

The High Desert Observer

February 2019

The Astronomical Society of Las Cruces (ASLC) is dedicated to expanding public awareness and understanding of the wonders of the universe. ASLC holds frequent observing sessions and star parties and provides opportunities to work on Society and public educational projects. Members receive the *High Desert Observer*, our monthly newsletter, plus membership to the Astronomical League, including their quarterly publication, *Reflector*, in digital or paper format.

Individual Dues are \$30.00 per year

Family Dues are \$36.00 per year

Student (full-time) Dues are \$24.00

Annual dues are payable in January. Prorated dues are available for new members. Dues are payable to ASLC with an application form or note to: Treasurer ASLC, PO Box 921, Las Cruces, NM 88004. Contact our Treasurer, Patricia Conley (treasurer@aslc-nm.org) for further information.

ASLC members receive electronic delivery of the HDO and are entitled to a \$5.00 (per year) Sky and Telescope magazine discount.

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Masthead Image: February 10, 2017 From Las Cruces, Moon rising over the Organ Mts in Penumbral Eclipse.



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February Meeting --

Our next meeting will be on **Friday, February 22**, at the Good Samaritan Society, Creative Arts Room at 7:00 p.m.

The speaker will be Dr Stella Kafka and the topic will be "The AAVSO".

Member Info Changes

All members need to keep the Society informed of changes to their basic information, such as name, address, phone number, or email address. Please contact Treasurer@aslc-nm.org with any updates.

Events

ASLC hosts deep-sky viewing and imaging at our dark sky location in Upham. We also have public in-town observing sessions at both the International Delights Cafe (1245 El Paseo) and at Tombaugh Observatory (on the NMSU Campus). All sessions begin at dusk.

At our Leasburg Dam State Park Observatory, we hold monthly star parties. Located just 20 miles north of Las Cruces, our 16" Meade telescope is used to observe under rather dark skies.

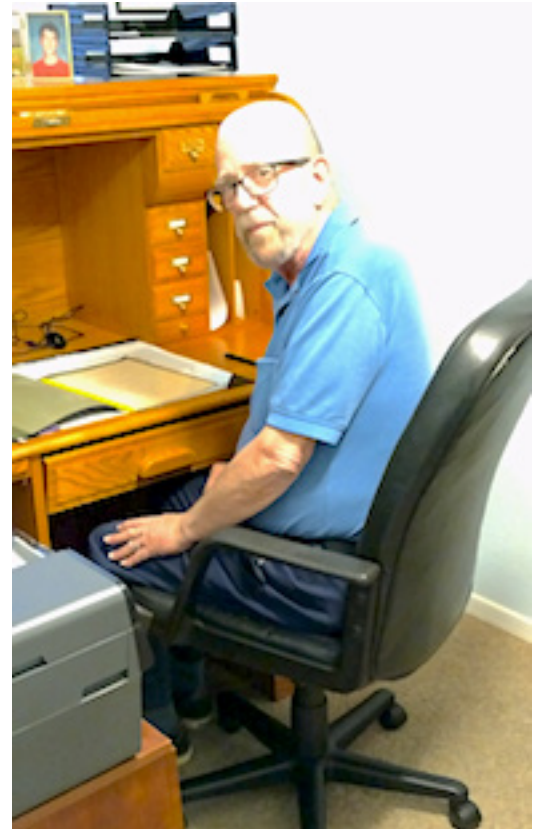
Please see *Calendar of Events* for specific dates and times.

From the President's Desk

February 2019

I know that you might think my reading material is a little strange, but ideas fascinate me and this one is really different. A theory put forth by Professor Erik Verlinde, a string theorist, says "There is no gravity, no dark matter, and Einstein was wrong." He thinks that gravity is not a fundamental force of nature because it's not always there. Instead he believes it is emergent- coming into existence from change is microscopic bits of information in the structure of spacetime. He has just published an elaboration of his previous work "Emergent Gravity and the Dark Universe" which argues there is no dark matter or dark energy. Something for you to think about while enjoying a cold one.

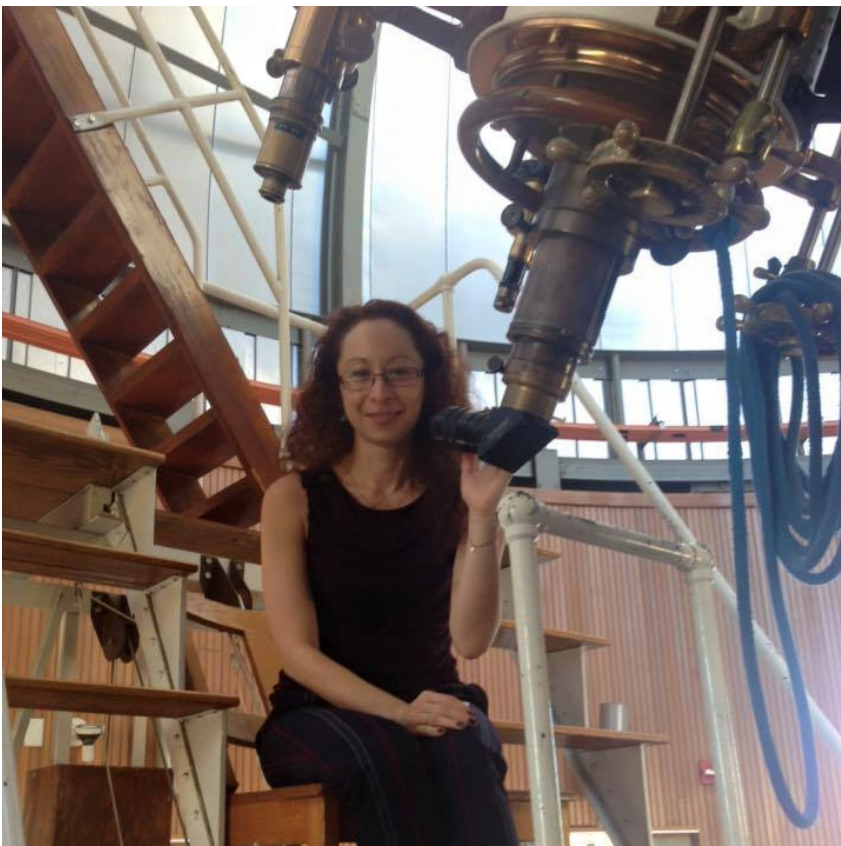
Our speaker this month is Dr. Stella Kafka, the director of the AMERICAN ASSOCIATION OF VARIABLE STAR OBSERVERS. Before her tenure at AAVSO Dr. Kafka held positions at CTIO, Spitzer Science Center/Caltech, Carnegie Institution/DTM and AIP Publishing. She will be discussing some of the most common aspects of stellar variability and their significance in astrophysics. She will discuss their common light curve identifiers and present work by AAVSO observers. She will also discuss how you can participate in variable star observations, contributing to the AAVSO International Database.



The answer is 42!

