The Los Angeles Astronomical Society

THE BULLETIN

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In This Issue

The last 60 Inch session of the season is scheduled for December 1, 2018. Please make your reservations now.

Witch Head Nebula (IC 2118) in the Constellation Eridanus. The bright star is Rigel in the Orion Constellation.

Above is an example of what is possible with a low-cost astro imaging setup. Taken this weekend at Lockwood using my old Canon T2i, a lousy 135mm lens at f7.1, and a low-cost Vixen Polarie tracking mount. The Witch Head Nebula (IC 2118) is a stack of about 3 hours of 60-sec exposures. Witch Head is cropped by about 30%. Processed in PixInsight.

.Photo Credit: Brian Paczkowski

All current LAAS members who have Facebook accounts are welcome to join the "*LAAS Members Group*." Any and all photos shared in this group may be shared on our club's official Facebook page and in The Bulletin.

Click on the image to view the LAAS on Facebook.

Migration to Groups.io Information

Hello LAAS Members,

Thanks for your patience as we make the switch from the Yahoo Groups to the Groups.io discussion forums. When we made the switch, everyone was added to the Home group (for announcements) and the General Discussion group, which you may find "too chatty" and your e-mail box is getting cluttered. Here are some simple options to get rid or manage the "chatter":

At the bottom of each message from the General Discussion group is an "unsubscribe" link. This will remove you from the General Discussion group.

Log into https://laas.groups.io/g/generaldiscussion (you may have to self-register a password if you have not done so) or send a blank e-mail to generaldiscussion+unsubscribe@laas.groups.io (you don't have to put anything in the subject line or body). You will get a email from groups.io asking for confirmation…just reply and you will be removed.

If you want to see the threads but not have them clutter your mailbox, you can login as described above and use the Subscription option on the far right menu and pick from a range of options ranging from individual messages (which is how it is set by default) to no-email.

If you need help, please let me or Andee know and we can help you with configuring the mail preferences.

Thanks again for your patience,

Spencer SooHoo, PhD
LAAS Secretary
secretary@laas.org
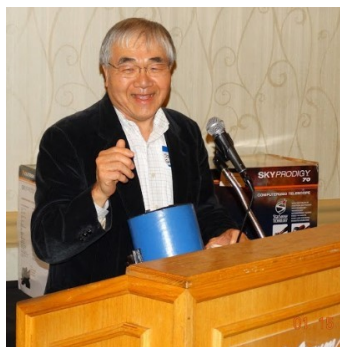
Astrophotography in Urban Light Pollution
A Simplified Method
By Vance C. Tyree

I gave a class on astrophotography in June of 2016. In that class I discussed a method for extracting very faint deep sky objects from urban light pollution that involved some rather difficult, time consuming procedures that would not be practical for casual imaging. I looked into a way to automate that process, but ultimately, it was more difficult than my limited software skills could handle. Even though that method could extract the Rosette Nebula (see below) from Bortle Scale 8 light pollution I needed a simpler method that could be done easily, even if I had to give up some low light level dynamic range.

1 Sub-Exposure

30-Frames Processed
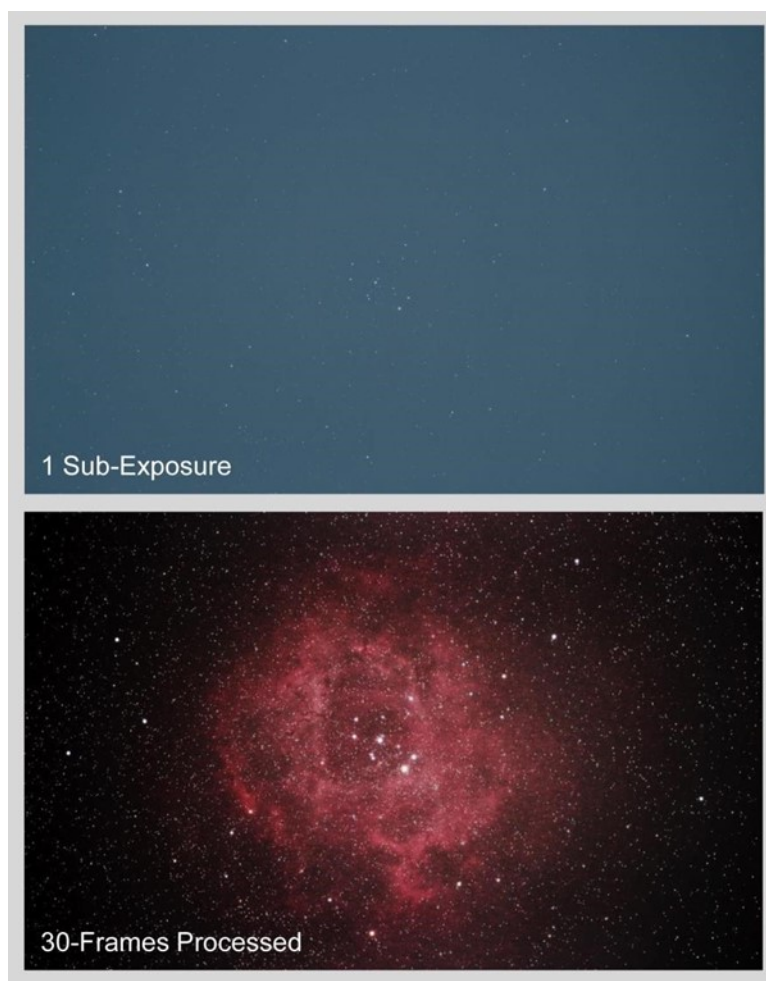
After some time I decided to explore the capability of a new version of SharpCap (www.sharpcap.co.uk) which contained some powerful tools for deep sky imaging. SharpCap was originally developed by Robin Glover (a UK amateur astronomer) for planetary imaging to stack planetary images and high magnification lunar images to produce a very nearly perfectly aperture limited view of the objects. With the introduction of SharpCap 3.1 Pro (requires a paid annual license fee of £10 GB or about $13/year), deep sky imaging was dramatically changed.

What Physics Underlies this Method?

In the astrophotography class I mentioned two key physical characteristics of CCD and CMOS imaging chips that permit extraction of faint images from much brighter urban light pollution:

High Quantum Efficiency (QE): QE indicates that the image chip pixels respond to a fraction of the arriving photons, so if the QE is 50% then on the average it takes two photons to produce a stored electron in the pixel. Most recently marketed CMOS image sensors have between 40% and 80% QE, with the newly available Back-side Illuminated (BSI) CMOS sensors having the highest QE.

Perfect Linearity of Response to Photons: This means that if you double that number of photons arriving at a pixel the image chip then you will have EXACTLY double the number of electrons stored in a pixel in the image chip.

This sensor linearity is the key to being able to subtract out the light pollution, leaving the faint deep sky image added to the light pollution level. However, a high QE increases the image chip sensitivity to faint images that have photons arriving at a very low rate. With urban light pollution levels that have brightness more than four magnitudes per square arc-second brighter than a truly dark sky area, you cannot afford to waste arriving photons from the deep sky object.

A third property of CMOS image chips (and significantly less so with CCD chips) is that the read noise in CMOS image chips is in the range of 0.5 to 5 electrons RMS, which is significantly less than the CCD read noise that can range between 3 and 20 electrons RMS. The low read noise enables using very short exposure times relative to what is commonly used for deep sky imaging. Typical deep sky imaging in very dark observing sites commonly use exposure times in the range of 2 minutes to 20 minutes per sub-exposure. In an urban location there is a limit to the length of exposure time before the image sensor pixels begin to saturate with light pollution. Once the sensor begins to saturate then it is not possible to extract the faint deep sky image.

In urban imaging, we will take advantage of another basic property of photography that dates back to the beginning of chemical film imaging in the 19th century. In general photography, the tradeoff between light level (lens aperture; f/#) and exposure time is such that a 1/100 sec. exposure at f/5.6 or 1/200 second exposure at f/4 can be traded off to produce an image that looks exactly the same because the total photon flux is the same at the image sensor. In astrophotography for a given telescope, that property is similar in that for a given sensor sensitivity (QE and DSLR ISO number, or camera gain) a deep sky image will look the same if you average together 20 exposures at an exposure time of 100 seconds each or if it is 200 exposures at an exposure time of 10 seconds each or if it is 2000 exposures of 1 second each.

Unfortunately, this tradeoff breaks down as the number of photons collected from a deep sky object at a given exposure time falls into the range of the RMS read noise of the sensor chip. There are ways to calculate this crossover point based upon measurements of sky brightness using a device called a Sky Quality Meter which costs about $135. Fortunately, there is another way to measure sky brightness using Sharp Cap 3.1 Pro.

<u>What Software Tools are Required?</u>

We discussed what software tools will be suitable in the astrophotography class, but this new method will require investing some money into the required tools because there are no free equivalent tools available at this time. I have been working with the following tools in my recent experiments in urban deep sky imaging.

PixInsight version 1.8 or later: This is the most expensive tool in this software tool set because a license costs €230. (about $266). However, I have not found anything else that has a tool for background extraction that comes close to what PixInsight has. The **Dynamic Background Extraction** tool is a key tool needed to remove the light gradient from the light pollution. Also, the histogram stretch is excellent for the initial image stretching.

Sharp Cap 3.1 Pro - or alternatively - Deep Sky Stacker Live:

Sharp Cap 3.1 Pro (Ver. 3.1 has the first stable live stacking tools): This is used to control the camera and to live stack (and average) a long series of short exposures to accumulate enough photons in the image to see a smooth image. This tool is designed to work with USB2 and USB3 CMOS cameras. It will <u>not</u> work with a DSLR at this time.

Deep Sky Stacker Live 4.1.1 (http://deepskystacker.free.fr/english/index.html): There is every reason to believe that a DSLR can use short exposure strategy to create nice deep sky images in light polluted urban skies. Deep Sky Stacker Live is a freeware tool from France that is a subset of Deep Sky Stacker, which I have used in the past to stack DSLR images. DeepSkyStacker Live does <u>not</u> replace DeepSkyStacker. They are both using the same engine, but DeepSkyStacker Live does not have all the features that are needed to create images that can be post-processed properly. I have never used Seep Sky Stacker Live, so I would be interested in hearing any feedback from a LAAS member who has used it successfully. *I will not cover procedures for using **DeepSkyStacker Live** in this article.*

GIMP 2.10.6 or later: GIMP is a free (no license fee) general image processing tool similar to Photoshop (you can use Photoshop if you have a copy). This recent version of GIMP is capable of processing images with 16-bits per color dynamic range. Dynamic range is critical to stretching the brightness of faint deep sky objects to make them easy to view. The 16-bit per color dynamic range is the minimum dynamic range that can be used to get good image quality.

Sharp Cap 3.1 Pro saves stacked images as 32-bits/color. PixInsight can process 32-bit/color images from Sharp Cap to remove light pollution gradient and to do preliminary stretching.
However, the final stretching and cosmetic tweaking is done with GIMP 2.10.6 at 16-bits/color.

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Even though these experiments used a cooled, temperature controlled camera, I think the methods I will be describing will also work with the supported cameras that are not temperature controlled because the high level of the light pollution will require exposures shorter than 30 seconds (I have used 10 seconds at Garvey Observatory).

Sharp Cap 3.1 Pro Tools: The most important tools in SharpCap that make urban imaging possible include a tool to measure the CMOS camera sensor read noise, and a tool to measure the brightness of the light polluted urban sky. These tools will help us calculate the optimum exposure time for the sky conditions at the time of the sky brightness measurement. Even though the light pollution sky brightness varies depending upon atmospheric transparency, the amount of variation that I have observed so far has not had significant impact upon the optimum exposure time.

The live stacking feature in Sharp Cap 3.1 Pro is particularly valuable if you are imaging with a telescope that cannot be auto-guided. The telescope drive at Garvey Observatory is a 40 year old Schaefer German Equatorial drive with no auto-guiding capability and with rather large Right Ascension periodic error. In addition to the RA periodic error, the polar alignment of the Schaefer drive at Garvey Observatory is not vary accurate, so there is significant R.A. and Dec. drift in the tracking which limits the total time that can be used to live stack images. For the equipment at Garvey Observatory, the total stacking time is on the order of 20 to 30 minutes before drift begins to be more than ten percent of the image area. Initial experiments indicate that the typical moderate cost Go-To equatorial telescope drive available today will not need auto-guiding with exposure times less than 20 seconds.

The live stacking feature in Sharp Cap 3.1 Pro has some extremely convenient features that make urban deep sky imaging much easier than I thought was possible before I started experimenting with live stacking. The first image taken in the live stacking process is used as a reference image (unless the star images do not meet star image roundness criteria) for the subsequent images. Each subsequent image is star aligned with this reference image. Sharp cap selects a number of bright stars in the reference image and finds these stars in subsequent images. It does what-ever X-Y translation and rotation is required to match the reference image stars in subsequent images before averaging the images together. This averaged image becomes the reference image for the next image, and the process repeats. Over an interval of several minutes the drift, periodic RA error and image rotation becomes apparent around the periphery of the stacking image as the stacking process progresses.

In addition to the star alignment, Sharp Cap also will, in real-time perform dark frame calibration and flat field calibration on each sub-exposure before aligning the image with the accumulating averaged image. Therefore, it is <u>essential</u> that you take the time to create a master dark frame and a master flat frame before starting your imaging session. Failing to do these basic calibrations will result in a final image that, when stretched, will have some rather unpleasant image artifacts.

After you have live stacked your sky image for the total time that you have selected, the stacked image can be saved as a 32-bit/color linear FITS image suitable for processing in PixInsight and then finally in GIMP.

<u>Let's look at a Garvey Observatory example:</u>

The first step is to measure the camera sensor characteristics. This only needs to be done once for a given camera, so it is worth taking care in getting this measurement as accurately as possible. You will need to point the telescope at a featureless uniformly illuminated surface. This is most easily accomplished using the same flat field device that you will use to prepare the flat field calibration master frame. An example of a simple flat field device using a light diffuser panel for a fluorescent light fixture and some plastic foam packing material will be described in another article.

The illumination must not be from fluorescent lighting or from LED lighting because these light sources produce light pulses at a 120 Hz rate and will cause artifacts in the image that will result in inaccurate sensor measurement. A late afternoon sky near zenith or incandescent lighting is preferred.

Sensor Analysis: SharpCap 3.1 has some in-application sensor analysis instructions for performing the sensor measurement, so I will not repeat them here. The image below is a screen snap of the analysis result for the ZWO ASI071 camera at Garvey Observatory. I could not aim the Garvey telescope at a uniformly illuminated surface so I used a rather simple flat field diffuser that can be made from packing foam and light panel diffusing plastic sheet (mentioned above).
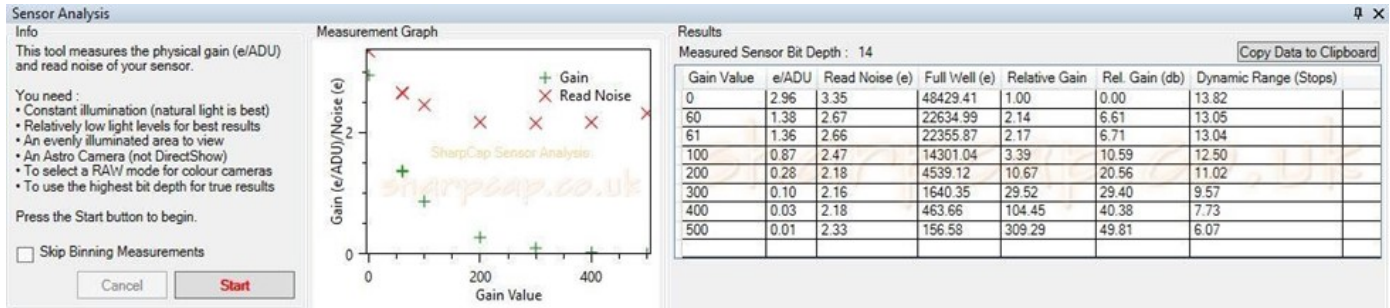
This data is saved within SharpCap for future use in the sky measurements.

