http://www.raclub.org/

The StarGazer

Newsletter of the Rappahannock Astronomy Club No. 3, Vol. 5 November 2016–January 2017

A Stargazer's Report—The Southern Hemisphere

By Ryan Rapoza

Small and Large Magellanic Clouds and Milky Way from the Coral Coast of Fiji ©Ryan Rapoza

Note from the author: Special thanks to my wife Jessica who has always been very supportive of my hobbies and was again supportive in joining me in my Southern Hemisphere viewings. This was our honeymoon—we had 28 days together, and she allowed me to experience a night sky I will never forget. Thank you, dear!

My main stargazing goals for the trip were to capture the Southern Cross, Large and Small Magellanic Clouds, and if possible, Alpha Centauri (the closest neighbor to our Sun). These are all objects that can only been seen south of the Equator. What follows is a "travelogue" of our trip.

Australia

We began our trip with several days in Australia, arriving in Sydney on October 13 at 7:45 a.m. local time. I immediately noticed a significant amount of greenery as we descended into the city. My hope was that this would reduce the light pollution.

Sydney—The city was wonderful; however, the weather at night did not cooperate—nothing but cloudy. We did manage to find the Sydney Observatory and took a tour. It is located on a hill overlooking the Sydney Harbor Bridge and is just west of the "Circular Quay" shipyard. The observatory is very well run. Exhibits included old telescope hardware from the early days of the observatory and my personal favorite—the astronomy photos (*cont'd page 4*)

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.

The StarGazer
November 2016–January 2017
Published Quarterly by Rappahannock Astronomy Club
Editor: Linda Billard

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

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Calendar of Upcoming Events

After School Program (outreach), Mt. View High School	February 7
Star Party, Caledon State Park	February 25
Star Party & Outreach, Marine Corps Museum	March 11
Star Party, Caledon State Park	March 18
Star Party, Caledon State Park	April 29

Recent Outreach Events Completed

Star Party, Caledon State Park	November 5
Night in Washington's Day, Ferry Farm	November 12
Outreach, Park Ridge Elementary School	December 9,12, & 19
Star Party, Caledon State Park	January 28

President's Corner

Welcome to New RAClub Members (November–January)
❖ Teresa Tindal
❖ Barbara Deal

Happy New Year! Hope you all enjoy another great newsletter. So far, this year's been gloomy but the skies are sure to clear soon. We have a number of events coming up this year. A couple I would like to highlight are outreach events at the Marine Corps Museum in Stafford and the Star Party event and presentations at Stratford Hall in Westmoreland County.

The **Marine Corps Museum event** will be held on March 11, starting sometime before sunset. Event details are still being worked out but I expect a great turnout if the skies are clear. Last year's event had a few hundred attendees even though it was overcast; I can't imagine what it will be like on a clear night. It's a great event for getting the word out about the club and promoting astronomy throughout the Stafford area. If you have a scope, don't be shy— come out to join us.

The **Stratford Hall event** may be the best event of the year—it runs Saturday, May 6 through Sunday, May 7. This might be our first true overnight trip other than Big Meadows. There will be a presentation on Saturday evening followed by observing. On Sunday morning, there will be another presentation focusing on the Sun, followed by some solar observing. The event is planned in spite of the weather because there will be presentations. I would expect more on the presentation side, if the weather doesn't cooperate. There will be areas for camping at the site and rooms for rent as well. This should be a great event and a wonderful opportunity to spend the night under the stars at this particularly dark site on the Northern Neck.

We have some other events in the works, and these will be shared with the club members as the events grow closer and the details sorted out. I would be glad to hear about any additional ideas for events if anyone wants to share/give feedback. Hope everyone has a great winter…maybe it will actually snow this year.

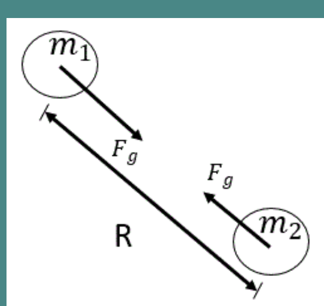
Clear Skies, Scott Lansdale

Astronomy Math: Gravity by Scott Busby

Even before taking an astronomy class, most people have a sense of how gravity works. No math is needed to understand the idea that every mass attracts every other mass and that gravity is the force that causes apples to fall from trees. But what if you want to know how much you'd weigh on Saturn's moon Titan, or why the Moon doesn't come crashing down onto the Earth, or how it can be possibly true that you're tugging on Earth exactly as hard as the Earth is tugging on you? The best way to answer questions like these is to gain a practical understanding of ***Newton's Law of Gravity***. Here's the equation:

$$F_g = G\frac{m_1 m_2}{R^2}$$

- mass 1 (kg) → m_1; mass 2 (kg) → m_2
- Force of gravity between mass 1 and mass 2 (N) → F_g
- Universal gravitational constant (Nm^2/kg^2) → G
- Distance from center of mass 1 to center of mass 2 (m) → R^2



In the above expanded equation, the meaning and units for each variable are presented.

Whenever you encounter an equation like the one above, it's a good idea to make sure you understand not only the meaning (and units) of each term, but also what the placement and powers of those terms are telling you. The force of gravity, F_g, appears on the left side of this equation in units of newtons (N). The force occurs between two objects such as those shown in the figure at left; each object produces the gravitational force F_g on the other.

A Stargazer's Report—The Southern Hemisphere (continued from page 1)…

of the year. There were photos in several categories, including deep sky, landscapes, and planetary. Our tour included a history of the observatory, a daytime solar observing session, and a "Southern Skies" planetarium show. The observatory also provided simple (free) night sky printouts for the month of October. These included all the objects I wanted to see, heightening my excitement about what I would see on this trip!

The observatory was originally commissioned to perform official time tracking duties for the City of Sydney. At 1 p.m. each day, there is a ball drop (similar to our NYC's New Year's ball drop). As any good astronomer knows, proper timekeeping has often been the duty of observatories throughout the world, and the Sydney Observatory was no exception. We were lucky enough to witness the ball drop in person. The tour then moved on to a solar observing session using an .8-m Meade LX200gps telescope. We had a wonderful view of the Sun (at about 1 p.m. on October 16) and saw two major sunspots as well as two minor spots. (The observatory offers night tours with a telescope viewing session as well.) The tour concluded with a planetarium show of the southern sky. I particularly enjoyed this because it included an explanation of where I could find the Southern Cross, the Large and Small Magellanic clouds, as well as Alpha Centauri, fueling my ambition to see these night sky objects.

The Sydney Observatory was the site of my first "ah-ha moment" related to the stargazing. In a conversation with an observatory staff member, she had mentioned her favorite stellar object to photograph was the "Orion Nebula during the summer." The mention of summer made me chuckle. The Orion Nebula is my favorite object to photograph as well; however, my memories of shooting it include my daughter and me bundled to the eyeballs trying to catch a decent photo in the dead of winter.

Sydney is not like large US cities that go for miles and miles and then blend into the next city. When you reach the Sydney's edge, it ends rather abruptly and the wild outback begins. This was evident on a tour to the Blue Mountains from Sydney; a 45-minute drive would put you far enough away from the city that you could probably have a nice view of the night sky. When in Sydney, I would certainly recommend checking out the city observatory. As for my view of the night sky…that would have to wait.

Cairns—Cairns (pronounced "Cans") was our second stop. We arrived October 17. We went there to see the "Great Barrier Reef." There was no local observatory like in Sydney. Although we had two nights without cloud cover, light pollution made it difficult to catch any glimpse of the true southern night sky. We took several late night walks along the boardwalk, but the view was to the northeast and there was nothing I could recognize. One night was particularly frustrating—I walked all over the town trying to find a dark spot (a park or alley). No luck. I would have to wait still longer.

Melbourne—As we flew into Melbourne midday on October 21, I again noticed the landscape as we descended for landing. More so than around Sydney, the countryside was predominately farmland with soft rolling hills. Again, I thought of how dark the night sky would look if I had a chance to view the night skies from one of these locations. However, once we were in the city, it was clear that most of the population in Victoria (Melbourne's state) was centrally located within 40 km or so of the city. The city itself had a "small NYC" feel to it that included tons of people and lots of transportation—taxis, buses, trains, and a free subway. Melbourne has a beautiful skyline that lights up the night sky. It includes the Eureka Tower, the tallest building in the Southern Hemisphere. All this meant, of course that again, I would be at the mercy of light pollution.

Melbourne does have an old observatory site. Located in a beautiful area known as the Royal Botanical Gardens, this observatory was also originally commissioned to perform official timekeeping duties. However, unlike the Sydney observatory, there were no consistently running tours. Instead, you have to request a tour in advance, and they are conducted by the Astronomical Society of Victoria. The domes were not accessible here, unlike in Sydney.

Unfortunately, I didn't get a good look at the night sky in Melbourne. We had rainy weather, and if it wasn't raining, I couldn't tell what the sky looked like because our hotel was in the heart of the city and covered in light pollution. This was our last stop in Australia, and I can't say that I had any success seeing the southern sky. It was at this point I began to worry whether I would get to see any of the objects I was hoping to see.

New Zealand

After no success in Australia, I was still hopeful that the pristine New Zealand landscape would help with light pollution and that the weather would finally break for us. New Zealand has a population of only 4.5 million people in the entire country, of which 2.5 million are in the main city of Auckland on the North Island. My hope was light pollution would not be an issue in Queenstown, which is on the South Island.

Queenstown—We arrived in Queenstown on October 25. Our schedule was very busy, and that night, we had scheduled dinner at the skyline gondola and restaurant located above the main township. The view overlooking the city was incredible, and there was no time limit on how long you could stay up there. Our original plan was to stay until it closed at midnight, and I would capture as many photos as possible.

After a quick gondola ride, we arrived at the restaurant, and it was clear that luck was finally on our side. A giant sign displayed in the waiting area of the restaurant said "Skyline Stargazing: a guided tour." A jolt of excitement hit me, and given our lack of previous success, my wife easily agreed—"Let's do it," she said. The price was a bit high ($89 NZ, (about $60 USD)) but I didn't care. The tour was scheduled to last an hour, weather permitting. I was very excited but we had about 90 minutes to kill until our 9:30 p.m. tour. After enjoying several adult beverages, we were greeted by our tour guide (who was from Michigan (!)). We followed him to a hill that was nearly on top of the restaurant and blocked any light from the town below. The company had set up two Celestron telescopes, a 9" and 11". FINALLY, some good conditions for observing! We had a clearing of clouds, but our tour guide assured us, weather changed quickly. So, he started with the brightest object in the sky that night that was setting quickly, Venus. Don't get me wrong, I love Venus, but I was anxious to get to the good stuff. After Venus, next was Saturn. Our guide allowed plenty of time for our tour group (about 10 people) to view both objects through the two telescopes. Oddly enough, this was the first time my wife had looked at Saturn through a telescope. (She is usually asleep when I am up late viewing.) Then a question came from our tour guide. "Does anyone know the closest star to our Sun?" Finally, "where is it?" I thought to myself. I scanned the heavens trying to figure out which star it was. "Boom!" with a green laser, our tour guide pointed at the brightest object visible that night (third brightest in the sky after Sirius and Canopus). I was so happy; I had finally gotten to see the closest star to our Sun. I couldn't help but think there could be "something or someone" looking back at me on Earth. The telescopes were then adjusted for a closer look. The guide then asked, "Does anything seem odd about the star, anything look strange?" I knew the answer, but stayed quiet to allow someone else to answer. "Does it look like there may be two stars there?" he asked. Many people looking through the telescopes indeed were able to make out both Alpha Centauri A and Alpha Centauri B of the binary star system.

At this point, I set up my DSLR camera on my little travel tripod and tried to grab some photos of the sky. This was highly encouraged by the tour guide. I was very thankful and blessed to have finally seen our next closest neighbor. While I was setting up my tripod, I listened to our guide as he pointed out Alpha Centauri's night sky buddy, Beta Centauri. Their significance was that they helped you find the Southern Cross in the night sky. They are collectively referred to as the "Pointer Stars." Alpha Centauri sits to the right (west) of Beta Centauri. If you then continue toward the left in the night sky (east) you come to the Southern Cross. I couldn't believe it! I had been hoping to see these for weeks now and couldn't believe they were finally here and so easy to view.

I began to take photos of the night sky, capturing several shots of Alpha and Beta Centauri as well as the Southern Cross (or CRUX). Our guide then explained how south is found using the Southern Cross. Unlike Polaris in the Northern Hemisphere, there is no single star that sailors can use to find the Southern Celestial Pole (SCP). The instructions the guide provided for finding the SCP were to pretend you could fold the constellation of the CRUX four times in the sky to the left (east). Then make a straight line to the horizon and that would be the SCP. The technique seemed a bit difficult…lucky for us in the Northern Hemisphere that Polaris works great.

We had been outside for roughly 25 minutes before the quickly changing weather conditions made themselves apparent. The clouds began to roll in. The tour was then called off before the guide could show us the Large and Small Magellanic Clouds. The tour team was very helpful, providing us with hot chocolate and even refunding 50% of the cost because we were unable to complete the tour.

After the tour was scrubbed, we made our way down to the town below via gondola and began our walk back to the hotel. We had been warned that weather could change very quickly, and indeed it did. We had clear skies before the tour started and then completely cloudy within 25 minutes. By the time we got near the hotel (about 1 hour later), skies were clear again. I had to go out while I could. My wife went to bed, and I went out into the late night in search of a dark quiet spot to take photos and collect my thoughts. Unlike in Australia, I was quickly able to find a park that was dark within a few minutes of the hotel. I set up and shot for about 30 minutes. After taking many shots of the sky, I noticed that two clouds seemed not to be moving. I wondered what those could be. I wasn't completely sure what the Magellanic Clouds looked like. It wasn't until later that night that I was able to confirm they were indeed the LMC and SMC. Below is one of the shots I took from Queenstown NZ on the night of October 25, 2016.

Sky over Queenstown NZ, October 25, 2016. 30-s image taken on Sony Alpha 6000 with F5.6 at focal length 50mm and ISO 3200. ©Ryan Rapoza

Auckland—Our time in Queenstown was quick. We were then off to New Zealand's largest city, Auckland, on October 28. Auckland has 2.5 of the 4.5 million citizens of NZ. Again, I would run into problems with light pollution as well as cloud cover. I was unable to see anything while in Auckland.

However, New Zealand was where my luck finally turned. We were not there very long, but the skies were finally visible. I would recommend Queenstown for a number of reasons, not just the sky. It was sparsely populated and at a high altitude and latitude very far south (about 45 degrees S). I personally have decided it is where I will retire. Conditions are ideal for dark sky viewing, and a quick hour drive would put you in a completely isolated spot.

Fiji

Fiji was the last stop on our southern adventure. I was very careful when I chose our hotel. I selected a hotel that had OK reviews but was located on Fiji's "Coral Coast." My reasoning was that the Coral Coast is on the southern side of the main island. This meant I would have clear views south with little light pollution in that direction.

From our room, it was 40 feet to the water. The hotel had lights around the complex, but they were dimmed after 1 a.m. The first two nights, the conditions cleared after midnight. I took many photos of the sky looking south from the beach. From Fiji it was very easy to see the LMC and SMC. I had difficulty viewing the southern "Crux" both nights because a small amount of clouds seemed to line the horizon where I would have expected to see it.

As you can see in the photo that leads this article (see page 1), the LMC and SMC were clearly visible in the night sky. The Milky Way was also easily visible. The LMC and SMC were my favorite objects. The size and brightness of the LMC (.90 magnitude) was very impressive. To put the size of the LMC in perspective, when put my arm out fully extended, while making a "U" shape with my thumb and index finger, the LMC was slightly larger than the distance between my thumb and index finger.

Conclusion

I had no luck in Australia—the problems were mostly weather related. I highly recommend visiting the Sydney Observatory. If possible, rent a car so that you can get out of the cities to remote locations that should provide good viewing conditions. If you visit Melbourne, you may want to contact the Astronomical Society of Victoria because they do have similar functions to RAC (star parties, community events, etc.).

New Zealand turned out much better for us, and Queenstown was unbelievable and my favorite location for day and night activities. I recommend paying for the skyline gondola and the stargazing tour. The tour guide was very knowledgeable, and the telescopes were in excellent condition. The tour company even provided weather jackets rated to −70° and hot chocolate for those that need additional warmth.

If you go to Fiji, I recommend getting a hotel with a beach facing south for an unobstructed view of the southern sky. Hotels located on the northern side of the islands may have mountains that obstruct your view.