Tracy Stuart, ASLC President

February 2019



Dr. Stella Kafka, Director of AAVSO

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Calendar of Events (Mountain Time - 24 hr. clock)

Feb	01	17:41	Sun Sets
	01	23:04	Mars Sets
	04	14:04	New Moon
	08	18:30	OUTREACH; Tombaugh Elementary Star Party: 6:30 to 8:30 PM
	09	17:00	OUTREACH; MoonGaze, International Delights Café
	09	17:00	OUTREACH; MoonGaze, Pan Am Plaza on University Ave
	12	15:26	First Quarter Moon
	13	18:00	OUTREACH; Desert Hills Elementary Star Party: 6:00 to 7:30 PM
	15	19:00	OUTREACH; Tombaugh Observatory Open House: 7:00 to 8:00 PM
	18	22:21	OCCULTATION, Sirius is occulted by asteroid (4388) Jurgenstock
	19	08:54	Full Moon
	22	09:00	Sacramento Mountains Spectroscopy Workshop; 22nd, 23rd, 24th all day + evening
	22	19:00	ASLC Monthly Meeting; Good Samaritan Society, Activities Meeting Room
	23	17:45	OUTREACH; Dark Sky Observing at Leesburg Dam State Park
	26	04:28	Last Quarter Moon
Mar	01	18:05	Sun Sets
	01	22:44	Mars Sets
	01	01:54	Jupiter Rises
	02	18:00	OUTREACH; NPO Program at City of Rocks SP, B. Nigg, M. Nuss, C. Turner
	06	09:04	New Moon
	10	02:00	Daylight Saving Begins: Spring Forward
	14	04:27	First Quarter Moon
	15	20:00	OUTREACH; Tombaugh Observatory Open House: 8:00 to 9:00 PM
	16	19:30	OUTREACH; MoonGaze, International Delights Café
	16	19:30	OUTREACH; MoonGaze, Pan Am Plaza on University Ave
	18	03:05	Jupiter: Double shadow transit, Ganymede & Europa; Alt 09° 24'
	20	19:44	Full Moon
	22	19:00	ASLC Monthly Meeting; Good Samaritan Society, Activities Meeting Room
	25	06:56	Jupiter: Double shadow transit, Ganymede & Europa; Alt 34° 57': At dawn
	27	22:10	Last Quarter Moon
	30	19:30	OUTREACH; Dark Sky Observing at Leesburg Dam State Park
	30	19:30	OUTREACH; NPO Program at City of Rocks SP, B. Nigg, M. Nuss, C. Turner

Be sure to visit our web site for ASLC information: www.aslc-nm.org

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Announcements

1. The February ASLC meeting will be held on February 22, 2019 at 7:00 PM at the Creative Arts Room, Good Samaritan Society Las Cruces Village, 3011 Buena Vida Circle, Las Cruces, New Mexico. The program for the February meeting will be a presentation by Dr. Stella Kafka, Director of the AAVSO. She will tell us all about the AAVSO and its programs. You don't want to miss this one: she is smart, knowledgeable, friendly and outgoing, an excellent speaker and just plain fun to talk to.

2. There is another comet in the skies now. It is called Comet Iwamoto and it was discovered in 2018 and is designated Comet C/2018 Y1 or Comet Machholz-Fujikawa-Iwamoto.

This comet is fast moving and will pass closest to Earth on Feb 12, 2019. For a few days around Feb 12th, it will be moving about 7 degrees per day. If you want to view or photograph Comet Iwamoto, the

President's Comments:

Tracy Stuart, President, welcomed the group to tonight's meeting. He noted that the November 2018 meeting minutes as published in the January issue of the High Desert Observer (HDO) were incorrect. ...**The incorrect portion published in the HDO as:**

Astronomical League (AL):

Ron Kramer is currently serving as Vice President and acting President of the AL. The AL has published a calendar for 2019 that has extensive astronomical and AL information included. Cost is \$13 per calendar (the same price as the Planetary Society calendar). Ron has several calendars with him tonight and if members are interested can provide additional copies.

Presentation:

This month's presentation was by Society member Dr. Bill Stein, "What is AAVSONet and How You May Use It". The AAVSONet is a dispersed, shared robotic telescope network operated by the AAVSO. Bill explained how members and non-members may submit proposals for an observing program on variable stars to the AAVSO Bright Star Section.

Bill also noted that the Section is proposing that the Fall 2019 meeting of the AAVSO be held at New Mexico State University (NMSU) on 25 26 October 2019. The meeting will cover several topics and volunteer help from the community is desired and encouraged.

The November 2018 Monthly meeting will be held on 16 November to not conflict with the Thanksgiving holiday.

The October meeting of the Astronomical Society of Las Cruces concluded at 8:20 pm. A social time followed at Pecan Grill.

-Respectfully submitted by John McCullough, ASLC Secretary

....**should have read as:**

Presentation:

This month's presentation was by Society member Stephen Wood on "Planetary Imaging". Stephen recently relocated from Florida in search of darker skies. He noted that when he started imaging in the 1980's, only film was available. However, digital imaging and processing has changed everything. He discussed methods for improving planetary images that visual observers can also take advantage of.

The November meeting of the Astronomical Society of Las Cruces concluded at 8:15 pm. A social time followed at Pecan Grill.

-Respectfully submitted by John McCullough, ASLC Secretary

With this correction, Tracy asked that the November meeting minutes be accepted. The minutes were accepted by acclamation.

Treasurer's Report:

Trish Conley, Treasurer, provided a summary of the Society's finances. She had received \$937, primarily membership dues for 2019, since the last meeting. After paying monthly rent for a storage unit and other expenses, the net for the period was \$892.

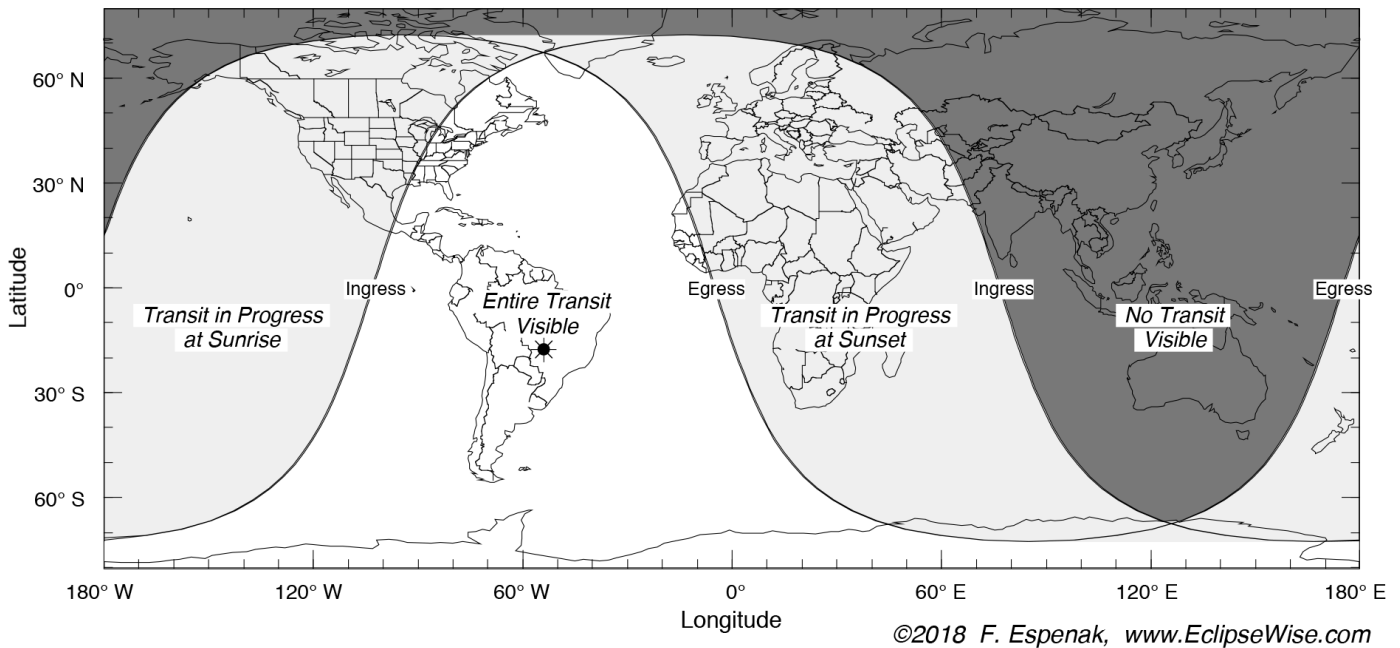
In Case You Missed it, News from the Heavens

By Kevin Brown

2019 Mercury Transit

On Monday, November 11, 2019 Mercury will transit the sun for the first time since 2016. There are approximately 13 transits of Mercury each century. From our location here in New Mexico the transit will already be in progress at sunrise. It will transit close to the middle of the Sun with a separation between the centers of the Sun and Mercury of only 76 arc-seconds. There will not be another Mercury transit until November 13, 2032. In comparison, the last transit of Venus was on June 6, 2012 and the next Venus transit will not occur until December 11, 2117.

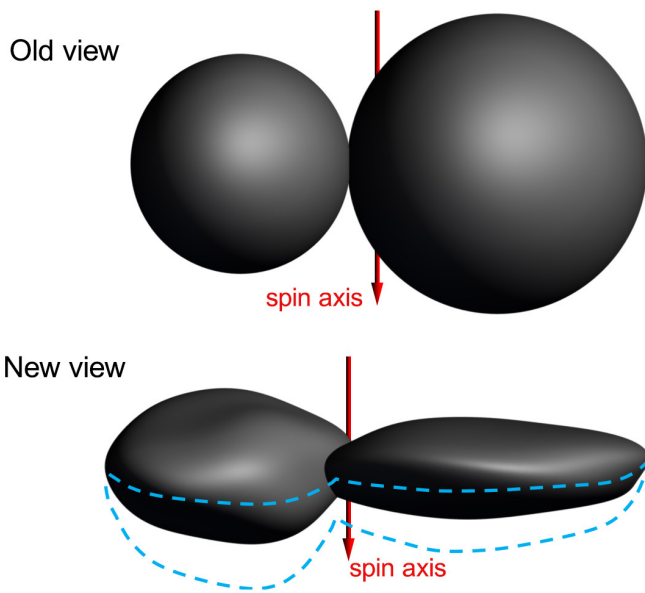
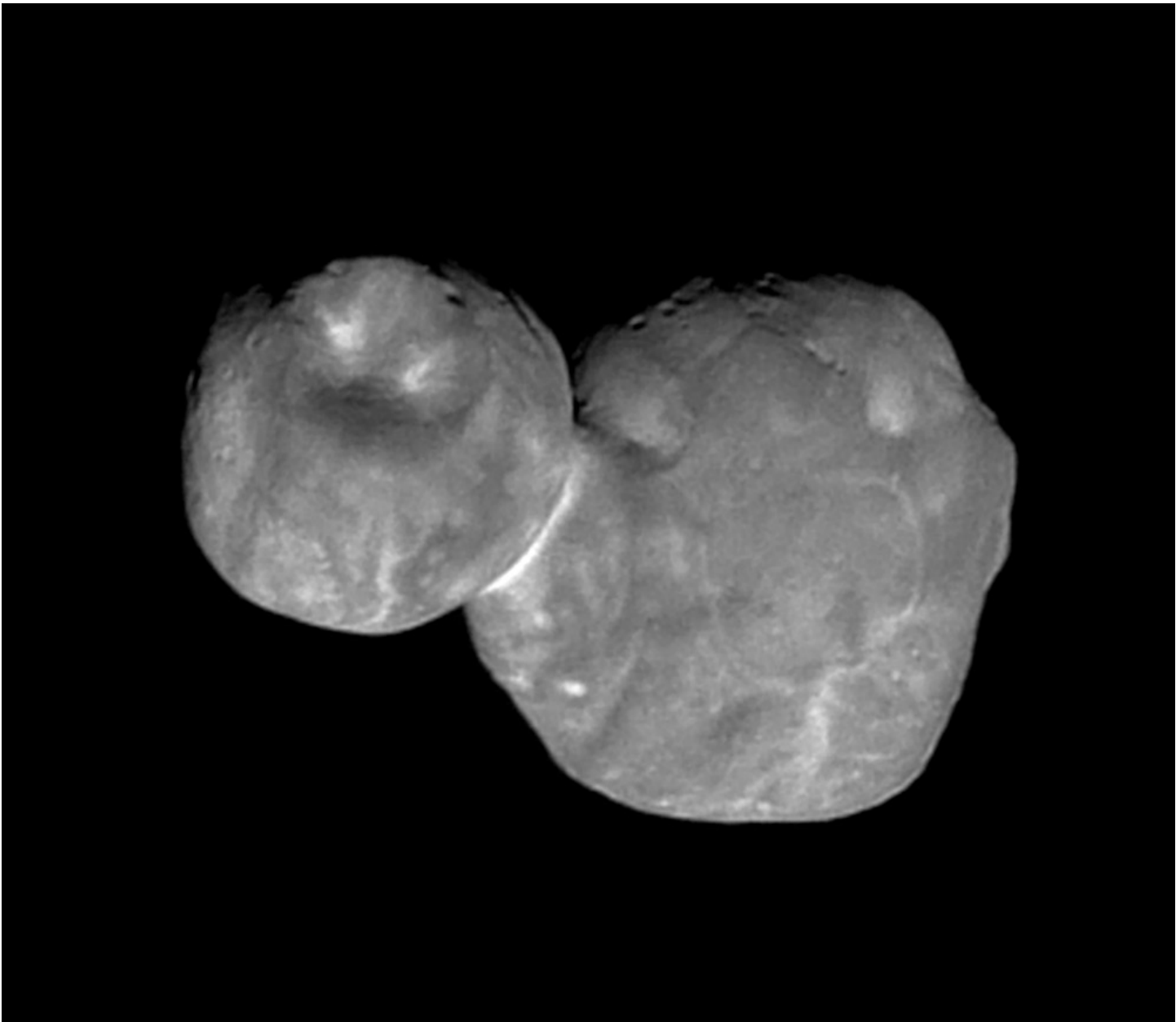
Transit of Mercury: 2019 Nov 11



New Horizons' Latest View of Ultimate Thule

The image below is the most recent released image of Ultimate Thule taken by the New Horizons spacecraft. just before the flyby. This was taken on January 1 just seven minutes before the closest approach. The image had an original resolution of 440 feet per pixel. It was stored in the spacecraft's data memory and transmitted to earth on Jan. 18-19 where the image was sharpened to enhance fine detail.

Shortly after closest approach, another image was captured from a different perspective. Although the object was backlite, there was enough information to make a new calculation as to the shape of Ultima Thule, and it is a different kind of Snowman, a Pancake Showman, as shown in the diagram below the image. Astronomers are thrilled, and puzzled.



Hubble accidentally discovers nearby ancient dwarf galaxy



Astronomers using Hubble to study the globular cluster NGC 6752 found a dwarf galaxy of old stars (~10 billion years) hiding behind the cluster's brighter stars. It is visible in the left half of the image above. The galaxy has been named Bedin 1 by its discoverer Luigi Bedin and his colleagues at the Astronomical Observatory of Padua. The galaxy is about 30 million light years away and measures only around 3,000 light years at its greatest extent. It has been classified as a dwarf spheroidal galaxy.

Japanese spacecraft to land on asteroid to retrieve sample



If everything goes as planned the Japanese Hayabusa2 spacecraft will briefly touchdown on near-Earth asteroid Ryugu to collect a sample. The touchdown operation is scheduled to take place between February 20 – 22. Hayabusa2 has been studying the 3,000 foot wide carbon rich asteroid since June 2018. Two additional sample grabbing touchdowns are planned. The spacecraft is scheduled to return to earth orbit in December 2020. At that time a capsule containing the samples will be dropped to Earth and retrieved for study by scientists around the world.

The Uranograph - February 2019

By Bert Stevens

Constellation of the Month: Orion, The Great Hunter

One of the most obvious constellations is also one that is almost universally recognized as a figure of a man in the winter sky. It is composed of two first and two second magnitude stars forming a vertical rectangle and a diagonal line of three second magnitude stars in their middle forming a belt. It is Orion, the Great Hunter.

Mythologically, Orion was the son of Poseidon, the god of the seas, or at least was a gift from Poseidon, depending on which version of the story you are reading. He grew up strong and handsome, becoming a great hunter. In his travels, he met and fell in love with Pleione and her beautiful daughters. He



Constellation: Orion The Great Hunter

pursued Pleione for several years trying to win their affection. Finally, Zeus intervened and transformed the Pleiades into doves and they flew off into the sky to become the open cluster of the same name.

Meanwhile, Orion traveled to the isle of Chios where he fell in love with King Oenopion's daughter Merope. After asking for her hand in marriage, the King agreed, but required that Orion clear the island of the many wild beasts which besieged it. Orion complied, but Oenopion continued to make excuses to put off the wedding. One night, Orion got very drunk and forced himself on Merope. In revenge, Oenopion blinded Orion while he slept.

Wanting his sight back, Orion consulted an oracle who told him he had to travel to the easternmost point where the Sun rises from the sea. A young guide helped him and they had many adventures in their travels. He did finally meet Helios, the sun god, who restored his sight.

Traveling back, they stopped on the isle of Crete. There Orion met his female counterpart, Artemis, the Huntress and goddess of the Moon. He fell in love with her and she with him. They became constant companions.

Artemis's brother, Apollo, fearing the she may be just another of Orion's conquests, plotted against him. One day he spied Orion swimming far out at sea. Calling over his sister, he challenged Artemis to hit the tiny speck bobbing out in the ocean. She launched her arrow and made a direct hit. When Orion's body washed up on shore, she realized what she had done. She placed Orion's body in her silver Moon-chariot and carried him into the darkest part of the sky, where his stars would shine the brightest. She also placed his hunting dogs with him, now the constellations Canis Major and Canis Minor. This location places him southeast of the Pleiades, so he appears to be continuing to pursue the Pleiades across the sky.

The stars that compose Orion are actually part of an OB association. This is an extremely open type of open star cluster. This places most of the stars in Orion approximately the same distance from us, about 800 light years away. They are virtually all of spectral type O or B. The stars in this Association all formed from the same gigantic gas cloud, so they are all moving in approximately the same direction.

The exception is the red giant star that marks Orion's left shoulder, Betelgeuse (pronounced, the same way as the character in the movie of the same name, "beetle juice"). Betelgeuse is roughly half the distance of the stars in the Orion OB Association, but it is much larger than the other stars here. If it were placed in our Solar System, it would stretch all the way out to the asteroid belt, between Mars and Jupiter. This is a huge star, one that has grown old and it is shedding its outer atmosphere into space. It is possible that one day Betelgeuse will become a supernova. If so, it will be as bright as the crescent Moon and it will be easily visible in the daytime.



Running downward from Orion's belt is a line of three stars. This is often depicted as his sword in constellation drawings. The middle "star" is really not a star at all and if you look at it with binoculars, you will see that it is a fuzzy patch commonly referred to as the Orion Nebula (M42). This is actually a complex of three or four nebulae. When you look at it with binoculars or a telescope, you may be able to discern a greenish color. This is the glow emitted by oxygen when it is excited. The major color emitted by the nebula is a red from excited hydrogen, but your eye is not very sensitive to red. Photographic film and digital cameras are more sensitive to red than the eye, so most pictures show it as a red-to-white nebula, rather than the greenish one you will see directly.

Not only is the Orion Nebula easily visible, but it is a very exciting area for astronomers. It is a stellar nursery where tens of thousands of new stars have formed within the past ten million years or so. This is an extremely active region of star formation with all the right ingredients to make stars: dust and gas in large quantities, and other stars to help start the compression that will eventually form the new stars.

The center of this Nebula contains an obvious group of four stars called the Trapezium. What is

The Orion Nebula - Messier 42

not so obvious is that there are a thousand stars there, very close together, all less than a million years old. The sky on a planet circling one of those stars would be amazing, with hundreds of stars visible in the daytime, and a thousand brilliant stars shining in the night.

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Separating Stars and Nebulae

Alex Woronow

Introduction:

Many fundamental processing steps, including color adjustments, sharpening and even noise reduction, introduce artifacts into images. Some of these artifacts appear as abrupt star-background transitions while others may be dark or bright halos due to 'ringing' (a.k.a. Gibbs Phenomenon), as shown in Figure 1. Introduction of many of these artifacts can be avoided if the stars and nebula can be processed separately then recombined.



Figure 1: (Wikipedia)

Once the nebula is in a separate image, you may, for artistic whimsy, decide not to put the stars back in at all. If you want to put them back you can deconvolve or otherwise sharpen the two separate images without generating artifacts around the stars. You can adjust star colors separately and precisely while doing the same with the nebula. And so on. After all the separate processing, the stars and nebula can be recombined and further processed, as desired.

Example Result:

In Figure 2a, the Pelican nebula is fully processed without stars. It is a narrow-band image in SHO (Sulfur, Hydrogen, and Oxygen). The stars were often magenta and had distracting, bright magenta halos.

Using Gimp and Resynthesizer, the stars and nebula were placed into separate images. The image containing the extracted stars was processed to remove most of the star's color, then recombined with the nebula image to yield Figure 2b. Had RGB images been available from a separate processing task, the stars could have been extracted from the RGB into a separate image and that image recombined with the SHO image. In any case Figure 2a, even when significantly enlarged, does not show obvious scars from the removed stars.

These images of the Pelican nebula represent my first attempts to cure a problem by separate processing of nebula and stars. This modest level of success has coaxed me to venture further along this path, and even beyond to separating stars, RGB, and L images and processing each of the three separately before recombining all--but the rationale for that tripartite approach will await a later article, perhaps.

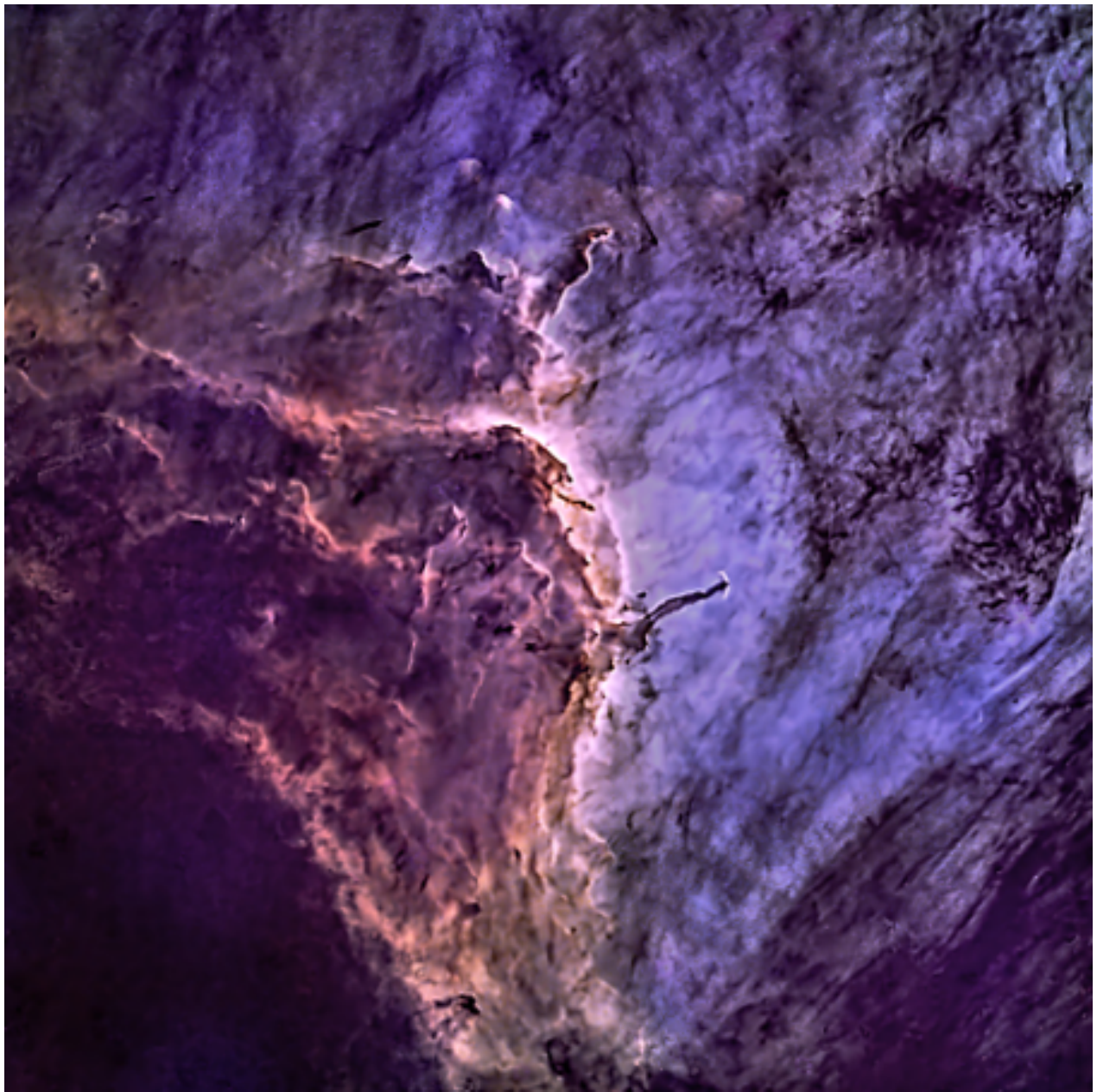


Figure 2a: Pelican nebula fully processed after stars were removed.

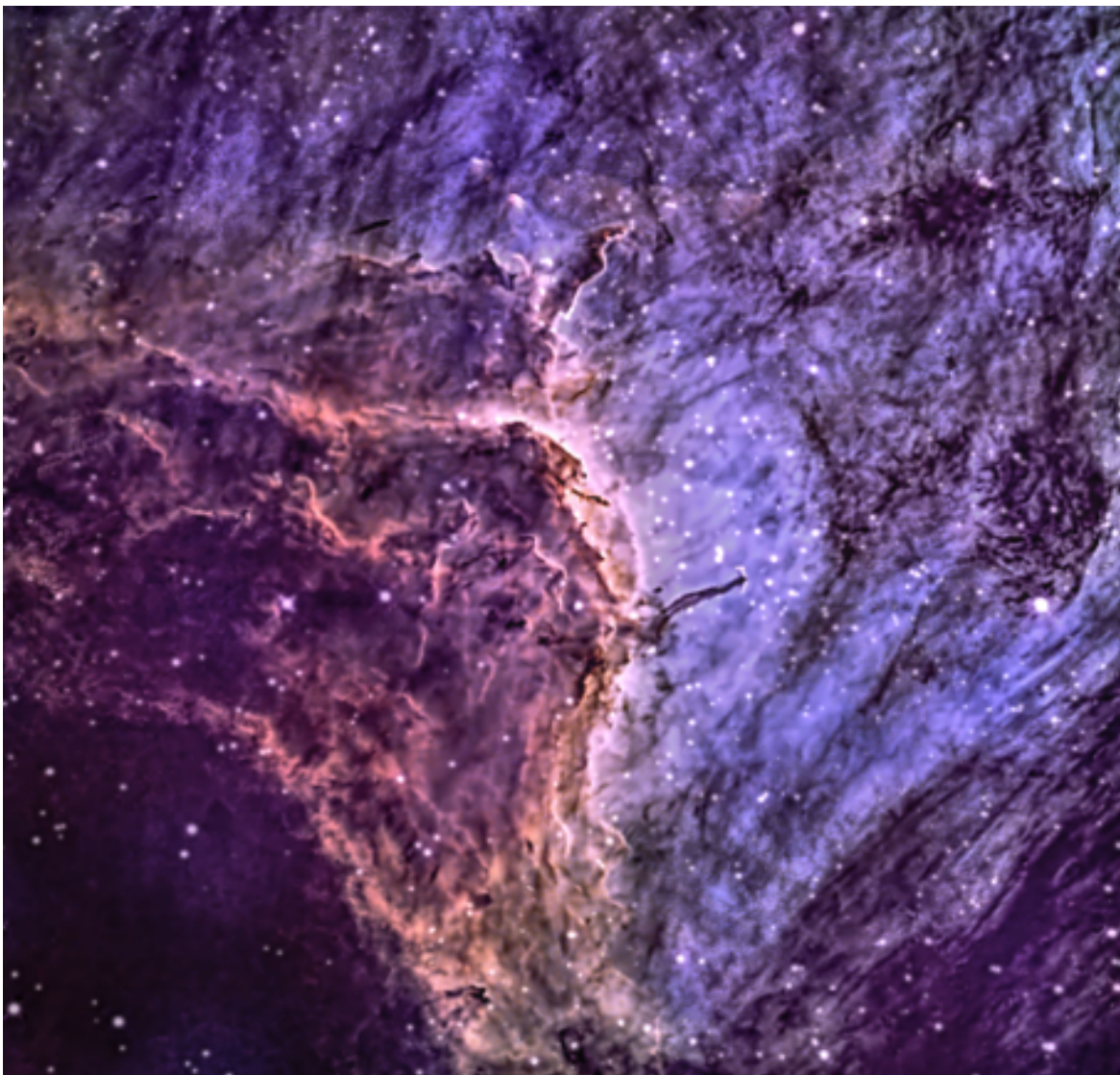


Figure 2b: Fully processed separately, the Pelican nebula and the stars have been reunited.

ASLC - High Desert Observer, January 2019

The Star-Nebula Separation Process:

The star-nebula separation inevitably involves star masks that identify the image component (stars) that needs to be removed and replaced with some reasonable approximation of what was the underlying image content. There are several tools that can remove the stars and 'heal' or 'inpaint' the scars left behind. If you intend to reintroduce the stars, the quality of the inpainting need not be wonderful...the stars will largely cover the healed areas anyway. If you intend to promote a final starless image, the inpainting should be compatible with the surrounding color, brightness and noise levels, and trends of these features. Furthermore, patched areas should have continuity, not a sharp boundary with the surroundings. Many different algorithms do inpainting; some better meet the preceding criteria, and some do it faster than others.

The three programs I superficially review below are PixInsight, Gimp using plugins, and PhotoShop CS6 using plugins. Before looking into these, let's consider, and reject, the program named 'Inpaint'. It does a beautiful job of matching the surroundings, but the output image is just 8 bits--Ouch! Collecting, calibrating, stacking and combining RGB yields images with a minimum of 16 bits. Therefore, passing an image through Inpaint loses, forever, any color depth beyond 8 bits that was present before using Inpaint! Not Good. So, let's look at the three most popular star-removal options.

PixInsight (\$\$):

PixInsight offers the easiest solution for PI users. Make a star mask, invert and binarize it, and invoke the DefectMap process, feeding it the altered star mask. There are some DefectMap options you can select. I usually use the Gaussian and Circular options--but experiment!

Aside:

The idea of using a defect map is not mine. The first link (see the end of this article) bears the source of this technique (Salvatore Giambruno). Somehow, in the course of the discussions on that forum, the idea of using DefectMap seems to have gotten lost. Too bad; it works at least as well, in my opinion, as the more promoted MultiMedianTransform (MMT) method used in the videos (see end of article). Notice that the MMT method fills the star scars with nearly a uniform shade of gray, abruptly transitioning from the surroundings and poorly representing the trends of structures that intersect the repaired areas. Other methods do somewhat better, e.g., the Resynthesizer plugin for Gimp. My video compares several methods (but not the MMT method). Still, what tool to use, when, and how remains a topic open for research

Gimp (Free):

I have Gimp 2.10.6 on a 64 bit Windows 10 computer. I am aware of three Gimp plugins that inpaint. Each requires a mask to delineate the targets for inpainting. I usually make my star mask in PI and load it into Gimp as a layer along with the target image; convert the black background of the mask to transparent; convert the white areas (stars) to green; merge the layers, select-by-color the green; grow the selection by a few pixels; then heal/inpaint the selection with one of the plugins. The plugins appear to work on 32 bit images (and perhaps 64 bit?)

Resynthesizer Plugin (free):

This plugin can be downloaded (free) from

<https://www.gimp-forum.net/Thread-Resynthesizer-heal-selection-plugins-for-Windows>

It works well--better than DefectMap, but it runs quite slowly. It is a reliable method for inpainting.

InpaintBCP Plugin (free):

This plugin can be downloaded from <http://inpaintgimpplugin.github.io/>

It does a top-notch job of inpainting, but I have had mixed success with getting it to work on abundant star fields. The author has been advised of this. Maybe a fix will be forthcoming.

G'MIC-Qt Plugin (free):

This plugin greatly extends the entirety of Gimp's tools. One of its capabilities is inpainting, which has several alternative algorithms. I use the Repair>Inpaint [Multi-Scale] or >Inpaint [Morphology]. This plugin can be downloaded from <https://gmic.eu/>. I have had intermittent trouble transmitting areas to be inpainted from Gimp proper to G'MIC. The quality is comparable to Resynthesizer.

Etc:

Any manual selection tool can delineate regions for inpainting, including star spikes or individual stars, for example.

PhotoShop (\$\$\$\$):

I use CS6 extended, which functions on 16 bit images only, when it comes to inpainting. The basic work flow mimics that given for Gimp with the exception of the last step. Once the masked areas (green) have been selected, you select Edit>Fill>Content-Aware. Although the execution is quick, the results are not as good as those from Resynthesizer. The inpainted areas often have a discontinuity at their edges, which may cause residual artifacts, even if the stars are reintroduced.

Actions:

Annie's Astro Actions (\$) and Troy's Astro Actions (Free) both use dust/scratch repair at multiple scales to inpaint stars, without using a star mask. The star removal is quite good, but without the mask, preservation of fine, non-star structures is a concern--but unappraised to my knowledge.

Separating & Reinstating Stars:

Once you have generated a starless image by healing/inpainting or DefectMap, do not alter that image before making a separate starsOnly image. To make the starsOnly image in PI, I use PixelMath:

$$\text{starsOnly} = \text{originalImage} - \text{starlessImage}$$

In Gimp or PhotoShop, I am not entirely sure how to do this subtraction. I suspect that the two images are superimposed as layers and the blend mode is, probably, set to Subtract? If you are an expert in one or both of these programs, you probably already know the answer. In any case, after you process the stars and nebula separately, you must recombine them processed. The possibility arises that simply adding the two images (mirroring the subtraction step above) will result in saturation of a noticeable proportion of the stars. That is, stars+nebula = >1. To remediate this, I recombine them with the PixelMath setup shown in Figure 3 (and with the Rescale option off). Basically, it compresses values above cutoff according to a simple exponential 'unstretch' when power > 1.0. While applying this tool, I monitor the image Statistics, watching the maximum values, and adjusting the cutoff and power that keep that maximum clearly below 1.0. (Again, I have no idea how to mimic this statistic-limiting algorithm in PS or Gimp.)

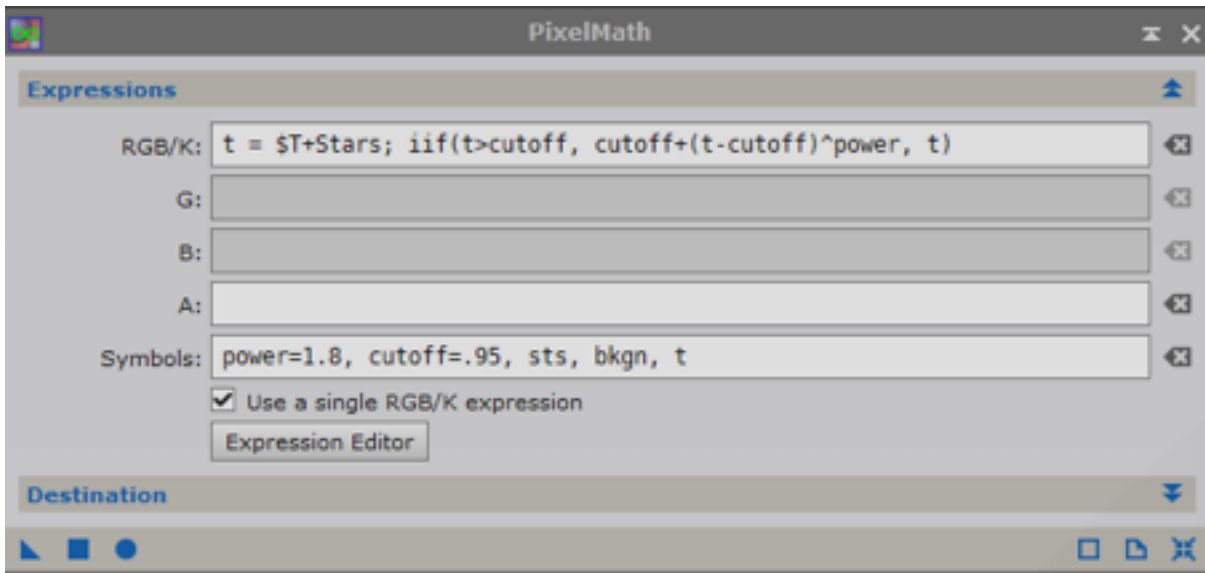


Figure 3: The PixelMath icon's settings for recombining the starless and starsOnly images. The rescale option (in the Destination pull down) is unchecked.

Final Thoughts:

Any of the three programs, PixInsight, Photoshop, or Gimp probably will work sufficiently well if you intend to put the stars back in at the end. The best of these in matching the repaired area to its surroundings is Gimp with Resynthesizer.

PI references:

discussions <https://pixinsight.com/forum/index.php?topic=11794.0>

discussion, videos <https://pixinsight.com/forum/index.php?topic=11879.msg73083#msg73083>

(Note: If you have slow internet, like I do, then watching these long and somewhat protracted videos can be painfully frustrating. I fix this a bit by downloading them using VidPaw and watching them off-line.)

* * * *

So you wanna go remote!

Setting up and operating a remote observatory- what I've learned.

By David Doctor

For many years I had planned to “one day” be able to operate my own observatory and equipment from a dark sky site. After years of planning and anticipation, then 3 years of building, installing and troubleshooting, “one day” became now. In July of 2018 I was able to complete my first remote imaging session from beginning to end! Of course this is a work in progress and there are countless maintenance tasks, repairs, upgrades etc that this sort of thing will always require, but if you are a tinkerer that’s part of the fun!

The purpose of this article is to share some of the decision-making steps, operational points and other concerns related to this project that hopefully will be helpful to anyone thinking about going remote!

Choosing a site



You're going to spend probably most of your time in this area. Many considerations exist all depending on your situation. Obviously you want a dark site, but there will be a compromise. This is different than portable imaging where you can take your stuff to the darkest spots on the planet. In the case of a permanent set up you will need power lines and internet. That might be challenging in a isolated location.

“High or Low” which way to go? The troposphere is the lowest layer of the Earth's atmosphere and is where basically all the weather is, so forget trying to set up above that because that's around 11 miles up! However the lowest part of the troposphere is the planetary boundary layer where friction between the earth's surface and the atmosphere can affect air flow. At around 7000 feet you are above this layer so at least theoretically it can be a plus. The downside to higher altitude is potentially more wind and weather exposure, specifically lightning. Several people I know in our area who are at the top of the hill have had lightning strikes knock out equipment repeatedly. Bottom line is probably the darker the better regardless of altitude with consideration given to local seeing if that is known (see below)

Seeing isn't everything, it's the only thing. If you have a portable seeing monitor, that's great. You can check seeing in potential sites under consideration but remember seeing is not guaranteed over the lifetime of your observatory. The climate is changing always. Seeing is also a very local phenomenon and is unpredictable. It helps to be able to ask people who have been there for at least a few years what their experiences have been, which brings us to the next tip:

Astronomy communities. These have several advantages. You have people already doing what you want to do in an area that has at least some proven observing merit with respect to conditions. Many of these areas also have lighting restrictions so you are less likely to run into a situation where right after you set up a bunch of developers come in and build next to your observatory or people move into the lot next to yours and put up nasty security lights! Access roads to these types of developments are typically well maintained so you don't have to risk life and limb driving equipment to your observing site! You also do not have to reinvent the wheel as it were. You are likely to find people who went through many of the troubleshooting steps you are going through and can help you avoid mistakes and problems.

There are a couple of potential downsides to some communities. If there is a property owner's association make sure there are no restrictions that would affect what you want to put up there. For example, some communities may not allow modular homes if you want to have a small house on your property in addition to the observatory. Some developments have managers that oversee all of the available lots and sell them directly to buyers in which case you are probably going to pay much much more than market value for the property .

How far away from my home residence should I be? This is another big question. For myself, I am very thankful that I live just under 2 hours away from my observatory. Despite flawless planning there are going to be unanticipated events where you (or your wife, etc) will really need to be able to get to your set up for whatever reason. If this is not the case you will probably have to have your observatory in a development where someone there can assist you in an emergency. Many astronomy communities have this service but at additional cost. If you have friendly astronomer neighbors then you may be able to have one of them assist you in an emergency if you are away. The other advantage to relative proximity is that you can check the condition of your observatory with some regularity and deal with any rodent issues, moth infestations and other nature related phenomena!

Dome or roll-off?

Most people who are planning this already know which side of this debate they're on. For myself I chose roll-off for several reasons:

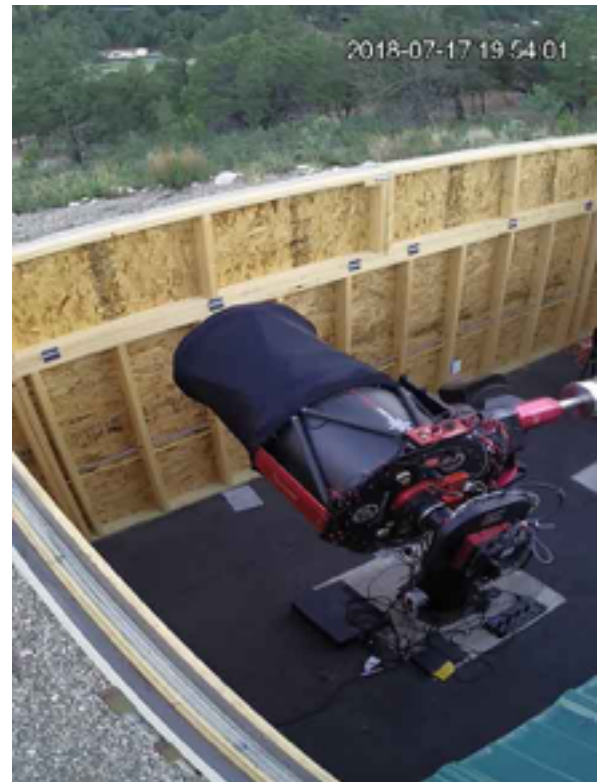
- 1) Despite “remote” imaging, I do have a passion for the night sky so there will be times when I might have an imaging session in progress but will set up a chair inside the observatory and just do some casual observing with a pair of binoculars. Can't beat that!
- 2) Even modest sized roll-offs can accommodate 2 piers so you can have 2 separate imaging platforms, one for example with larger, longer focus optics and the other possibly for wider field imaging.
- 3) Roll-offs are MUCH easier to operate remotely. There is only one piece of equipment, the roof motor, which is highly unlikely to fail. Current software for roof operation and equipment such as back up sensors to detect roof position are amazingly cheap (less than \$200 for everything!) Domes are quirky and it introduces one more layer of stuff that can go wrong. The dome has to be synched with your mount and often will not close unless it is in one specific position. Several dome shutters have more than 1 motor , adding to the potential glitches. Software from what I have seen can be very expensive.

4) Warm rooms. This is a great feature of the roll-off! I can stay up there for over 2 hours if needed in an enclosed comfortable room at least 20 degrees warmer than the outside.

Now there are a couple of downsides to the roll-off. Unless you use a very short pier where the roof will not hit your scope regardless of the position it's in, you have to make sure your scope is properly parked before the roof can close. You can use a scope sensor which can interface with your control software or you can employ cameras to enable you to confirm visually that the scope is in the right spot before closing your roof. Extremely reliable contemporary security cameras can be easily obtained for less than \$100. The other issue with roll-offs is more wind exposure. If the wind exceeds 10-15 mph it can be difficult to image depending on your equipment.



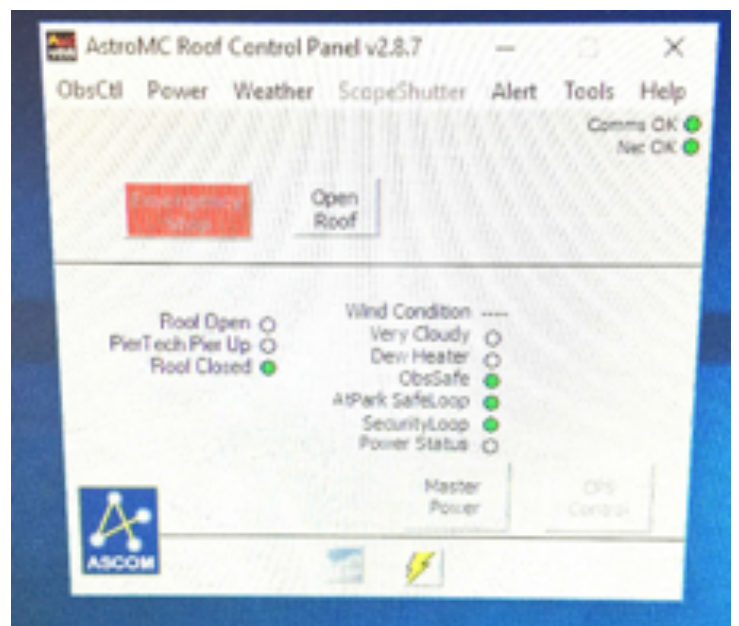
Simple to build tower consisting of PVC pipe onto which is mounted the outdoor video camera and Boltwood Cloud Sensor II.



Scope is parked flat as confirmed by outdoor monitoring camera



There are 2 cameras inside the observatory used for monitoring equipment



Foster Systems produces a low cost software package for remote roof control. Just click on the "open roof" button!

Am I ready? The stepwise progression toward completely remote operation.

If you are in the planning stages you want the transition to be as smooth as possible so you are not having to deal with multiple equipment issues all at once. This can be overwhelming. Ideally you should already have become fairly comfortable with "unattended" operation meaning you can turn your equipment on and it can run basically problem free throughout the night. There are many executive programs (e.g. ACP, CCD autopilot, SG pro etc) available now that can control all of the basic imaging functions such as focusing, guiding, rotating, etc. Once you have mastered the unattended operation of your equipment, you are ready for the next step which is simply turning on your equipment and starting your session completely off site. So instead of opening the roof with the hand switch in the observatory,

physically turning on power to your mount, camera etc you will do all of these same tasks as though you were there in the observatory except you won't be there...at all!

Site work and infrastructure considerations.

If you have trees on your lot you want to cut down, make sure there are no property restrictions regarding that. Even if there are no documented rules against it you might be surprised to find very passionate tree huggers in your neighborhood! Explain what you are doing and why. If there is a rainy season in your area, make sure there is proper drainage set up around your observing site. The other usual permanent observatory considerations are the same with respect to your concrete piers etc. Make sure the concrete is reinforced with rebar and goes down to the bedrock which can be a variable depth. If your pier requires alignment to the pole DO NOT use a compass. Best is a device called a Theodolite which enables you to site directly to the pole star. If you are installing multiple piers obviously make sure there is adequate separation for simultaneous scope operation. Make sure to install conduits to run data wiring from your piers to your warm room or control area and power from the mains to your pier. I don't think it's necessarily a problem to embed the conduits in your piers. It is highly unlikely you will have a problem with vibration in, for example, a 3 foot by 4 foot pier anchored to bedrock with 1 or 2 conduits. One conduit can be for AC power and the another for data. It's very handy to have power right there on the pier so you don't have to have cords running everywhere. Make sure though to have your piers isolated from the rest of the flooring.



This yellow device is called a theodolite, used by land surveyors. There is a low power spotting scope where you can sight Polaris and polar align your mount if necessary

Elevated observatories etc. A few folks I know have elevated their domes, placing the piers 30 feet or more above ground. Looks impressive but honestly, I have never seen any evidence that images are better by having your dome above ground convection. It's a huge expense which I am not sure is justified especially if you are budgeting for this project. However I have seen issues with cement observatory flooring that a few people out here have noticed. Cement is a significant heat sink and it can adversely affect seeing. If you do cement flooring you have to pay more attention to cooling down the observatory before starting your sessions. From what I have seen I think wood or similar material is a better choice.

You will need to run power and data to the observatory from wherever it comes in to the property. If you have a house you can run it from there. