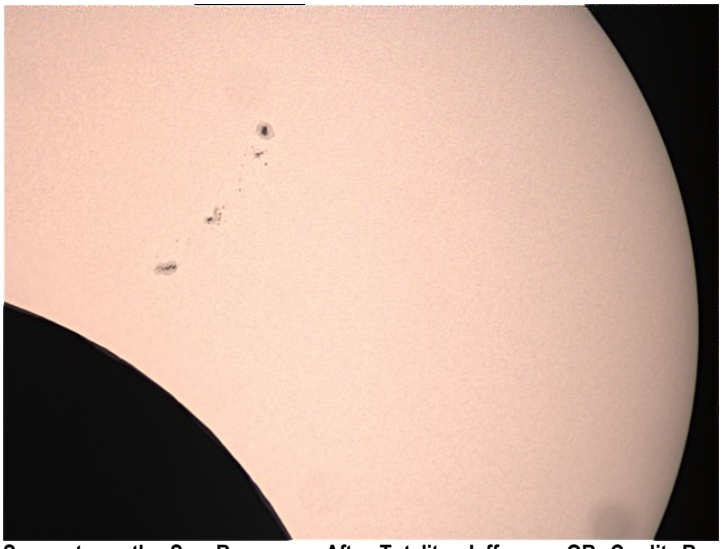
The Eclipse from Jefferson, Oregon

By Ron Henke

I call the trip to see the eclipse the "Sibling Tour," because it included visits to see my brother in San Jose, CA, and my sister in Jefferson, OR, where Jane and I were for the eclipse. After the eclipse, we went on to Tacoma, WA, to visit Jane's sister.

Jefferson is 18 miles south of Salem. My sister lives on ¾ of an acre, with an unobstructed view to the west. We got there 2 days before the eclipse, and I spent the day before the eclipse "practicing" the setup and use of the telescope and camera so I would be ready for the next morning. August 21 finally arrived and with coffee cups in hand, my niece and I set up the telescope and took a few practice images to ensure that everything was ready to go. And then we waited.

It was great being at my sister's house. The room wasn't $500 a night, and the food was good (and free). Because we were not in a public area, there were no crowds…just my wife, myself, my sister, my niece, and her boyfriend. The eclipse started about 9:05 a.m. I had brought solar glasses for everyone, so everybody had a chance to watch the eclipse "live." I got to use the glasses also, in between imaging the eclipse. Totality occurred at 10:17 a.m.



Sunspots as the Sun Reappears After Totality, Jefferson, OR. Credit: Ron Henke

The effect of the Sun being covered was noticeable. First, the breeze that was evident just before totality stopped. As totality approached, the light became a strange amber color. We all commented on it, and no one had ever seen anything like it before. The next thing we noticed was a drop in temperature. This was the biggest surprise to me although I don't know why. The temperature drop was 4 to 7 degrees in the surrounding area. I am aware of temperature drops of 17 to 20 degrees at higher elevations. Once totality happened, it became dusk-like dark with some of the brightest stars visible. Procyon was particularly bright. I must admit, once totality was over and the Sun was waxing, the experience became somewhat anti-climactic.

The best part of my experience was being at my sister's house to enjoy the experience with some of my family. The picture that accompanies this article is of the Moon moving off the Sun, complete with sunspots.

Successful Ad Lib—Laurens, SC

By Glenn Faini

Although I began preparing for and anticipating the Great American Eclipse 2 years before the event, the actual day of the eclipse was totally ad lib and improvised. That it turned out nearly perfect was divine providence.

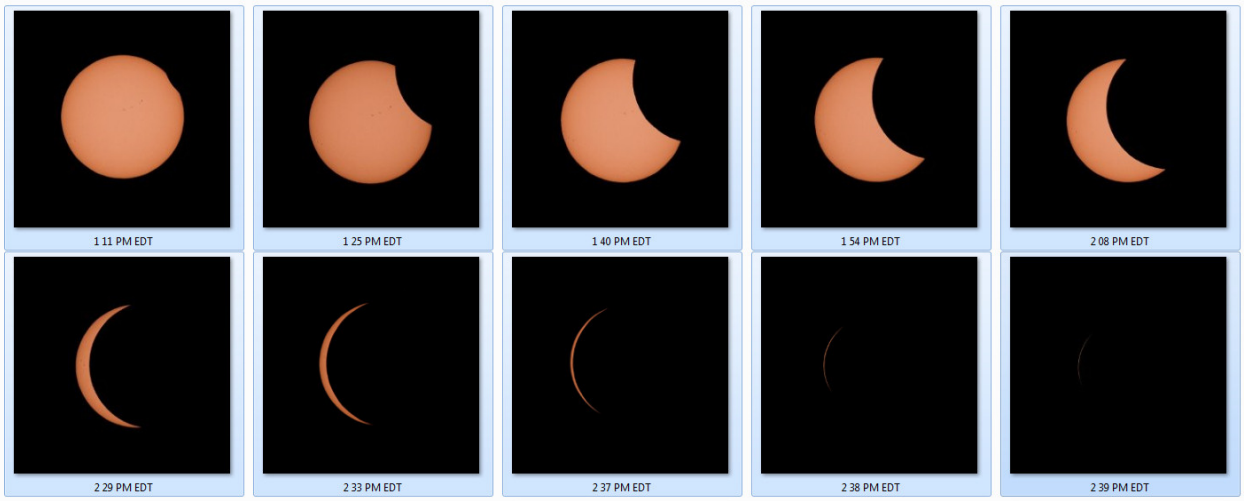
Hotel accommodations were not a concern because my brother and parents both live within 50 miles of the centerline. As planned, I drove down Friday and spent the weekend with family and friends. My brother works in

Spartanburg, SC, and was certain we could drive down Monday morning and avoid traffic by using the back roads. That turned out to be unnecessary. The roads were clear the entire drive.

We planned to drive to the centerline in Mountville, SC; however, our friends found an ideal spot a few miles north, in Laurens, SC. A short detour brought us to a perfect location—a garden center only a block from Laurens Courthouse Square, the epicenter of the town's eclipse festivities. The garden center, Verdin's Too, was very accommodating, providing tables, umbrellas, fresh organic fruit, vegetables, homemade cookies, drinks, coffee, ice cream, and most importantly, a bathroom.

To minimize confusion and distractions, I chose not to bring my telescope but to simply use my Nikon D3300 with a 200-mm telephoto lens and a tripod. That was the first problem. Because I could not practice onsite, I didn't realize how high the Sun would be and how awkward it would be to try to see and focus through the viewfinder. I ended up holding my camera in my right hand and using my left hand to hold my 80-mm Orion solar filter in front of the lens. My test exposures showed that my shutter speed (1/500) would allow me to do that during the partial phases. It was awkward but worked perfectly.

As the eclipse progressed, clouds began to build. It changed from clear skies, to scattered clouds, and eventually broken cloud cover. Thankfully, the clouds gave the Sun a wide berth and never impeded our view. I took photos every few minutes using my predetermined manual exposure. However, I had read that things get crazy during totality…It goes by fast…You get flustered…Emotional…You make mistakes. Because this was my first total eclipse, I decided to err on the side of caution and let my camera automatically control the exposure so I could let myself experience the event. The experience was phenomenal. Knowing what I know now, I would have spent fewer of those precious 160 seconds taking pictures and more just looking up and around.