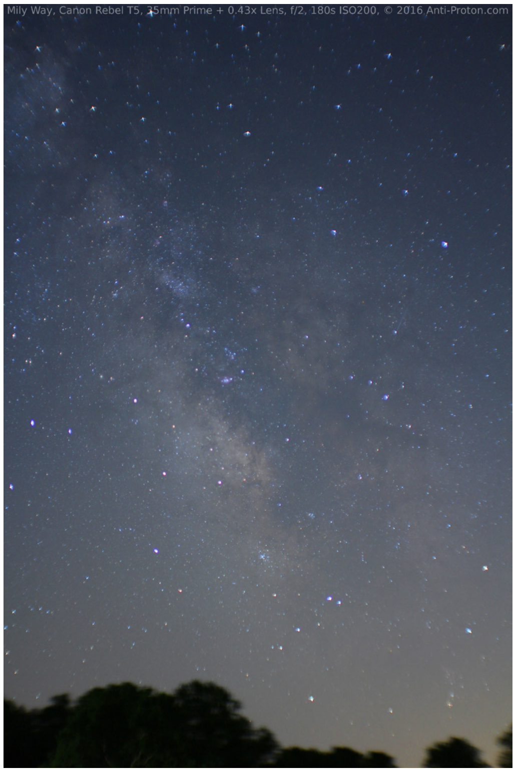
Equipment wise, I took a Sony DSLR camera with a travel tripod. My first images were not in focus which I didn't notice until after I looked at them on my PC. I decided that fully zooming my camera in or out was not the best choice. At ¾ zoomed in, the images seemed to sharpen up. The image on page 1 was done with this in mind and turned out much sharper.

Finally, every astronomer should see the southern sky. I spent several hours just staring at the night sky (especially in Fiji). The Magellanic Clouds are very impressive…I will never forget how large they were in the night sky.

Prehistoric Astronomy

by Tom Watson

Since time untold, humanity has gazed up at the stars and wondered what they were and what they meant. From religious beliefs and myths to navigation and simple aesthetic appreciation, our ancient ancestors devoted time and precious resources to understanding the stars and astral phenomena. The configuration of the prehistoric sky and the study of how our prehistoric ancestors perceived that sky is known as archaeoastronomy. Understanding how our sky has changed helps us understand our past, but also our future.



The Milky way Galaxy ©Tom Watson

Our ancient ancestors were avid astronomers in their own right. With no understanding of science and the world full of terrifying and unexplained phenomena, the regular and predictable nature of the stars, planets, Moon, and Sun provided a mechanism for predicting changes throughout the year, as well as a means of explaining events via the addition of religion. Evidence of the vast importance of the sky to our ancestors can be found carved and painted into the artifacts and ruins of nearly every major prehistoric site yet discovered. So significant was the sky that entire religions and large structures were created to address these celestial movements, such as the great Pyramids and Stonehenge.

Religious Beliefs

Religion was arguably our first attempt as a species to provide an explanation of the seemingly unknown behaviors and phenomena of our world. Over the past millennia, thousands of deities have been proposed, and many religions created. Examination of prehistoric artifacts has revealed that, just as is the case with modern religions, prehistoric religions appear to have used the sky and the movement of stars, planets, the Moon, and the Sun. While deities were often associated with celestial bodies and phenomena of the sky were thought to herald events on Earth, the use of the sky for reasonably accurate prediction of standard weather cycles, such as the start of a wet season, can be seen as a nearly scientific and practical usage of the motion in the sky.

Examples of Prehistoric Astronomy

Lascaux Cave—Cave paintings at Lascaux Cave in France depict what many archaeologists believe to be constellations and stars. Painted as early as 15,000 B.C.E., these paintings provide an early example of our ancestors recording the position of stars. It is unknown whether the paintings were simply artwork, had religious significance and/or some predictive capability. Interestingly, the cave is illuminated at sunset near the winter solstice. (https://en.wikipedia.org/wiki/Archaeoastronomy#Lascaux_Cave)

Stonehenge ©Tom Watson

Stonehenge—Built perhaps as early as 3,000 B.C.E., Stonehenge is one of the most iconic prehistoric sites in the world. Archaeologists still debate the exact function and configuration of the impressive stones, although it is widely accepted that their role was likely astronomical. By observing the stars at various times and various locations around Stonehenge, its original builders might have been able to predict solstices and equinoxes, as well as other phenomena. (https://en.wikipedia.org/wiki/Stonehenge)

The Pyramids of Giza—The great Pyramids of Giza are one of the seven great wonders of the world built to house the tombs of ancient leaders of Egypt. Passageways within the pyramids were constructed to point so that they aimed approximately at the point in the sky that the stars appear to rotate around—the Celestial North Pole.

Perhaps the ancient Egyptians believed that this point in the sky held some religious significance. The vast and complex work required by manual laborers to build such enormous structures and correctly align them with the stars is a testament to the importance the celestial bodies played in the religion and daily life of ancient Egyptians. (https://en.wikipedia.org/wiki/Archaeoastronomy#Egypt) (https://en.wikipedia.org/wiki/Egyptian_pyramids)

Light Pollution ©Tom Watson

Changes in the Sky

Prehistory encompasses all of the time before records were kept. The end of prehistory varies from place to place but is commonly several thousand years B.C.E. Over the last few millennia, the position of the stars in the sky and our ability to observe them have slightly changed owing to the effects of the various phenomena described below. These changes have complicated our analysis and understanding of prehistoric astronomy, as well as degraded or altered our current astronomical ambitions. Perhaps no greater change has been observed than the advent of modern-day lighting and its adverse effects on our ability to see a dark, vibrant night sky.

Light Pollution—Perhaps the most easily seen change that has occurred in the night sky is the increase anthropogenic light. Humanity has filled the night sky with so much unnatural lighting that is readily visible from space. A side effect of the proliferation of human-produced lighting is the reduction in the darkness of our nights. This makes it harder to see fainter stars and other faint astral phenomena. Thousands of years ago, our ancestors had only fire, the natural light of the stars, the Sun, and the light reflected from the Moon. Not only has light pollution had an adverse effect on humans and animals alike, but it has also robbed from us of one of the most beautiful sights that can be observed, the Milky Way galaxy. Our ancestors slept under dark, vibrant skies filled with the sea of stars.

Polaris ©Tom Watson

Atmospheric Pollution—This type of pollution is less observable than light pollution and yet harmful not only to our view of the sky but also our bodies is atmospheric pollution. Particulate matter thrown into the air causes distortions in the faint light drifting through the atmosphere from space to our eyes. This can result in anything from a simple glowing haze to outright visible distortion, similar to the natural twinkling of stars. Atmospheric pollution not only distorts the light coming from space, but it also reflects anthropogenic light pollution back at the observer making it harder to see faint objects in the sky. In this way, atmospheric pollution and light pollution combine to wash the beauty and majesty of the night sky from our field of view.

Polaris Drift—While pollution distorts our view of the sky, the stars themselves have also shifted in position over the millennia. The stars appear to move overhead, rising on one side of the horizon, passing overhead, and setting on the other end of the horizon. This celestial rotation is the result of the Earth rotating with respect to the stars. Like any rotating sphere, there is an axis drawn straight to the middle. Observing the stars for many hours will lead the observer to realize that the stars apparently rotate around these axial points. While the Southern Hemisphere requires complex observation to determine where the actual axial point is because there is no a significant star at that location, Northern Hemisphere observers benefit from a star that rests nearly directly on top of the axial point, the polestar, Polaris.

Orion Nebula ©Tom Watson

Product Review: Hoya Didymium Red Intensifier

by Tom Watson

With more and more people living in cities and suburban areas, light pollution has become a greater problem. One of the most common sources of light pollution is low-pressure sodium streetlamps, those famously orange lights that flood our eyepieces, drowning out the stars and filling our photographs with orange glows around their edges. While numerous filters exist to combat light pollution and to enhance the colors that we see or photograph, many are quite expensive for an enthusiast who is already spending a lot of money on camera equipment, telescopes, and mounts. One inexpensive filter is the Hoya didymium red intensifier.

Didymium red intensifier filters are used in photography to intensify red color, for example brightening the redness in a photograph of roses. Interestingly, while the spectrum of light that is allowed to pass through the red intensifier obviously allows red, light at the wavelength emitted by low-pressure sodium lights is also partially blocked. As shown in the comparison below, using a didymium red intensifier filter can drastically reduce the effects of orange streetlights, causing photos of the sky at night to be darker and to contain less orange glow.

Using a didymium red intensifier filter from Hoya (purchased from Amazon) quickly provided me much relief from my orange low-pressure sodium streetlights. It was priced under $30 and screwed onto my camera lens. The filter can be used for wide-angle photography in a suburban or city area, but also to reduce the orange glow from distant cities when at darker locations. The only significant tradeoff is a slight increase in reddening of certain faint objects, such as Nebulae, as well as the slight reduction in light entering the lens and increased chance of lens flare caused by adding an additional piece of glass the optic system.

Pros	Cons
❖ Inexpensive reduction of common light pollution.	❖ Can sometimes make some light pollution worse.
❖ Intensification of the red in nebulae.	❖ Can intensify red colors in some stars too much.
❖ Available for nearly any camera lens.	❖ Adds another piece of glass, slightly darkening the image and increasing lens flare.
	❖ Hard to find for telescope eyepieces.

Op Ed: How Should Beginners Start Observing the Sky?

by Jerry Hubbell

I recently got a question from Tom Field of Field Tested Systems, the maker of RSpec Astronomical Spectroscopy software. He was talking with a friend who wanted a recommendation for a first telescope for her husband. This question comes up often and is probably the most asked question by beginners wanting to get into astronomy and observe the sky. Tom was specifically asking about the difference between an Explore Scientific telescope and a Meade ETX telescope on a go-to mount. In the interest of full disclosure, I currently work for Explore Scientific. I decided to really explore this question, and here is my response:

Hi Tom,

> This is an interesting question...and as with most things, the answer depends on several factors. If he is a rank beginner who has not owned a telescope before, then the traditional advice has been if you want to just learn the sky, starting out with binoculars is the preferred method.
>
> I don’t want to go on a long dissertation here, but this may be the basis for a future article I will write for our club newsletter. Anyway, back to the question. My general philosophy about equipment, technology, and astronomy is that the instrument should disappear, and there should be (virtually) nothing that stands between you and the objects you are discovering in the sky. In that regard, the suggestion to use binoculars places the simplest technology in your hands so that you can concentrate on the sky and not be bothered or encumbered by the technology.

Binoculars are easy to learn to use and handle, and for this purpose, a size such as 7 x 50 is easy for even 10-year-olds to handle. If you want higher power, then 10 x 60 is a good size also. The main point here is to gather as much light as possible. I would also suggest getting a good pair, not the bargain-basement version. I would even suggest spending about twice what the lowest priced units cost at the department stores. Bottom Line: for just learning the sky, binoculars, coupled with some nice paper charts, are probably the most cost-effective instrument.

However, there are other motives that drive people to think about buying a telescope, even beginners. The draw is the electronic technology. People like to apply electronics to all the things they do in life; we have computers in all our appliances now. Who can resist buying that computer-controlled crockpot that you can set with your iPhone App, LOL! Anyway, people want things to be easy and maybe don't want to learn things so much. They want technology to bring the world to them instead of going out into the world to discover it personally. Kind of like the TV has done.

So, the expectation is that they are interested in looking at the cool objects that are in the sky, but don't really want to work at it. They want to push a button and have the planets handed to them on a silver platter. For these people, an electronic go-to mount system with their telescope mounted on it is a necessity, even to the point where it may require sacrificing light-gathering power to gain the convenience. Ironically, the go-to system may be able to point the telescope at more objects, but because you have sacrificed light-gathering power, you see less.

As a personal aside, I am in it for *both* the electronics and the objects. My goal is to be able to do the most sophisticated observations that reveal very subtle behaviors of these celestial objects with equipment that is designed and built such that you can forget about the equipment. It literally disappears from your thoughts. You don't need to worry or think about it working...it just does.

There is a third way that could just maybe satisfy that need for electronics involvement with your observing as a beginner. You would buy a pair of binoculars, or if you have the funds, a nice beginner telescope, such as the Explore Scientific AR102, on a very capable EXOS I manual German equatorial mount and add a nice electronic planetarium star chart program. If your friend's husband really wants to learn the sky and not be sidetracked by the complexity of the electronics, I would suggest this option. Even better would be to use the telescope with paper-based charts such as SkyAtlas 2000.0. Don't forget the planisphere to get a general view of what's up.

Planisphere (academic.evergreen.edu)

In summary, I would advocate learning the sky first with the simplest instruments available. I would suggest this progression:

Naked Eye & Planisphere
Binoculars & SkyAtlas 2000.0
Manually Controlled Telescope & SkyAtlas 2000.0

After that and some more studying, the beginner will soon know what objects he/she is "really" interested in and can then invest in equipment designed to scratch that itch in a cost-effective way. I hope this gives you some things to think about and helps explain it to your friend.

I am interested in what you think about that; let me know what she decides.

SkyAtlas 2000.0
(www.astropixlar.com)

I think it is important to note that in my response, I discussed the changing face of the astronomical hobby and the notion that young people today have grown up immersed in the electronic universe of gadgets and the Internet. Also, the other main factor involved is that the expectation of instant gratification without too much effort has been inculcated into our thinking. As technology does more and more, and relieves us of the drudgery of repetitive work, we expect our tools to do the thinking for us, so we do not need to understand all that is involved in getting the results we need…or want, *fast*. The failure here is that, for me, when observing astronomical objects, the lack of understanding minimizes the value of the effort. The purpose of the hobby is to learn all the details involved with observing the sky. This helps you to place a value on the hard-earned knowledge of the sky that you gain. The opposite is to use Google to search for pictures of astronomical objects and page through them looking at the eye candy but not really understanding what you are looking at and how the image was obtained (not that there is anything wrong with that, if that's what you want to do, but it's not astronomy). The bottom line is that in my opinion, this hobby is about learning, not about seeing objects. It takes effort, patience, and time. It's all up to you. I may be a bit old-fashioned, but I think there's immense value in doing the work and spending the time to learn the sky, and there are tools available to help you do it correctly.

Whenever you talk to your extended family and friends, don't be shy about sharing your knowledge of equipment and how you started observing the sky. Whether you agree with my thinking, or not, it is important to engage as many people as you can to help grow our hobby and share our experiences.

FOCUS ON: Montes Taurus and Taurus-Littrow Valley

By Jerry Hubbell

(Note from the author: A version of this article was published in the January 2017 ALPO The Lunar Observer *as the Focus On bi-monthly article. Part of my role as the Assistant Coordinator (Lunar Topographical Studies) is to write articles periodically on research done by ALPO contributors. To see full-size versions of the photos, go to http://moon.scopesandscapes.com/tlo.pdf)*

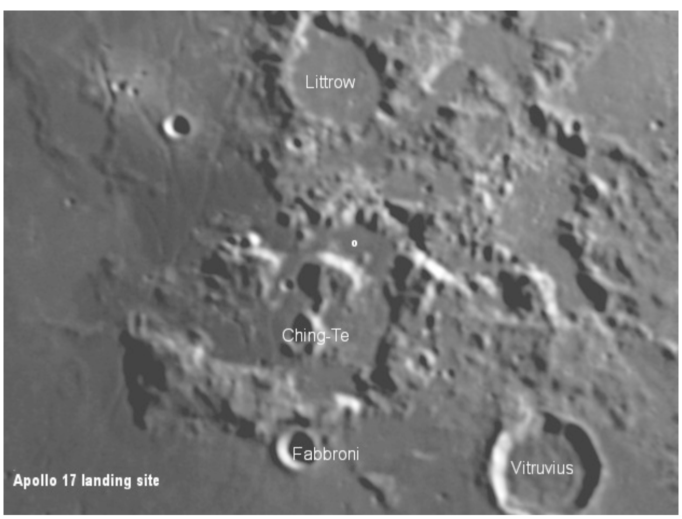


Figure 1. TAURUS-LITTROW, Tucson, AZ, June 10, 2008 – Rik Hill, 03:53 UT. C14 SCT, 2x Barlow, UV/IR Blocking Filter, SPC900NC CCD, Seeing 8/10.

Located on the southeastern edge of Mare Serenitatis (Sea of Serenity), the Taurus-Littrow Valley and associated Montes Taurus provide an awe-inspiring landscape to explore and photograph. This area was visited by the Apollo 17 astronauts in December 1972 during the final manned mission to the Moon of the Apollo program. Note that the Apollo 15 landing site lies on the western shore of the Sea of Serenity near Mons Hadley and the Hadley rille. Apparently, NASA decided the mountains surrounding the Sea of Serenity were particularly interesting in topography and formation (Figure 1). Located at selenographic coordinates 20.0°N 31.0°E, this area was formed between 3.8 and 3.9 billion years ago, when a large object impacted and formed Mare Serenitatis and the surrounding mountain ranges.

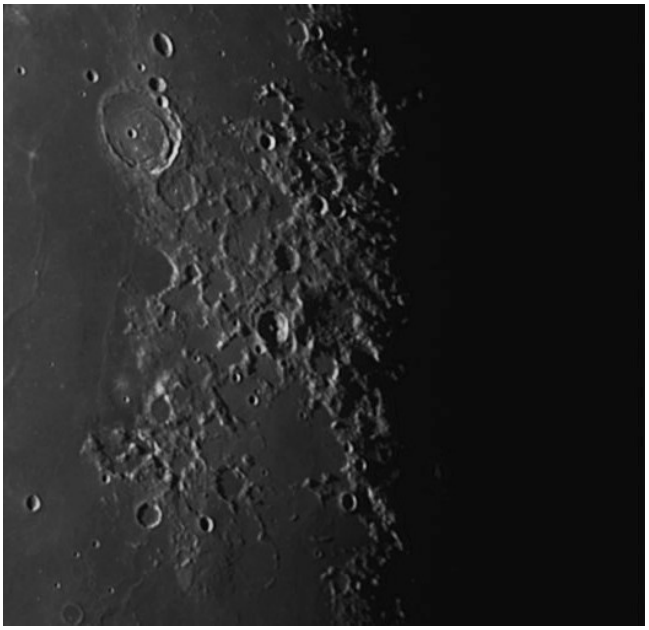


Figure 2. Late Afternoon MONTES TAURUS Region, Starkville, MS, September 20, 2016—David Teske, 09:39 UT. 60mm Moonraker f/16.7 refractor, Mallincam GMTm CCD, clear sky, seeing 6/10.

North of the crater Romer lies the tortuous region called Montes Taurus, at selenographic coordinates 27.3°N, 40.3°E. This area stretches 100 mi (165 km) across the Moon's surface, reaching a height of about 16,000 ft. (4,900 m) above the level of Mare Serenitatis. The Taurus-Littrow Valley lies on the southwest edge of this region. The mountains in this area are a result of the bombardment of objects billions of years ago, resulting in a highland area averaging nearly 7,000 ft. (2,100 m) above the average lunar surface height. (Figure 2)

Although this region is overshadowed by the large open area of the Sea of Serenity, it deserves close scrutiny because the area just west of where Apollo 17 landed, at selenographic coordinates 20.1N, 30.8E, contains a nice series of rilles, Rimae Littrow. This system just north of Mon Argaeus is an interesting area for high-resolution lunar imaging. If you examine the lower right corner of LAC Chart LAC-42 Mare Serenitatis, you can identify the various rimae and mons in the area. LAC Chart LAC-43 Macrobius contains the location of the Apollo 17 landing zone.

The excellent image of the Montes Taurus Region in Figure 3 brings into great relief this pummeled area of the Moon. There are plenty of interesting features here to pique your interest in lunar topography and the formation of the Moon. In his submission, Howard Eskildsen included the following notes on Figure 3:

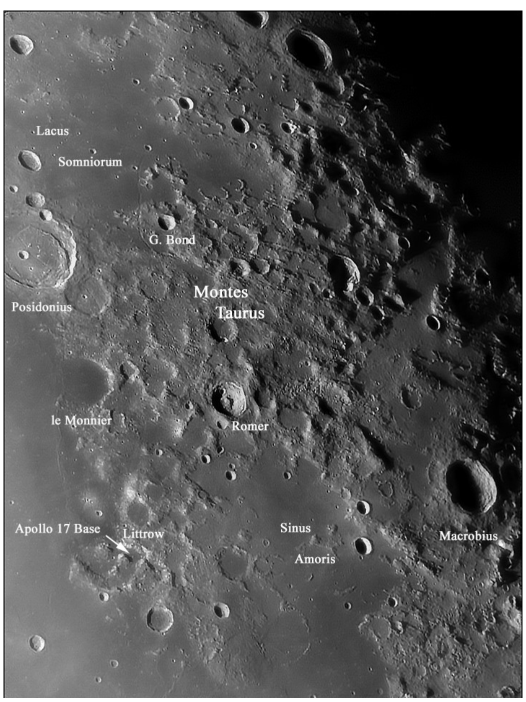


Figure 3. Montes Taurus, Taurus Littrow, Ocala, FL, December 17, 2016— Howard Eskildsen, 11:14 UT. 6" f/8 refractor, 2x Barlow, DMK41AU02.AS CCD, seeing 8/10, transparency 4/6

Taurus Mountains: Between the Lake of Sleep (upper left) and Bay of Love (lower right), the battered highlands of the Taurus Mountains rise, pocked and scarred. Much is said about surrounding landmarks, such as the floor-fractured Posidonius, the flooded arc of le Monnier, the Apollo 17 landing site in the Taurus-Littrow Valley, etc. Little, however, seems to be said about the mountains themselves.

This battered section of highlands shows remains of ancient craters that pocked the original lunar crust and were in turn scarred and partly filled by subsequent impacts. Roughly parallel scars etch the northeastern portion of the Taurus Mountains, perhaps from a remote basin-forming impact. The two freshest-appearing craters, G. Bond and Romer are just east of rilles that bear their names. (Neither rille is labeled on image to avoid clutter.) Rima G. Bond is a graben caused by uplift that split part of the crust, allowing a section to drop downward to form a narrow, flat floor within the crack. It appears to be older than its namesake crater based on albedo differences seen on the LROC QuickMap. The Rimae Romer are also grabens and are older than the crater, evidenced by crater ejecta that partly obliterate the southern portion. Although given less attention than other areas, the Taurus Mountains are worthy of study and contemplation of the events that created and sculpted them.

This region will certainly continue to be a focus of future missions to the Moon, not only because of the historical association with Apollo 17, but also for its rich source of scientific data.

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Highlights of Recent RAClub Presentations

Abstracted from Bart Billard's Meeting Minutes

November 2016

[Note: Elections were held, and there was no presentation.]

December 2016

Ryan Rapoza presented a report on his trip to the Southern Hemisphere. See the lead article beginning on page 1 of this newsletter for a full description of his presentation.

January 2017

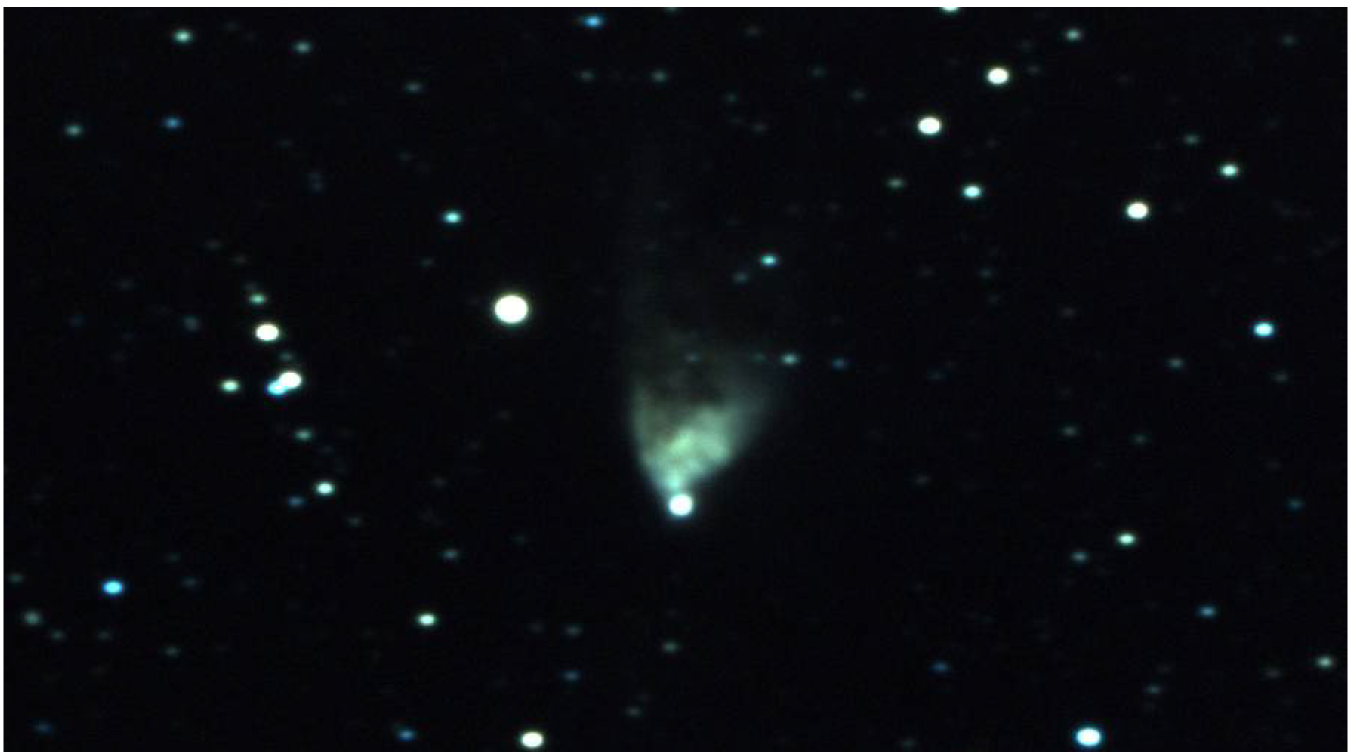
The club held a special "All About Telescopes" workshop for members and the public. Members brought telescopes and discussed the telescope types and answered questions. Bart Billard described his Dobsonian reflector, which allowed him to pay more for the telescope optics by paying less for the "mount" that held the telescope and allowed it to be pointed. It was easy to set up but required manual tracking, and the user had to get used to how much it had to be nudged up or down, in addition to clockwise nudging, to keep objects in view. One question was about maintenance. Bart said the main thing was "collimation:" making sure the main mirror was not tilted. Cleaning the mirror should be rarely necessary.

Tom Watson talked about refractor telescopes and illustrated with his 80-mm aperture achromatic refractor. He explained that lenses tended to focus different colors by different amounts, and achromatic lenses were designed to compensate somewhat with a two-part lens made of different kinds of glass. The result was reasonably good, but could have halos of color around bright objects. More complicated (and expensive) apochromatic refractors more or less eliminated the halos.

Glenn Holliday showed another reflector telescope with an equatorial mount. This type of mount allowed the telescope to be aligned so that adjusting for Earth's rotation was simpler than the combination of nudges needed with the Dobsonian mount. One could simply turn a single knob to keep a target from drifting out of view for long periods of observation.

Ryan Rapoza and Scott Lansdale, with assistance from Glenn, showed three examples of Cassegrain telescopes. Ryan had a Celestron NexStar 8SE with a go-to mount. He said it only required centering on three bright stars to align it so it could find thousands of objects visible in the sky. It had a "corrector" plate at the front, a mirror with a hole in the center at the back, and a secondary mirror in the middle of the corrector plate that sent the light back through the hole instead of out to the side like a reflector. Bart suggested the corrector could be viewed as a lens for "tweaking" the performance of the mirrors to get better images. The Maksutov-Cassegrain also had a corrector that used a different shape (spherical) for the same purpose. The Ritchy-Chrétien telescope that Scott showed worked without a corrector. Instead, it had specially shaped mirrors to get the improvement a corrector would provide.

Image of the Quarter



First Light for the MSRO's new camera—NGC 2261, aka Hubble's Variable Nebula, is located in the constellation Monoceros. It is illuminated by the star R Monocerotis (R Mon), which is not directly visible itself. NGC 2261 was imaged at Palomar Observatory's Hale Telescope's first light by Edwin Hubble on January 26, 1949, more than 20 years after the Palomar Observatory project began in 1928. Hubble had studied the nebula previously at Yerkes and Mt. Wilson. Coincidentally, this is our first light image using the new color CCD camera on the MSRO 12-inch telescope! It is a combination of about 21, 60-s exposures using the QHY163C camera. The image is unguided and was taken remotely by Myron Wasiuta and Jerry Hubbell. It is a highly cropped section of a much wider image.