Sky Brightness Measurement: SharpCap has a sky brightness measurement tool in the Smart Histogram tool.
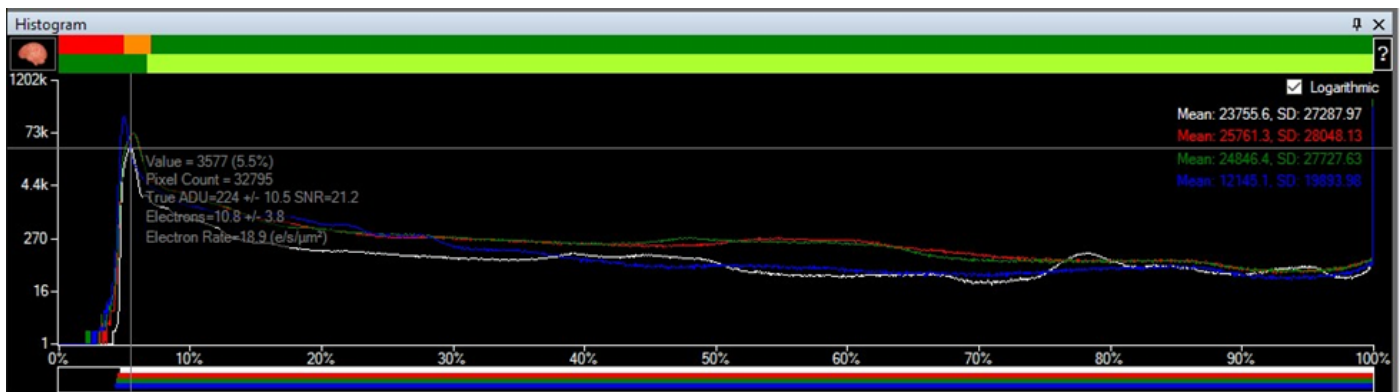
The "Brain" button in the upper left hand corner of the Smart Histogram tool gives you access to the sky brightness measurement feature.

Just for general information: You can determine the approximate level of sky light pollution brightness from Clear Sky Chart (http://cleardarksky.com/csk/) by selecting your city or a city nearby from the "Browse" list. The color coding is based upon a light pollution brightness scale called the Bortle Scale (https://en.m.wikipedia.org/wiki/Bortle_scale). I have developed a spreadsheet that can calculate the approximate Sky Brightness in electrons/pixel-second (similar to what SharpCap does) for a given Bortle Scale value in magnitudes/square arc-second, along with information on a camera and a telescope. This may be useful to people who want to use a DSLR to duplicate this procedure for imaging in light polluted skies. I will make the spreadsheet available to anyone who is interested in imaging with a DSLR using this method of urban deep sky imaging.

Follow the instructions in the Sky Brightness window to measure sky brightness:

This is a screen capture of the sky brightness measurement I did at Garvey Observatory prior to attempting any deep sky imaging using the ZWO ASI071. It is important to realize that the actual sky brightness may vary from night to night (and even during a given night), but the sky brightness measurement will give you a reasonable estimate of the faintest detectable nebula from your imaging site (such as Garvey Observatory). The detection threshold is fairly forgiving to different gains and exposure times near the "Optimal Exposure". The optimal exposure from the example above is about 25 seconds, but the Schaffer GEM drive at Garvey Observatory has rather large periodic error so I chose an exposure time of 10 seconds. The gain setting has little impact upon faintest detectable object. I chose a gain of 375 because it makes a better live stacking image for visitors to see on the computer screen.

This 10 second exposure setting gives up a little in the faintest detectable object, but not a great deal as seen from the graph below:
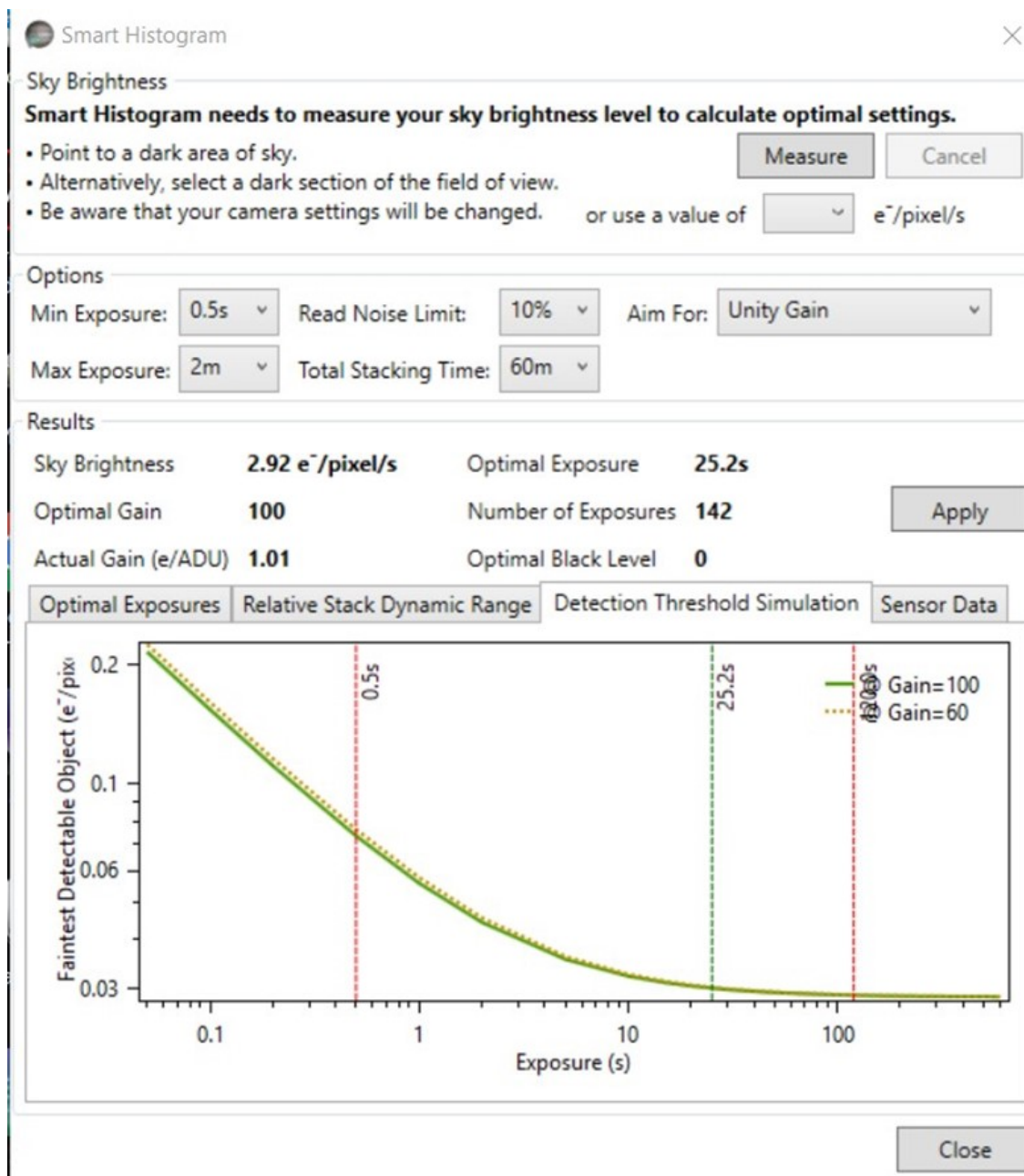

We are still in a region where the detection threshold is flattening out. As you can see, there is not much reduction of the faintest detectable object will be gained by using exposure times greater than the recommended 25.2 seconds. Now that we have chosen gain and exposure time based upon local sky conditions, we can begin imaging.

To begin imaging, make sure that SharpCap is connected to the camera that you are using. Set the gain and exposure time that has been recommended by SharpCap, or some gain and exposure setting that is reasonable based upon the recommendation by SharpCap. You will begin seeing images on the screen, but they are not being captured. Aim the telescope to the desired deep sky object and check the star pattern in the live images to make sure that your object is centered. Click "Live Stack" in the tool bar. The screen will split between the upper image and a lower Live Stack control screen:
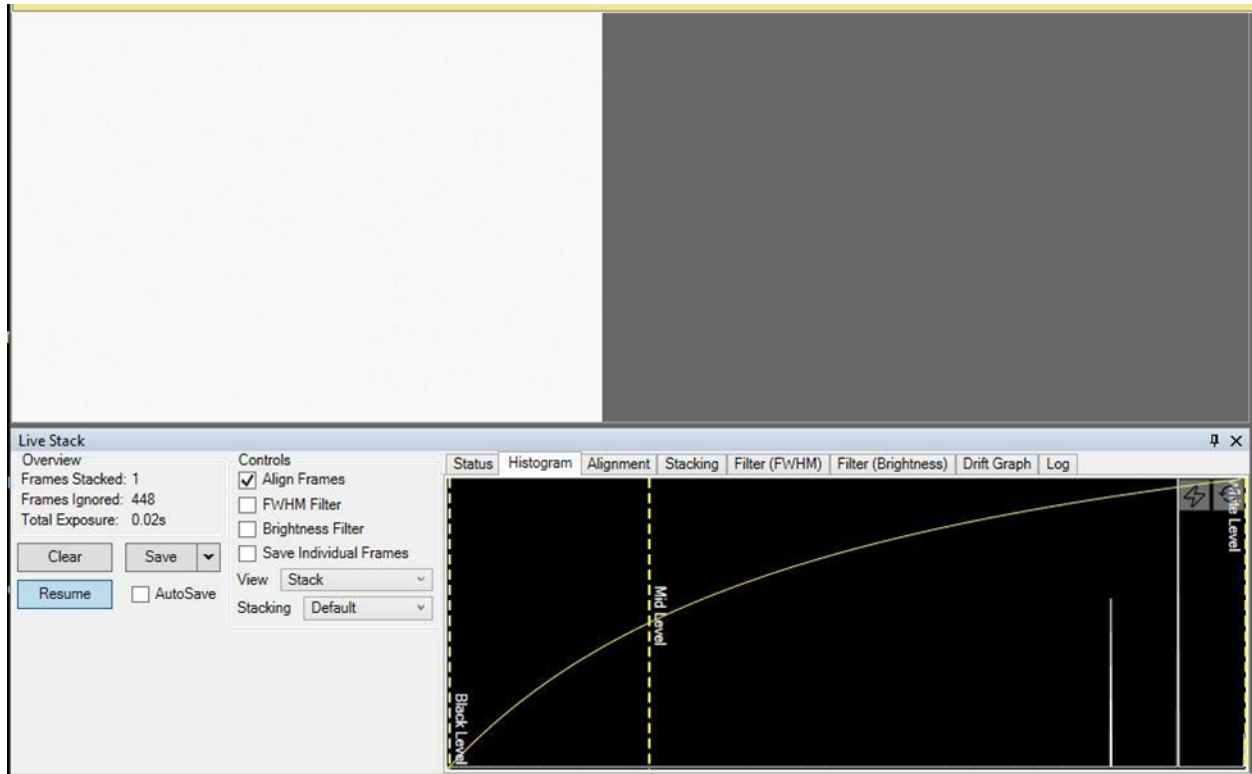
The upper left hand area is the live image being stacked. Click "Histogram" to enable stretching the accumulating live stack image. You may move the vertical dashed lines labeled "Mid Level" and the "Black Level" to show a stretched version of the image of the object as it accumulates during live stacking. Under "Controls" on the left side of the "Live Stack" window there are settings that can be selected. Initially, it is better to leave them at default settings. The "Save" drop-down list gives you a way to save the live stretched image by selecting "Save as Viewed" in the save list. After you have live stacked the desired number of exposures, you will then click the "Save as Raw (32 Bit) Stack" from the "Save" menu. It is critical to save the image as a 32-bit image to give you enough dynamic range to stretch the final image and to subtract out the light pollution. By saving the "Save as Viewed" image, you will have a reference image to see where the nebulosity of the object is in the frame so you can avoid the nebulosity area when you use PixInsight to extract the light pollution.

For the image that I took of M20 using the Garvey Observatory Orion 120mm telescope, the "Save as Viewed" image is as shown:
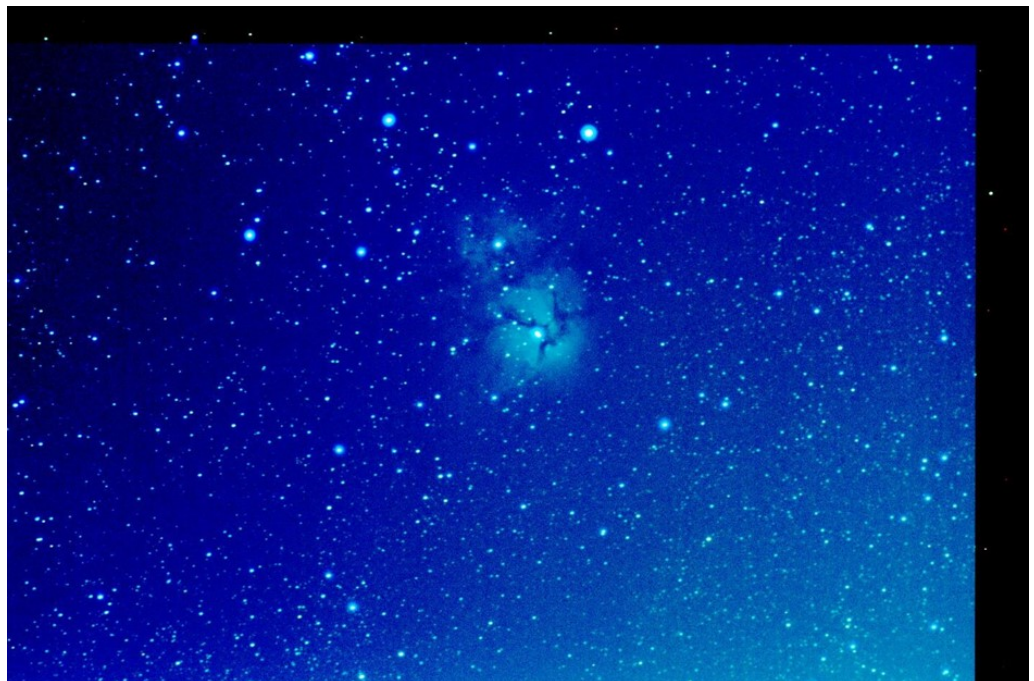
While the live stack is proceeding, you can watch the nebulosity become more distinct and you will see very faint stars come into view. Take note of the fact that the star images are perfectly round. This is because SharpCap aligned the stars to the first reference image and shifts the subsequent images to keep the image area aligned frame to frame. The short (10 second) exposures are short enough to avoid having the Right Ascension (RA) periodic error and the drift cause star images to become elongated. The image color is dominated by the sky light pollution, so the red color of the Trifid Nebula is not readily visible, but we can see where the nebulosity is located in the image frame. Also, we can see the dark bands along the upper edge of the image and along the right hand edge of the image. These areas are the Declination drift
(upper dark band) and the RA drift (right hand band) caused by the fact that the Garvey Observatory Schaffer GEM is not perfectly polar aligned. The light pollution has a strong gradient diagonally (upper left to lower right). This will at least partially be removed by PixInsight. There is no way that the live stack stretched "Save as Viewed" image can be pro-cessed to remove the light pollution gradient because the histogram stretching process is non-linear, so this image can serve only to identify areas in the image that contain the object nebulosity.

The final stacked image that you save as the "Save as Raw (32 Bit) Stack" image can be viewed only with image pro-cessing tool that can handle 32-bit per color images. PixInsight is one of these tools that can view the high depth image. The M20 image before processing doesn't look too promising:
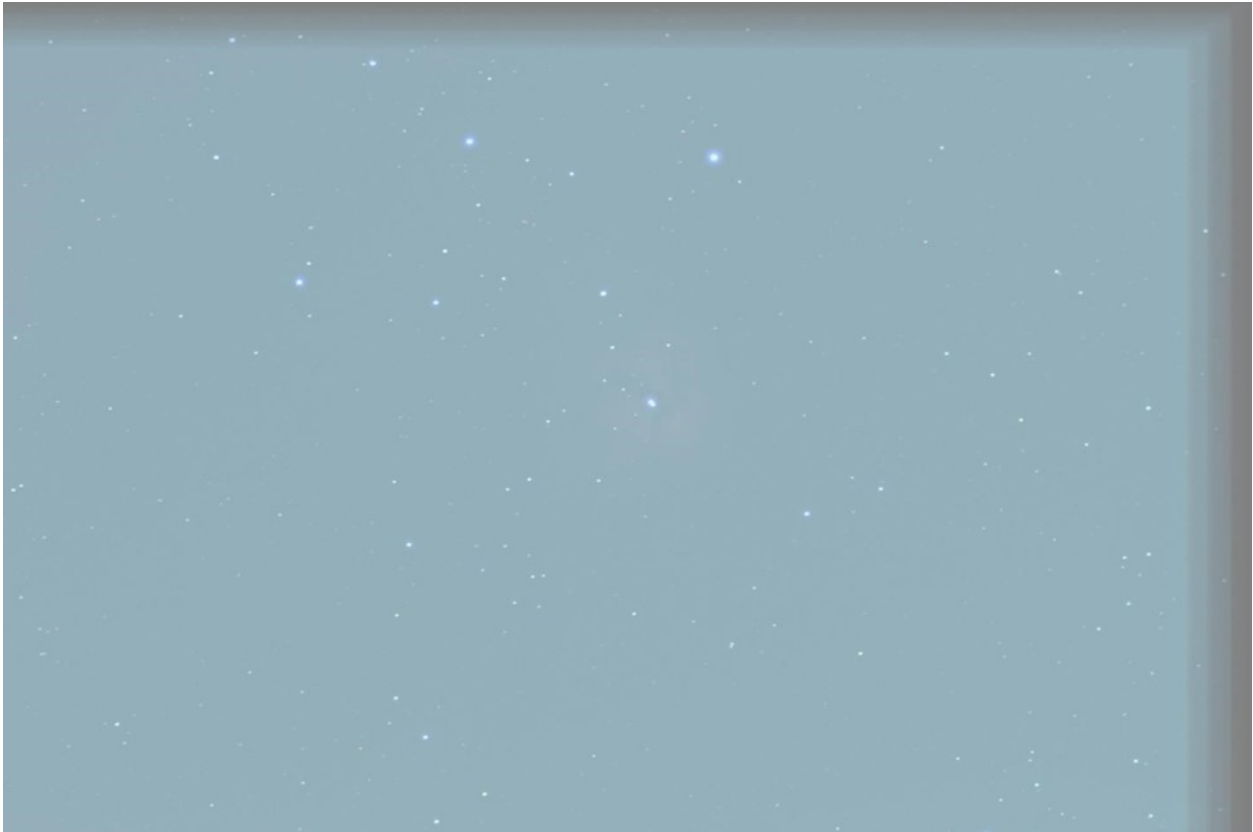
You can just make out the red nebulosity of M20, but the image is still very raw. Notice the vertical banding along the right hand edge. This is caused by the large RA periodic error of the Garvey Observatory telescope drive. Ultimately the drift and the periodic error will place an upper limit on the number of live stacked exposures can be accumulated before the drift reduces the usable frame size below what can be processed properly. In this particular M20 image I have a stack of 111 images of exposure time of 10 seconds each. That is equivalent of a total exposure time of 1110 seconds (18.5 minutes).

Images of M20 would be better if the total exposure time was about 120 minutes, but we can't achieve that with the tele-scope mount at Garvey Observatory and probably will not take that amount of time for deep sky imaging during a regu-lar Wednesday evening public observing session.

The next step is to remove as much of the light pollution gradient as possible with PixInsight. I will not attempt to explain the details of how this is done because there are some excellent tutorials on the PixInsight web page http://pixinsight.com/videos   as well as another web site:

https://www.harrysastroshed.com/pixinsight/pixinsight%20video%20html/pixinsighthomenewbie.html Before we attempt to remove the light pollution gradient, we must crop out the upper Declination drift region and the right-hand RA drift region. The image below has been cropped in PixInsight to preserve the 32-bit dynamic range of the original stacked image. We remove the drift regions so they do not interfere with the Dynamic Background Extraction processing as outlined below.

We will use the tool a PixInsight tool called Dynamic Background Extraction (DBE). The Harry's Astro Shed video on using DBE is excellent, so I will not repeat the instructions here. One really important feature of DBE is that it neutralizes the background color to gray but does not change the color balance of the stars and the nebulae. After doing a DBE on the cropped raw stacked image, I will then use the "Histogram Transformation" tool to do the preliminary stretch and light pollution removal. We don't want to attempt to remove light pollution in a single step because it is difficult to select the optimum point in one step. In principle, it is possible to perform multiple histogram transformations in PixInsight, but I prefer to use GIMP to complete the stretching using the "Curves" tool in GIMP. Make small, incremental curves stretches in as many as three or four stages to stretch the nebulosity while clipping off the light pollution with the black-point setting. The result of this strategy is the following image of M20:

I have cropped out the residual high order light pollution gradient that was not removed with DBE. I have yet to figure out how to deal with high order light pollution gradients in DBE, so this will be a subject of another write-up. Given the fact that this M20 image was recorded over the brightly lit baseball field area during a slightly hazy night this image is not too bad. I have posted this image and two others (M8-Lagoon Nebula and M17-Omega Nebula) on Instagram @vctyree and @la.astronomical.society. The M17 image was taken with a 95% illuminated moon in the eastern sky. I think a live stack for about 120 minutes (720 exposures at 10 seconds each) will result in an image that is a little less grainy. I will attempt a longer stack time on some other faint nebula from my back yard (Bortle 8) to see if the image quality can be improved using a longer live stack time. This process for imaging in urban light polluted skies is a work in progress. I expect that as I gain experience with this imaging procedure during the next several months, there will be changes in the procedure as better processing steps are developed. I will be interested in hearing about your experience with this method or some with some other method. I am at Garvey Observatory Night events almost every week, so I will be interested in discussing your experiences.

★☆★

Next Steps in the Search for Exoplanets

By Evan Hilgerman

At Griffith Observatory we get questions of all sorts and sizes. One of my favorites is when a young child sheepishly walks up to me and asks, "Are there aliens?" Normally other people in line will chuckle slightly, but astronomical observations collected over the last thirty years indicate that there are a plethora of planets out there. On average, one planet for every star you can see in the sky and a number of those are rocky planets, approximately earth sized and could conceivable harbor liquid water. All of a sudden, maybe that child's question isn't so silly.

As recently as the 1980s astronomers were unsure whether or not planets existed outside of our own solar system at all. The first exoplanets, a term for any planet orbiting another star, were confirmed in the early 1990s. A steady stream of exoplanet confirmations followed through the mid-1990s and early 2000s, culminating with the launch of the Kepler Space Telescope in 2009. Kepler identifies exoplanets using the transit method, wherein the regular decrease in light intensity of a star caused by a planet passing in front of it is detected. The spacecraft found thousands of planets this way in the small part of the sky it observed. Combined with observations from other instruments and surveys, 3,778 exoplanets have been confirmed as of the writing of this article.

Nearly all known exoplanets have been identified using indirect methods including transits, stellar radial velocity measurements, and even gravitational microlensing. These won't be covered in detail here, but all you need to know is that we can only sense that there's a planet because of its effect on the central star, but we can't directly see it. We can estimate some parameters like the planet's size, density, and orbital distance. But that isn't nearly enough to determine if that planet could support life as we know it. After all, in our own solar system both Mars and Venus might be considered habitable by a civilization studying us from afar. To determine whether or not an exoplanet is truly earth-like we must directly image it. This is a challenging task. Only a handful of planets have ever been directly imaged, and those are predominately very large planets far away from their host star. Planets like Earth easily get lost in the star's glare because they are small and close to the star. The problem has been compared to attempting to see a lightning bug next to a lighthouse from 2000 miles away.

To image an exoplanet, the light from the central star must be precisely blocked out so it doesn't overwhelm the light from the planet. This is analogous to using your thumb to blot out a bright light so you can see what's next to it. NASA is pursuing two technologies to do just that, but on truly astronomical scales.

The first, a coronagraph, may be familiar to amateur solar observers. An exoplanet coronagraph would use a very precisely formed optical mask internal to the telescope to achieve the necessary contrast. Although this sounds simple, there are severe technical challenges. For one, the optical surfaces of the telescope must be controlled to within about 10 picometers (or 10-15 meters). To put that in perspective, the diameter of the electron cloud orbiting a hydrogen atom is about 120 pico meters. So let's just say this method would require a level of precision never before achieved on a space telescope.

An alternative, yet complimentary, method involves the use of a starshade, a large deployable shade flown in formation with the telescope. This approach is not without technical challenges either. It is, after all, a 30 meter diameter optical device that must be stowed in a 5 meter diameter rocket for launch. Its unique sunflower shape, necessary to account for diffraction of light, must be manufactured to micron level precision over a couple hundred meters of perimeter. And on top of that, the star shade must be flown about three earth-diameters away from the telescope, and do so with an accuracy of a couple of meters.
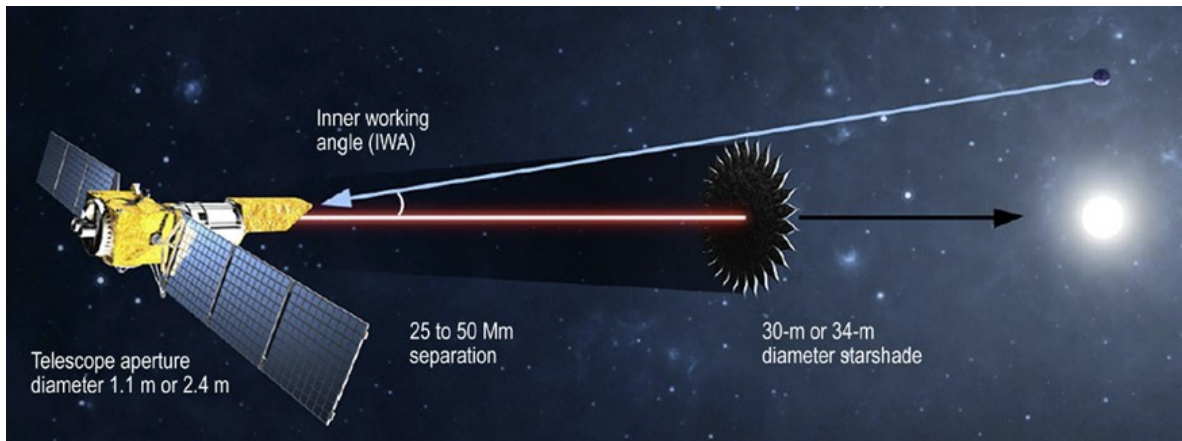
Schematic diagram of a starshade enabled telescope (Credit: Exo-S Probe Class Report, 2015)

Although challenging, both of these technologies are feasible in the near future and are baselined for inclusion on the WFIRST (Wide Field Infrared Survey Telescope) telescope. WFIRST will be the next large space telescope after the James Webb telescope, and is scheduled for launch in the mid-to-late 2020s. The pairing of both technologies makes for a very robust exoplanet exploration program. Since coronagraphs are interior to the telescope and easier to "point", many more observations can be made when compared to a starshade. However, starshades will produce a superior image quality. So the general concept of operations is to survey many star systems with the coronagraph to identify the most promising stellar systems, and then image those with the starshade.
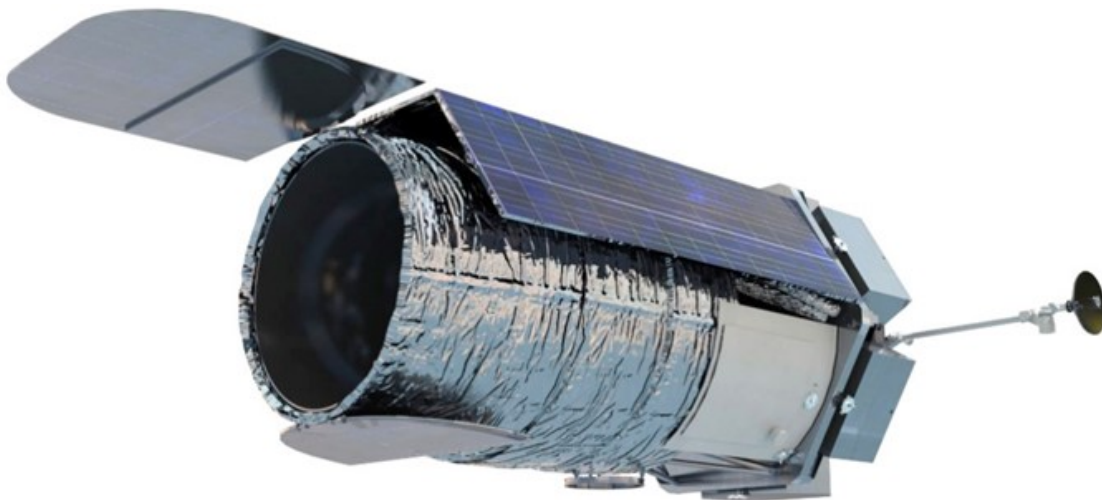
Rendering of the WFIRST space telescope (credit https://www.nasa.gov/wfirst)

We are not going to get an image with continents or clouds, or any of the features we see on planets in our own solar system. The image will likely only be a few pixels across. But those pixels contain the spectra of light from the planets. From the spectra, one can determine what sorts of gases or compounds are in the atmosphere of the target exo-world. So maybe we'll look at a planet that has oxygen in atmosphere, along with water and a bit of methane, a potential sign of biologic activity. And maybe, just maybe, we'll have finally found where the aliens are.

Outreach Report and Photos
By Van Webster

Rio Hondo Elementary School

El Monte, CA

10/12/2018

The prospects were shaky from the start. 5 members of the Los Angeles Astronomical Society ventured to El Monte, California and the campus of Rio Hondo Elementary School for a proposed evening of star gazing. Rain had been forecast for the later hours and pockets of high cumulous clouds dotted the otherwise blue sky. A dark, foreboding bank of dense clouds was marching its way northward towards the campus.

 We set up our telescopes anyway and caught glimpses of the newly crescent moon as it danced the dance of the seven veils through the gossamer cloud cover. We would call students over to the scopes when the view was clear.

The theme of the evening was Star Wars with costumed adults moving through the crowds of admiring students. The John Williams Star Wars sound track blared from the school's public address system. Kids lined up for photos with the cosplayers. There were lots of activity table with thinks to do and make for the students. The event was very well attended.

 Heven was tracking the weather in his phone as lightning bolts began to strike within the heavier clouds. While the sky closed in, we quickly packed up our gear for an early departure.

 The school staff was both friendly and appreciative. We were offered a basket of hot dogs, chips and snacks to sustain us through the short evening. So off into the night we went with raindrops striking on the windshield of our cars as we drove home

-Additional photos on the following page-

Session Nights

Mt. Wilson Observatory

2018 Session Schedule:

- December 1st (Sat)

The price for these nights are as follows:
$50 - 60 Inch Nights
$170 - 100 Inch Night

All of the dates above have been posted on the club calendar. These are private events exclusive to **current** LAAS members, families, and their guests only.

Please click on the following link to contact Darrell Dooley, our Mt. Wilson Coordinator before submitting payment.

mtwilsoncoordinator@laas.org.

To pay using PayPal or by credit card, please use the following link:

https://fs30.formsite.com/LAAS/MtWilson/index.html

To pay by check, please mail your check to:
LAAS
c/o Griffith Observatory
2800 E. Observatory Road
Los Angeles, CA. 90027
ATTN: Treasurer/Mt. Wilson
*Please write "60 Inch" on your check. Make your check payable to: LAAS

Note: If you pay by check, your check may be held by our Treasurer for several weeks, before clearing your bank.

60 Inch group photo from April, 2017

Meet The New Members

Welcome to the LAAS!

Kyle Knabb

Alan Christopherson

Earl Edwards

Bryan Sable and Cathy Nardico

Janice Margolis

Jesse Liao

Rayen Lin

Raymond Luna

Eduardo Ponsdomenech

Forrest Ginn

Kaan Beyhan

Nazmul Ula and Umme Warda

Rafael Gonzalez and Family

LAAS Board Meetings

Our LAAS Board Meetings take place once a month at the Garvey Ranch Park Observatory. You can find the dates for these meetings on our event calendar. All members are welcome to attend all Board meetings. These meetings begin at 8 PM.

NEW: You may listen to recorded meetings by logging in to our website at LAAS.org and clicking on the "Members Only" tab.

Before you try to access the "Members Only" information, you need to request login credentials from our Webmaster. On the left hand side of the page, scroll down and find "Login." Click "Login" for further information.

Volunteer Opportunities

Every LAAS member is a volunteer at some point. Some members volunteer to share telescopes with the public, while others tackle administrative duties, help out at our community and public events, or join a club committee. Taking photos at our events and writing articles about events for our club newsletter are great ways to volunteer. Participating at one of our out-reach events is another fine and fulfilling opportunity. This is YOUR club. Don't sit back and let other members do the work and have all the fun! Speak with a club officer and find out how you can volunteer and get more involved in the LAAS as a member.

Time To Renew Your Membership?

Please remember to renew your membership once you receive notice from the Club Secretary in your email inbox. Use this link to learn how to renew your membership: https://fs30.formsite.com/LAAS/MemberRenewal/index.html

Please send any new contact information to the club secretary at secretary@LAAS.org.

A Guide To The Night Sky

By Tre Gibbs

November begins with Saturn and Mars gracing our early evening skies, but by month's end, Saturn begins its fateful sojourn into the glare of the setting sun, leaving only Mars to reign supreme in the early evening sky.

Early in the month, and just after sunset, look for Mars (in Aquarius The Water Bearer) high in the south, while Saturn, much more faint, appears lower in the southwest, and still hanging out in the constellation Sagittarius The Archer. As Earth continues it's axial spin, the planets (and everything else in the sky for that matter) will slip further west rather quickly, so don't wait to view these wandering "stars", or you will miss them! By month's end, as Earth continues it's 365 day solar orbit - moving faster around the sun than Mars does - Mars will appear further west in the sky at sunset than it did in the beginning of the month, and will continue to move further west and become more and more faint as Earth continues to speed away from it.

Venus, which was gracing our early evening skies earlier this year, is now on the other side of the sun, and appears late in the month above the eastern horizon just prior to sunrise. For early risers, look for brilliant Venus just above the east southeastern horizon around 5:30 am toward month's end.
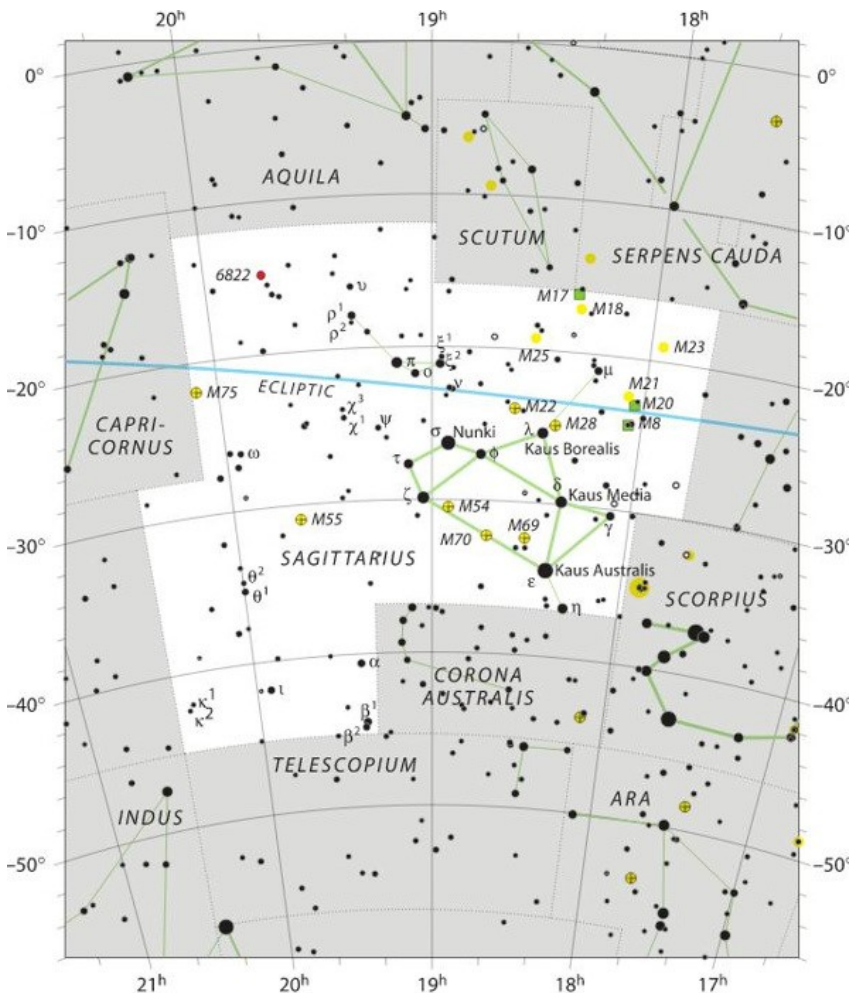
Image credit: EarthSky.org

The Full Moon for November is The Full Beaver Moon, and it occurs on November 22nd at 9:39 pm PST. Traditionally, November is the time of year when beavers are most active, preparing for the winter's freeze. As a result, it was a great time to hunt beavers in order to make certain there was enough fur to keep indigenous people warm during the cold winter months.

And speaking of the moon… the moon travels the same narrow path in the sky as the sun and planets. The moon also takes one month (or moonth) to complete one orbit around Earth. Therefore, there are times during each month when the moon will travel the sky with each planet. On the evening of November 11th, look for the moon slightly above and to the left to the planet Saturn, The God of Agriculture. Then, on the evening of November 15th, the moon has traveled east and pairs with The God of War, Mars. Look for the waxing gibbous moon, which will be slightly bigger than half full, just below and to the right of the "Red Planet".

Have a great month - and take some time to pause and look up. There's an incredible show going on overhead each and every night.

Tre Gibbs

Almanac
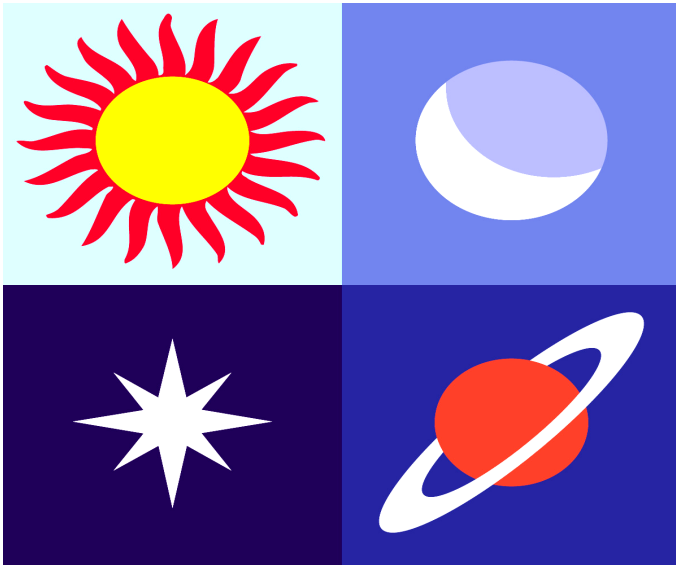
November 5, 6 - **Taurids Meteor Shower.** The Taurids is a long-running minor meteor shower producing only about 5-10 meteors per hour. It is unusual in that it consists of two separate streams. The first is produced by dust grains left behind by Asteroid 2004 TG10. The second stream is produced by debris left behind by Comet 2P Encke. The shower runs annually from September 7 to December 10. It peaks this year on the the night of November 5. The thin crescent moon will set early in the evening leaving dark skies for viewing. Best viewing will be just after midnight from a dark location far away from city lights. Meteors will radiate from the constellation Taurus, but can appear anywhere in the sky.

November 6 - **Mercury at Greatest Eastern Elongation.** The planet Mercury reaches greatest eastern elongation of 23.3 degrees from the Sun. This is the best time to view Mercury since it will be at its highest point above the horizon in the evening sky. Look for the planet low in the western sky just after sunset.

November 7 - **New Moon.** The Moon will located on the same side of the Earth as the Sun and will not be visible in the night sky. This phase occurs at 16:02 UTC. This is the best time of the month to observe faint objects such as galaxies and star clusters because there is no moonlight to interfere.

November 17, 18 - **Leonids Meteor Shower.** The Leonids is an average shower, producing up to 15 meteors per hour at its peak. This shower is unique in that it has a cyclonic peak about every 33 years where hundreds of meteors per hour can be seen. That last of these occurred in 2001. The Leonids is produced by dust grains left behind by comet Tempel-Tuttle, which was discovered in 1865. The shower runs annually from November 6-30. It peaks this year on the night of the 17th and morning of the 18th. The waxing gibbous moon will set shortly after midnight leaving fairly dark skies for what could be a good early morning show. Best viewing will be from a dark location after midnight. Meteors will radiate from the constellation Leo, but can appear anywhere in the sky.

November 23 - **Full Moon.** The Moon will be located on the opposite side of the Earth as the Sun and its face will be will be fully illuminated. This phase occurs at 05:40 UTC. This full moon was known by early Native American tribes as the Full Beaver Moon because this was the time of year to set the beaver traps before the swamps and rivers froze. It has also been known as the Frosty Moon and the Hunter's Moon.

Source: http://www.seasky.org/astronomy/astronomy-calendar-2018.html

Need Help With A New Telescope?

Visit the Garvey Ranch Observatory on any Wednesday night 7 PM to 10 PM for tips and assistance from your fellow LAAS members.

Learn more: The Garvey Ranch Park Observatory

November 2018

Sun	Mon	Tue	Wed	Thu	Fri	Sat
				1 NightFall 2018	2 Outreach/ Sherman Oaks	3 60 Inch Night
4	5	6 Outreach/North Hollywood	7 Garvey Night Board Meeting	8	9 Outreach/Mid-City	10 Dark Sky Night
11	12	13	14 Garvey Night	15 Outreach/ Koreatown area	16	17 Public Star Party
18	19 General Meeting	20	21 Garvey Night	22 **Thanksgiving**	23	24
25	26	27	28 Garvey Night	29 Outreach/North Hollywood	30	

Additional events with updated information may be posted on the calendar. Please log on to your account on the Night Sky Network (NSN) to view the complete schedule of club events. Link: https://nightsky.jpl.nasa.gov/

LAAS Outreach Program

The mission of LAAS is to promote interest in and advance the knowledge of astronomy, optics, telescope making and related subjects. In furtherance of its mission, LAAS conducts public star parties and other outreach events that are intended to enhance the public's understanding of astronomy and its enjoyment and appreciation of the beauty and wonders of our universe.

We provide outreach events at local schools, Griffith Observatory, Mt. Wilson Observatory, various state and county parks, and community events.
Join our Outreach team of volunteers today.
Contact Heven Renteria, our Outreach Coordinator at Outreach@LAAS.org

Want to include astronomy outreach at your school's science night or open house? Follow the link below to access the request form:

https://nightsky.jpl.nasa.gov/club-eventrequest.cfm?Club_ID=1344

LAAS Club Swag

LAAS JACKETS, T-SHIRTS, AND CAPS

Share your club spirit with the public and wear your club colors to help identify you as a member of the LAAS today by ordering a new jacket, t-shirt or cap.

If you would like to purchase club jackets, T-shirts, or caps featuring our club logo, please look for Richard Roosman at the public star party and at our general meeting. Richard will have the club merchandise on sale from 2 PM to 6 PM at the star party.

For further information, feel free to contact Richard at Richardinwalnutpark@msn.com.

You can also use the link on Paypal, if you would like to place an order for club merchandise by using the following link:
http://laas.org/joomlasite/index.php/laas-merchandise

Amazon Smiles

The LAAS is now listed on Amazon Smiles. When you purchase any goods on Amazon.com, Amazon will donate a small percentage of the funds they receive from you, back to the LAAS. Here's some information to help bring in funds for our club projects:

What is AmazonSmile?

AmazonSmile is a simple and automatic way for you to support your favorite charitable organization every time you shop, at no cost to you, with the added bonus that Amazon will donate a portion of the purchase price to your favorite charitable organization., such as the LAAS!

Learn more by following this link: http://smile.amazon.com/

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John O'Bryan, Jr.

Treasurer

Astronomy Magazine Discounts

Discounts for astronomy magazines can be found on the internet. Look for the best deals possible. Send a copy of your LAAS membership card with your check or payment to receive a club member discount.

As a member of the Night Sky Network, you may use the above link to renew your Astronomy Magazine subscription (or enter a new subscription) at the club discount rate. If this is a renewal, Astronomy Magazine will match your entered name and address and extend your subscription. For inquiries, please contact Astronomy Magazine customer service & sales at 1-800-533-6644.

Click here for a NEW Sky & Telescope subscription at the club discount rate.

Click here for online renewal of your Sky & Telescope magazine subscription

Join the Astronomical Society of the Pacific and help support the cause of advancing science literacy through engagement in astronomy. Member benefits include a **subscription to the online *Mercury* Magazine**, published quarterly, and **Astronomy Beat**, a monthly on-line column written by "insiders" from the worlds of astronomy research and outreach.

Subscribe or renew to the McDonald Observatory's StarDate Magazine and receive a special discount. Go to this page and press "Add to Cart" under the kind of subscription you want: http://stardate.org/store/subscribe Then, on the Checkout form, enter "network" in the Coupon Code box.

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213- 673-7355 Checked daily

Griffith Observatory:

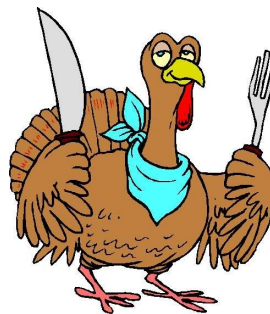213-473-0800

Sky Report:

213-473-0880

Lockwood Site:

661-245-2106

Not answered, arrange time with caller.

Outgoing calls – Collect or calling card only.

Click on any of the images below to discover links to astronomy information, videos, photos, and at times, old sci-fi movies, too!

Night Sky Network NASA

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