Solar Eclipse Sequence. Nikon D3300, 200mm, 1/500, f/8, ISO 100. Copyright 2017 Glenn D. Faini, GDF Photography.

Courthouse Square was filled with people, telescopes, and image projectors. My brother and friends experienced totality on the Courthouse steps. Darkness swept over us, lights came on, crickets chirped, stars and planets appeared, and the crowd cheered.

My camera did a decent job capturing what we saw, but the images of totality are overexposed, losing detail in the corona. I had intended to take multiple exposures, but forgot. If I get the opportunity to photograph another total solar eclipse, I hope to take multiple shots at different exposures to try to capture prominences and detail in the corona. I'm happy I got a few good shots, but am disappointed in the images for technical reasons.

The next total eclipse, in 2024 passes over my alma mater, Clarkson University, in Potsdam, NY. That seems like a perfect excuse for a college reunion.

Totality in McClellanville, SC

By Myron Wasiuta

Seeing the Great American Eclipse on August 21 was the fulfillment of a dream that started more than 30 years ago when, as a student in college, I traveled to see the Annular Eclipse in May 1984. Even back then, I had decided to travel to the South Carolina coastline as my viewing location for the 2017 event, hoping that the weather would cooperate, but if not, at least I would be at the beach! I also liked the fact that I would be one of the last people in the United States to be in the Moon's shadow as it headed out over the Atlantic. I would see it with my wife Terry and our four kids.

The drive to SC was long, and we arrived in Conway, SC, around 9 p.m. Saturday evening. We found a small shopping center with a Food Lion and pizza place for dinner. After dinner, we went into the Food Lion for some groceries. I immediately saw a large display of cakes in the bakery that were under a sign showing Totality! The cakes were all eclipse themed! Of course we had to buy one. I figured it was a small way to pay homage to the weather gods who would hopefully smile upon us on eclipse day. The picture I took of us next to the cake display was our first official picture on our adventure to see totality! A good omen I thought. I was surprised by the eclipse enthusiasm of the people working in the store despite being well north of the path of totality. They all knew about it and were quite jazzed up.

Food Lion Eclipse Cakes, Conway, SC. Credit: Myron Wasiuta

We arrived at Huntington Beach State Park late that night after a 13-hour drive—one that should have taken only 7 hours. The park gate and entrance station were closed, unattended, and locked. However, as luck would have it a camper was leaving at the same time and gave me the combination. Another good omen—I was able to open the gate and we proceeded to our campsite! Setting up our tents in the dark was somewhat challenging but went well. Although I made reservations 6 months in advance, this park was the closest I could get to the path of totality, which was about 30 miles to the south.

The night was hot and humid and filled with the sounds of insects and frogs in the nearby salt marsh. I could also hear the waves of the Atlantic crashing onshore like a distant gentle heartbeat. The next day was filled with hiking and exploring the natural beauty of the park and having fun on the beach. The tide was low, and it was a long white stretch of sand and emerald green waters that greeted us. Within 30 minutes, I was sunburned and remained so throughout the rest of our adventure.

Monday morning we awoke to the sound of rain hitting our tents—not a good omen! However, we were committed to our location and began the drive south toward Charleston along the coastal highway 17. I was initially planning to watch the eclipse from Bulls Bay, but on the way, we came across a charming little town called McClellanville. It had a school and library along a street lined with huge trees covered in Spanish moss. Absolutely beautiful. And because we were still 5 hours from the eclipse, there weren't too many people crowding the streets yet. That gave us some time to set up and explore the town. The community center was nearby and had eclipse-themed artwork displays made by school kids. There was also a scale model of our Solar System set up that could be walked from one end of town to the other. It even mentioned the Kuiper Belt! Boy these kids know their science.

The nearby church had set up an outdoor grill, and the smell of grilled burgers and hot dogs was too much to resist. By now the town was hopping with eclipse chasers, and our once empty field was packed with onlookers. Two in particular befriended us—Dave and Walt. Both had ridden their motorcycles from Texas to see the eclipse.

The sky gradually got eerily dark. Thankfully the clouds had cleared, and we could see the partial phases progressing with our eclipse glasses. I was amazed at how fast the Moon covered the Sun. As totality neared, a palpable tension could be felt in the crowd—people were restless and began to stand up. The daylight became subdued as though I was wearing sunglasses. It was almost like being in a dream state. Shadows were intensely etched in razor sharpness. The street lights came on, and a strange chill overcame us. Then suddenly it appeared—the most beautiful sight I have ever seen in the sky—the Diamond Ring. It looked much bigger than I thought it would. I yelled and screamed, and almost as fast as it formed it was gone. In its place was totality! For the next 2 minutes and 38 seconds my family and I stared in awe—trying to absorb the experience in all its facets. Of course this was impossible, but what an experience it was. Goosebumps ran up and down my arms. I couldn't think straight. I realized then what people meant by "eclipse madness." I futilely tried to take pictures through my telescope using the iPhone, but couldn't quite get it right. I filmed around me, rambling about in the darkness—coronal streamers and Baileys beads. Then it was over. I realized I didn't even give my wife a kiss during totality—something I had vowed to do back in 1984.

We encountered heavy traffic on the ride back to our campsite. During the ride, I reflected on the whole experience and decided then we would be once again in the path of totality in 2024. During that eclipse, I hope to make good on my promise to kiss my wife while the shadow of the Moon sweeps across our planet and once again brings a few fleeting moments of darkness to the day. A video of my experience is posted on YouTube and Vimeo.

Eclipse Impressions—Greenville, SC

By Glenn Holliday

We had a perfectly clear sky and gorgeous views of the 2017 solar eclipse in Greenville, SC. I'm happy we chose to go and got the first opportunity in my life to see totality. Totality really is a completely different type of event than a partial eclipse. I was surprised how bright the corona is! It extended a Sun diameter into space in every direction.

Totality went by way too fast—I didn't look for all the things I planned to. I did not attempt to set up a camera, concentrating on visual observing with binoculars. I was able to spot a hint of prominence among the very fine structure of the corona's streamers. The twilight domed the complete circle of the horizon. That was another first-time and striking event because sunrise and sunset just don't do that the same way. Venus was obvious but Jupiter was blocked by a roofline, and I did not catch Mercury or Mars.

The hours before and after totality are also beautiful to see. We found great examples of trees projecting hundreds of images of crescent Suns onto the ground. One of my favorite sights was in the last minute before totality, watching the last sliver of the limb of the Sun contract into a smaller and smaller arc until, while vanishing, it suddenly created the first Diamond Ring. I did not spot Baily's Beads at the onset of totality, but I did see them at the end, and they were my “alarm” to put down my binoculars and resume my solar glasses.

Months before the eclipse, I contacted the local astronomy club—Roper Mountain Astronomers—and learned they would be on Roper Mountain. (Except for those who were out of town...I learned my contact Dennis saw Jerry Hubbell in Casper at the Astro League conference.)

The Roper Mountain Science Center was already sold out for Eclipse Day, but we got tickets to spend the day on the mountain the day before the eclipse. Roper Mountain is a unique and very valuable resource owned by the Greenville School District. Just one of the facilities on the mountain is an observatory housing an 1898 23-inch

refractor. The instrument was built by Alvan Clark for Princeton. From there it went to the U.S. Naval Observatory and from there to Roper Mountain. They had a drawing for one person to observe totality through this beautiful telescope. That would have been worth winning!

Of course, they weren't using such a big aperture for solar observing while I was there, but I got to climb the ladder to observe the Sun through its 6-inch finder scope and a hydrogen-alpha filter. It did a better job showing both prominences and granularity at the same time than our club solar scope does.

On the mountain they told me they sold 2,500 tickets for Eclipse Day. There was space on the mountain for more—but it's probably good that people weren't over crowded.

During my pre-eclipse day on Roper Mountain, there must have been 100 volunteers putting on dozens of events and activities. One of them I met and talked with, Paul Winston, turned out to have written an eclipse activity for Boy Scouts of America. The requirements for that patch were nicely worded to accommodate those who got clouded out or were unable to get into the path of totality.

The city of Greenville delayed the first day of school till the day after the eclipse. The day after the eclipse, the TV stations in Greenville had stories about moms calling their doctors, asking if their children hurt their eyes watching the eclipse. But they had zero reports of actual cases of damage.

We made a long weekend of it. Driving down, I-95 was more packed than on most weekends, so I was glad I didn't wait any longer. Early on Eclipse Day, the two Interstates that pass through Greenville were parking lots inbound. As we came close to totality, local TV reported that the Interstates had suddenly gone from packed to empty. Ten minutes after totality was over, they reported the Interstates were full again, this time outbound.

We stayed an extra day to do other things in Greenville so as not to compete with the post-eclipse traffic. (I have family roots in Greenville.) That choice worked out well, and I plan to take that lesson into the 2024 eclipse.

Eclipse 2017

Tom Watson

The Great Eclipse of 2017 was an awe-inspiring event causing many would-be seers, astronomers, and photographers to journey en masse toward the path of totality, a narrow, clogged pathway stretching across the United States where the Sun's eclipse was both the most full and most aesthetic. While many were booking pricey hotels in planning their trips, some of us “locationally challenged” folk were relegated to choosing between our backyard and our neighbor’s backyard. I was just one such individual.

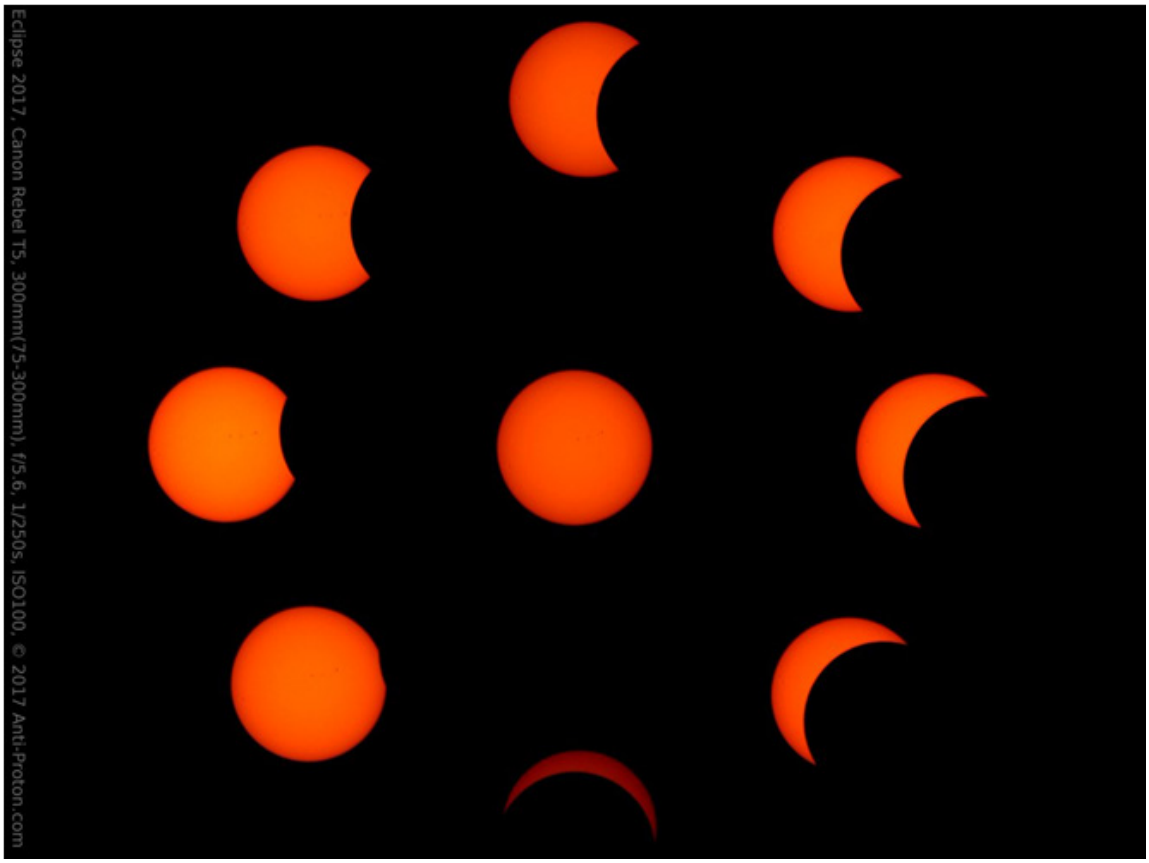
My Setup: iOptron ProCube Mount, Canon 300mm Lens, 1000 Oaks Optical Solar Filter, Canon Rebel t5. Credit: Tom Watson

My two potential locations were Caledon State Park or my front yard. Caledon offered a slightly better weather report as well as the chance to offer public outreach to anyone who might venture by. The downside was the people who might venture by. Would they attempt to touch my camera or cause me trouble in the middle of a rare photography experience? My front yard offered beautiful solitude and access to anything that I might need, but the weather report was not as favorable and there would be no one to educate. In the end, I chose Caledon National Park primarily for the better weather report and the chance to educate people on the wonders of the Sun.

As one of the first people to arrive, I had plenty of time to set up my equipment. I was using an altitude-azimuth tracking mount to follow the Sun, but would need at least one reference point in the sky to calibrate the unit. This proved to be a problem because the Sun was the only visible star. Using previous photos indicating the position of Polaris, the polestar, I carefully performed an approximate calibration of my mount and then prepared for my first test photos. I had purchased a 1000 Oaks Optical solar filter. The quality of the photos was not as good as I would have gotten with the hydrogen alpha filter I could have borrowed from the club, but I had found the hydrogen alpha filter to be very finicky, and I could not risk the loss of such an amazing event because of equipment failure. It only took me a few test photos to see that the Sun had several nice sunspots, and that I would be able to capture the eclipse as I intended.

I brought plenty of water as well as a laser thermometer to check the temperature of the equipment and try to keep cool. A major concern was the overheating of the equipment in the Sun. Nearly all of my equipment is black, and the Sun heated it to greater than 100°F within minutes. I wrapped my mount, camera, and lens in white linen to reflect as much light as possible, and constantly checked their temperatures using the laser thermometer. It took some jockeying, but I eventually achieved a configuration that would work for the upcoming event. As I did this, well over 100 people arrived. They gathered around me, but I had already picked the best place.

As the moment of the eclipse approached, so too did the clouds. I set my camera to take a photograph every 60 seconds for 4 continuous hours. I knew that I would take a significant number of bad pictures with the Sun covered by clouds, but I would also find many good ones in between. As the eclipse began to occur, I could see the photos I wanted to portray appearing in my mind, a collage of the Sun's eclipse. Stopping every 10 or 15 minutes to ensure the Sun had not drifted out of the camera's line of sight, I sat back and watched the eclipse with my own two eyes. It was truly beautiful, but what was most impressive was the sudden drop in temperature as the light was eclipsed.



A Solar Collage—Eclipse 2017. Credit: Tom Watson

Speaking with my wife on the phone, I learned that it had rained at my house and blocked much of the eclipse. My decision to photograph at the park had turned out to be a good one. Unfortunately, it wasn't long before the clouds began obstructing the eclipse at Caledon and prevented the majority of the second half from being seen. Two hours after the greatest moment of the eclipse, I began packing up my equipment as rain closed in on us. It had been a truly awe-inspiring event, and I had thousands of photos to examine and process as I headed home.

The 2017 Great American Eclipse Expedition—Casper, WY

By Jerry Hubbell

Even though the 2017 Great American Eclipse was not until August 21 my trip to Casper, WY, began on August 12. I headed out on the first leg of my journey to Springdale, AR, the headquarters for the company I work for, Explore Scientific, LLC. The plan was to fly there and spend a couple of days working at the office and packing for our road trip from Springdale to Casper. The next leg, with president Scott Roberts, and Director of Specialty Sales Greg Bragg, was going to be a grueling 2-1/2 day drive. We were going to arrive a few days before the eclipse to attend the Astronomical League's 2017 Convention called ASTROCON 2017. Unfortunately, we had to delay our trip for an additional day (that's a whole 'nother story!) and did not leave until late afternoon on August 14.

Ready to Go. Credit: Jerry Hubbell

After 20+ hours of driving, we arrived in Casper late Wednesday afternoon, August 16, the first day of the convention. We spent several hours unloading the trailer and setting up our booth. The convention went very well for, and we sold a lot of equipment.

On Sunday, August 20, we went to scope out the location where we were going to observe the eclipse with the Exploratorium group from San Francisco (https://www.exploratorium.edu/) and NASA TV. We set up our equipment at the location and met with several people from the Exploratorium and NASA TV. We received a tour of the studio they had set up to broadcast the eclipse all over the world via satellite.

The day of the eclipse came early after a restless night's sleep at a friend's home. My plan was to observe the eclipse visually using my bare-naked eyes and my Oberwerk 15x70 binoculars. What a view they provided! The Moon filled the eyepiece as it blocked the Sun. The corona was glorious to see, and through the binoculars, there was a major prominence on the southeast limb. Greg was shouting, and we heard lots of shouting and whistles during totality. I was glad I decided to observe the eclipse visually. A video of the day's events can be found here.


NASA TV Eclipse Broadcast Studio. Credit: Jerry Hubbell

We planned to observe from first contact to last contact, break down and pack our equipment, and then head out by 4 p.m. local time. We accomplished that but Scott, Greg, and I were woefully unprepared to drive non-stop—there were no rooms available that night from Casper east for 1,000 miles! We started heading back to Springfield on Interstate 25 toward Denver but the traffic was horrendous. So, after a quick stop at a rest area, we headed east on a smaller road for a few hours and then intercepted Interstate 80 toward Kansas City. We finally made it to Kansas City after 18 hours of driving. We were about a day ahead of schedule at that point, so we checked into a room in Kansas City around 1 p.m. and took a nap. We only had about a 4-hour trip back to Springdale, which we drove the next morning, August 23. My flight back to Virginia was due to leave on the afternoon of August 24. Suffice it to say, we got back in plenty of time!

This was a very memorable trip, and Scott, Greg, and I got to spend some quality time discussing all kinds of things astronomy related and otherwise. My flight home was uneventful, and my son Brian was there at Dulles International Airport to pick me up that evening. Phew! I was so tired after my 13-day adventure but I wouldn't change a thing!

Brief Eclipse Reports

Oak Knob, Nantahala National Forest, NC

By Bart Billard

Saturday, Linda and I (and our dog Phoebe) traveled to Asheville, NC, to visit a high school classmate and his lady friend. With much help from our friend's research, we chose western North Carolina as our eclipse observation location and left at 6:30 a.m. Monday for Nantahala National Forest. An interested neighbor of our friends kindly did the driving in his larger car. Traffic was quite light but we discovered that was because many people had arrived Friday or Saturday and camped out. We were lucky to find a parking spot. The six of us trekked to Oak Knob with essentials like food, water, and camp chairs. On the way, we met some people who were leaving to head further west because of forecasts for clouds. We decided to stay, figuring we couldn't get anywhere better quickly enough to make it worthwhile. It took a second trip to the car to get the equipment up. Oak Knob is a high open meadow at about 5,500 ft so the view is nearly 360 degrees.

Fortunately, the clouds did clear away about 1/4 of the way toward totality. Using the RAC NexStar and solar filter, I provided views to people nearby during about 2/3 of the partial phase leading up to totality. Then I switched to the video camera and video time inserter (VTI) I use for occultation timing. It allowed people to watch the progress on the laptop screen instead of taking turns at the eyepiece. I also got a sequence of brief video recordings of the progress of the partial phase, a complete recording of totality with about a minute before and after, and a few more short sequences showing progress of the Moon after totality. You can see my edited video of the event here. Also note that a single still frame from the video showing the Baily's Beads is shown at the end of this newsletter as the Image of the Quarter.

During the eclipse, the sky went from bright and sunny with cumulous clouds to a weird "sunset like" effect to the west with high clouds lit by the Sun as it re-emerged there. During totality at our location, the temperature dropped 5–10 degrees (to probably 60), and the ground got quite dark.

We experienced the bad traffic everyone feared on the return to Asheville. We crawled along for hours and got back to Asheville after 10 p.m. Our Tuesday trip back to Fredericksburg continued the traffic misery on I81. We decided to minimize the pain and stayed overnight in Salem, VA, finally making it home early Wednesday afternoon. Despite all the traffic issues, it was all worth it for a once (or maybe twice) in a lifetime experience. We're hoping we can see the eclipse in 2024.

Porter Library, Stafford, VA

By David Abbou

What can I say about the eclipse event at the Porter Library in Stafford? It was certainly unprecedented, with more than 1,100 people attending. The line was huge when I arrived an hour before the event, with the local sheriff's department called for crowd control! The library distributed hundreds of eclipse glasses that they and I received, and *The Free Lance-Star* photographer and writer stayed for the entire event as well. I also distributed lots of NASA outreach materials, which were quickly gone. The following is the report I received after the event from library's manager directed to all the volunteers who helped out:

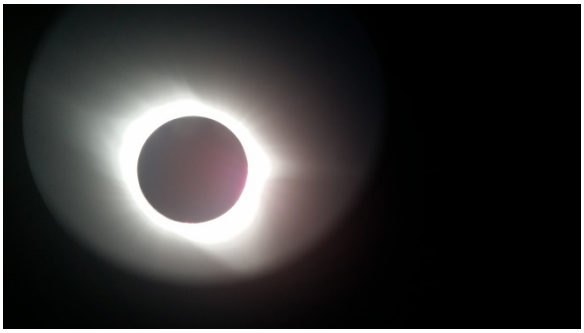
"Wow, folks! You all helped over 1,000 people, that's not a typo—yes, I wrote one thousand people—enjoy the event here today. The crowds kept coming, and the phones kept ringing, and you all kept smiling and answering questions and showing people where things were...I'll also send a shout-out to David Abbou, volunteer for the NASA/JPL Solar System Ambassadors Program! David set up his telescopes and talked with hundreds and hundreds of people. The calm actually came around 2:00 when we had given out the last of the glasses. People started sharing with complete strangers, and it was a really cool outside party with people taking turns, looking and oohing and aahing! David, thank you SO much for your generosity today! You are the best!"

David Abbou at Porter Library and the Maximum Eclipse in Stafford, VA. Credit: David Abbou

Cooksville, TN

By Tim Plunkett

Here is what I got using my camera phone through the telescope eyepiece.



Eclipse, Cooksville, TN. Credit: Tim Plunkett

Lathrop, MO

By David Hiles

Email @1:24 pm: Severe t-storms just moved through the area. Clouds broke long enough to see first contact. Clouds moved back in. Still hopeful.

Email @3:04 pm: All but rained out here. We could not see totality due to clouds. Very disappointed.

Clemson, SC

By Joe Francis

Sherry and I observed the total eclipse for about 2:38 minutes at the viewing field of Clemson University in Clemson, SC. This was the first trip we had taken since I contracted shingles in early February 2017. Recovery has been very slow and is still far from complete.

We took 2 days to drive down and 2 to return. My two brothers joined us at the viewing field ("tail-gazer" event). I didn't take photos of the eclipse because I was more interested in sharing the event with Sherry and my brothers. We used the Celestron 40x10 solar binoculars and an AP 70x10.5 Astro Bino fitted with solar filters. The AP binos were the best by far because of the wider field of view and clarity. We were at the center of the totality zone. The few early-day clouds had moved out of the way for clear views of the eclipse in a blue sky.

We were amazed that even with the Sun 95-percent obscured, the light on Earth was still daylight only slightly dimmed. Only with total eclipse of the Sun did we get dark like a moonlit night. The corona was amazing to watch. Each of us saw the corona differently as a function of our eyes. The total eclipse was over too quickly, of course.

After the total eclipse, we noticed crescent shadows under a large tree. It looked like the small spaces in the leaf canopy were acting as pin-hole lenses and projecting an image of the partially eclipsed Sun onto the ground. I tried to photograph this with my iPhone, but it didn't work. Sorry I don't have photos to share.

RAClub Supports "Meet the Moon" Events

By Scott Lansdale and David Abbou with Linda Billard

David Abbou and Spaceship Model at Meet the Moon

Scott Lansdale supported a successful Meet the Moon Night at Wilderness Elementary in Spotsylvania County on October 24. The turnout was good but was quite a challenge because most of attendees were small children. A step ladder with a handle on top helped. It gave the kids something to hold onto other than the eyepiece. One of the teachers had a small reflector set up but the club scope was a great addition. Although the sky was very clear, the seeing wasn't good. Got lots of "wow's" anyway. Saturn was ok at low power only. Scott said, "I kept the Moon at full eyepiece only, so not much magnification there either."

Despite the partly (and sometimes mostly) cloudy skies during the evening of October 28, David Abbou participated in the 5th annual Meet the Moon event at the Porter Library in Stafford, VA. The event, held in conjunction with International Observe the Moon Night, was a great success. The 80 or so adults and children who attended were treated to views of the first quarter Moon through three 8-inch telescopes. There were also indoor activities and displays, including the spaceship model in the photo at left. A few people asked David about RAC membership, and he directed them to the RAC website for more information. David appreciated the assistance of RAC member Mark Burns and the librarian's husband in manning the telescopes.

Timing a Triton Event

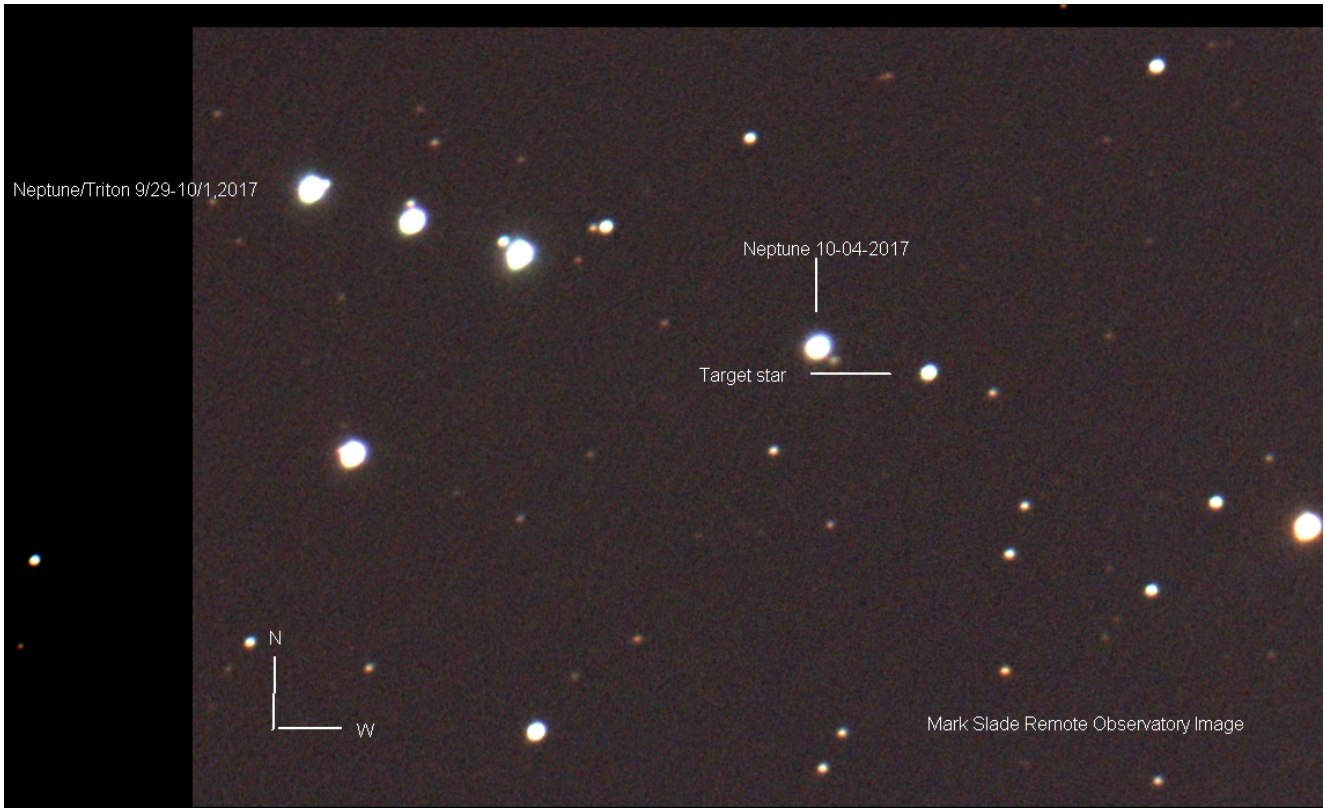
By Bart Billard

For some time now, I have tried to time occultations (i.e., when an asteroid or other solar system object passes in front of a star) from my house, reasoning that driving somewhere to capture one not predicted to pass nearby

should be postponed while I get some practice. The application "Occult Watcher" (OW) allows me to filter all the predictions available online to obtain a list of ones that are more easily reached from my location, and I focus on those with the shadow path predicted to be overhead or near enough that the prediction error leaves a decent probability that I could observe it. Recently, I have begun questioning that strategy because the opportunities that have not been "clouded out" have been so far apart that I may have missed some for lack of practice.

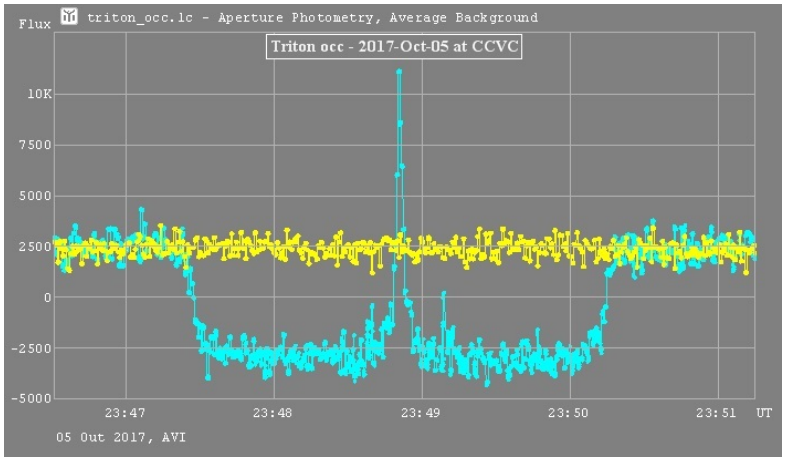
When I saw a prediction for a Triton occultation in OW, it looked promising enough to try. The probability of seeing the shadow without having to drive nearer to the centerline of the prediction was nearly 99 percent based on the uncertainties of the prediction. I used OW to "announce a station" well ahead of October 5, the date of the predicted occultation. Announced stations appear in a schematic cross section of the shadow path in OW, allowing other observers willing to travel to choose a location that avoids duplicating someone else's chord. Each timing observation provides a measurement of the size of the object along a line parallel to the motion of the shadow. The more different chords measured by all the observers, the more detailed the shape of the object that can be inferred. As the date approached, I saw more and more stations being announced. I also received an email sent out by one of the scientific leaders of an effort to coordinate observations. I was reminded Triton was the moon of Neptune. It has an atmosphere that can be probed by measurements of the starlight passing through before and after the occultation. The scientists even hoped some observers close enough to the center of the path would see the "central flash" when the star was directly behind Triton and a layer of the atmosphere at the right level would just focus its light on the Earth.

It became clear this was an important event, but there were a number of difficulties to be addressed. Myron Wasiuta and Jerry Hubbell agreed to help out. We planned to use the MSRO 2 telescope, a C14 that was just becoming operational the last week or so before the event. My Dobsonian would not do because the event duration would be too long for a telescope that did not track, and the separation between Neptune and Triton would be less than 12 arc sec. We did a practice run on October 1 and another on the night before the event. They were very helpful in



Position of Neptune Relative to the Target Star on Four of the Days Before the Event. Credit: Myron Wasiuta

working out how to go about making the timing video. Myron also took images of Neptune and Triton progressing toward the target star during the week before the event (see composite photo above). As the event approached, the weather forecast trends were not very good. We met before sunset and went ahead with preparations, hoping the clouds would hold off enough to record the event. Unfortunately, the clouds did turn out to be a factor. Neptune was visible but fading near the time of the predicted occultation. Analyzing the data to see whether Triton and the star were visible enough to time the event will be more complicated.



Light Curve for Triton Occultation, October 5, 2017, viewed from Constancia, Portugal. Credit: Rui Gonclaves

Many reports were relayed by OW about successful observations along with ones with clouds and bad weather. One station closer to the predicted edge of the shadow reported a 65-sec occultation. A station on a chord just 68 km closer to the middle than our 974 km reported a 130-sec occultation. The predicted center of the shadow path went through the southern tip of Florida and through Portugal on the other side of the Atlantic. Rui Gonclaves, near Constancia, Portugal, observed an occultation with duration slightly more than 167 sec. His report showed a light curve (see graph) with a spectacular central flash that more than double the change in brightness of the drop when the star disappeared.

Air Travel with an 80-mm Telescope

By Ron Henke

My wife and I traveled from Tucson, AZ, to Jefferson, OR, to see the eclipse—but we didn't drive—we flew. I had purchased the telescope and mount with this in mind, but it was the first time I had a chance to try it out. I used an 80-mm Stellarvue refractor and an iOptron Cube Pro mount…all of which fit in a carry-on suitcase. I was concerned about going through the security screening process with TSA. I had looked online and found a forum on Cloudy Nights that discussed the subject of carrying a telescope on a plane and everybody said it was not a problem. They were right. I put the tripod in with my checked luggage. The pictures below show the packing process.

There's a 3-inch piece of foam rubber at the bottom of the case. In the case are the scope, mount, solar filter (white box), camera (silver cube), power cable, and C-mount. There's actually some room to spare.

This picture shows the inside cover of the suitcase. It contains the hand controller on the right side and the spreader bar, dove-tail bar, and screwdriver on the left.

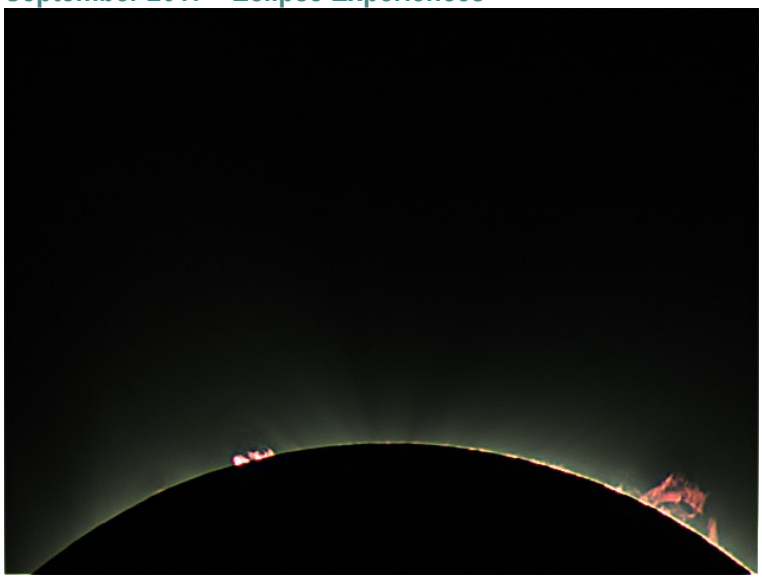
On top of the scope and mount, I put another piece of 3-inch foam.

Then I zipped the case and away I went.

Highlights of Recent RAClub Presentations

Abstracted from Bart Billard's Meeting Minutes
(Note: There was no presentation at the August meeting. The RAC picnic was held.)

September 2017—Eclipse Experiences



Prominences During Solar Totality–Shot in Jefferson, OR. Credit: Ron Henke

The program for the evening was reports of experiences observing the August 21 solar eclipse. Ron Henke began (via Skype from Denver), with Jerry Hubbell displaying slides Ron had sent. Ron said he was in Jefferson, OR, for the eclipse, where the duration of totality was 1:58 compared with the maximum for Oregon of 2:05. He used the same IOptron mount that Tom Watson reviewed in the April issue of the StarGazer and agreed with Tom's review. Ron said the breeze stopped during totality and that the local TV station reported a 4-degree temperature drop. Jerry Hubbell and Linda Billard, who were at higher altitudes reported greater drops. Ron said he had no problem taking his telescope from Arizona as a carry-on item. Ron's prominence picture, which was the current image of the month on the club website, was the final slide. Scott Lansdale asked about the granularity in the picture with the sunspots visible. Myron Wasiuta confirmed that it can be seen with white light, but said that with a hydrogen alpha filter, it is much more detailed and is at a higher level in the solar atmosphere.

Bart Billard described his trip with Linda to Asheville to visit their high school classmate and his lady friend. Together they went with a neighbor who did the driving to Oak Knob, near Huckleberry Knob in western North Carolina to view the eclipse. They had to park on the highway nearly a mile from the trailhead parking lot and walk nearly a mile and a half to Oak Knob. It took another trip back to the car to get the club NexStar telescope and video recording equipment Bart had brought. Many people were already camping at the site, and the word was more were at Huckleberry Knob not far to the west. A few were leaving to try to find a better location farther west because of cloud forecasts. However, the clouds began breaking up early in the partial phase, and none were nearby during totality. Bart and Linda said they saw light from the clouds in the distance during the totality phase. Bart showed the video he made with brief views of smaller and smaller crescents of the Sun showing progress of

the partial phase, then the beginning of totality from about a minute before to 30 seconds into totality, and finally the ending of totality and more clips of progress of the ending partial phase. The clouds were visible in the clips beginning and ending the video. His equipment for timing occultations provided Universal Time annotation along the bottom of the video.

Myron described his experience next, beginning with his first eclipse on May 30, 1984. He said it was cloudy for that event, but he saw it get dark and resolved to see the next one. He went to the South Carolina coast to be among the last in the United States to see the eclipse. He stayed in a beautiful state park and had to drive 40 miles south for the totality to McClellanville, SC, where they had a great festival with a shrimp theme. He showed a video he had made combining the video from his iPhone and his camera on his telescope by synchronizing their soundtracks. He noticed strange lightning seconds before totality but could not get it in focus.

Glenn Faini said he was able to stay with his brother located about an hour north of totality. They made an 8 a.m. start and found no traffic on the interstate. They went to Laurens, SC, a small town near Greenville.

Jerry Hubbell went with his company to Casper, WY, for a convention and the eclipse. He said Explore Scientific sold 4.5 million eclipse glasses, mostly bulk sales. They were overwhelmed with orders in the last week or two before the eclipse. Explore Scientific was involved with the NASA TV effort to broadcast the eclipse. He showed an Explore Scientific video covering the preparations for the event. It included an interview with Vivian White of the Night Sky Network and Astronomical Society of the Pacific.

After Jerry's video, Glenn was able to get some of his Facebook image posts and a video to show us. One image had Regulus visible near the eclipse. Payal Patel described the partial eclipse experience at Caledon. She said Tom Watson was also there. She showed an eclipse model they made at an art table Caledon had set up.

Scott showed his VLF recording at 40 KHz of the signal from a Puerto Rico station that he made on the day of the eclipse. He had added marks at the beginning, maximum, and end of the partial eclipse. He found some activity but could not really tell if it was related.

October 2017—How to Detect What Stars Are Made of

Bart Billard began his program by saying that he had had an idea for using an instrument he once worked with in the lab as the basis of an instrument amateurs could build to reveal information about stars and other objects in the sky. With help from Matt Scott and Lauren Lennon and advice from Myron Wasiuta and Jerry Hubbell, Bart was nearly ready to test it on a telescope.

As background, Bart described the story of the application of spectroscopy to the stars. Isaac Newton contributed to the understanding of how white light is a mixture of colors, comprising its "spectrum" with experiments in 1665 that are described in George Johnson's *The Ten Most Beautiful Experiments*. Newton passed sunlight from a hole in the shutter of his darkened room through a prism to produce the rainbow effect on the far wall. From his experiments, he concluded each color represented a component of light with a characteristic amount of "refrangibility," the degree to which it bent (refracted) in a prism or lens. White light was a mixture of these different kinds of rays.

Spectroscopy of astronomical objects began in the mid-1800s, not long after the death of Auguste Comte, a philosopher/scientist who erroneously concluded, based on distances being found for the planets and some nearby stars, that "…we can never know anything of [the planets'] chemical or mineralogical structure…" (let alone the stars). Physicists Joseph Fraunhoffer, Gustov Kirchoff, and Robert Bunsen pioneered spectroscopic techniques that identified dark lines in the Sun's spectrum as sodium. Soon other elements were identified, and in 1868, French astronomer Jules Janssen and English astronomer Norman Lockyer had found the first evidence of helium. Bart said the story of Comte and the early work with the Sun's spectrum is by Michael Richmond on his website "How do we know the composition of the stars?" (Michael Richmond is a professor of astrophysics at the Rochester Institute

of Technology.) There you can also read about Cecilia Payne-Gaposchkin's work to put spectroscopy on a more quantifiable basis, which led to the discovery that hydrogen is the most common element in the Sun and typical stars, followed by some helium.

Bart next talked about interference patterns and how they can be related to spectroscopy. He explained we see the effects when light from one source reaches our eye via different paths. For example some could reflect off the outside surface of a soap bubble film, and some could reflect off the inside surface between the film and the air inside the bubble. This light travels some distance farther, depending on the angle of its path through the film and the thickness of the part of the film it goes through. Like the waves in the surface of a ripple tank, light consists of waves with peaks and troughs. They can be aligned peak-to-peak and trough-to-trough and reinforce each other (constructive interference) or peak-to-trough and cancel each other (destructive interference). How they align depends on the distanced between one peak and the next, called the wavelength, as well as the difference in the length of the paths travelled. Different wavelengths correspond to different colors. The result is parts of the soap film can have some colors enhanced and others suppressed in a way that varies across the bubble and produces the iridescence effect.

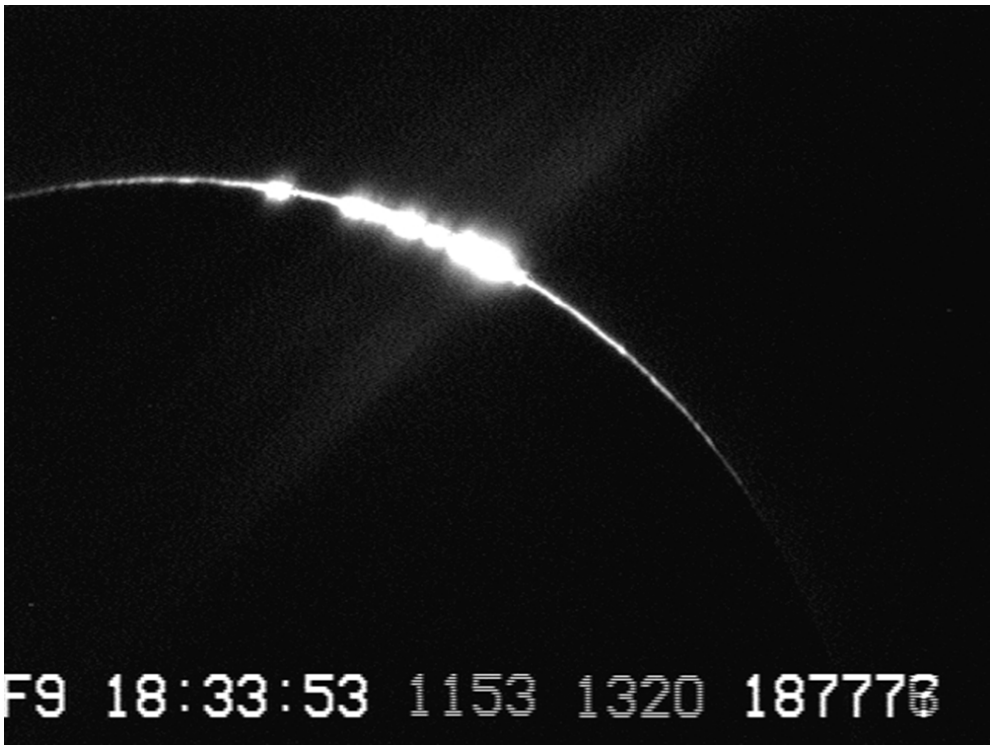
Bart illustrated with a diagram of a two-slit interference experiment. He showed how the distance from one slit would vary compared with that from the other. A point directly opposite the midpoint between the two slits would be the same distance from each slit, and light of any wavelength would align for constructive interference and be the location of a bright fringe. A point at an angle to one side of this first point would be closer to the slit on that side. The extra distance to the slit on the other side, measured in wavelengths, tells how many fringes at that wavelength would be found between the two points. Another shorter wavelength might be found to fit one extra wavelength in that same extra distance. Its pattern would have one extra fringe between the two points. That tells us we could distinguish these two wavelengths by counting fringes. It turns out patterns corresponding to a combination of wavelengths with varying intensities can be analyzed to reveal the relative contributions of all the wavelengths and thus reproduce the spectrum.

Bart next showed the Michaelson interferometer used by professional astronomers. It includes a "beamsplitter," which reflects part of the light and transmits part to split it into two paths, and two mirrors which reflect the light back to the beamsplitter the way it came. The beamsplitter recombines the returning light and reflects some of it to a detector. One of the mirrors can be moved closer or farther from the beamsplitter by a motor to vary the distance for the corresponding path and produce an interference pattern at the detector. This interferometer can produce up to 100,000 fringes just by moving the motorized mirror a centimeter, allowing it to distinguish light wavelengths extremely close together. On the other hand, it is very sensitive to vibrations, tricky to align, and requires expensive precision moving parts. Bart compared it with a common-path interferometer that is the basis for his instrument. It uses a lens and CCD camera instead of the detector, and the two mirrors are fixed and turned to send the light from the beamsplitter from one mirror to the other and back to the beamsplitter in nearly identical clockwise and counterclockwise paths. The camera sees two images of the source side by side a fixed distance apart. A person or camera looking into the Michaelson interferometer would see one source in line with the other, a variable distance in front or behind as the motor moves the mirror. The side-by-side images in the common-path interferometer produce their interference pattern like a two-slit interferometer. The fringes are spread out across the camera as a function of the angle of the light from the source. The common path makes it easier to align and insensitive to vibrations, and there are no moving parts. Bart said he first became enthusiastic about the idea when he realized he could let stars drift through the field of view of his Dobsonian telescope, and they would record the interference pattern on the CCD camera in their trails. The telescope does not need to track the sky.

Bart's Common Path Interferometer. Credit: Bart Billard

Bart concluded by showing his interferometer. He said he had had the good fortune some time ago to encounter Matt Scott and Jean Benson downtown early in his work on the interferometer. He realized Matt's mechanical engineering background would be very helpful and told them about the project. Also during the early phase, he discussed the idea with Myron, Jerry, and Lauren at MSRO Commission meetings, and Lauren mentioned she was getting trained to use the 3-D printers at the Library. Matt designed a yoke to hold the beamsplitter, and it was ready for Lauren to print when she completed her 3-D printer training. Since then, Bart has visited Matt and Jean several times to work on a layout on the original breadboard that can be enclosed in a box holding a collimating lens to direct the light from a telescope source and Bart's DSLR camera and lens to record the interference pattern. The walls of the box with adapters for the lenses were ready during the previous week, and Bart was able to record interference patterns indoors and included one in the talk. The next step is to make the lid for the box and decide on a bracket for stabilizing the package when mounted to the MSRO2 telescope. A copy of Bart's presentation is available here.

Image of the Quarter



Baily's Beads at 18:33:53 UT (2:33:53 p.m. EDT) August 21, 2017, Eclipse of the Sun at Oak Knob, NC. Credit: Bart Billard

Bart says: This is a single frame from my video of the solar eclipse recorded at Oak Knob (near Huckleberry Knob) in Nantahala National Forest, western NC. I used RAC's 5-inch NexStar telescope and solar filter with the PC164C-EX2 CCD video camera and IOTA video time inserter (VTI) equipment I use for timing occultations. The VTI annotation at the bottom shows the Universal Time of the odd and even fields to 4 decimal places each (1153 and 1320, respectively)… VERY precise.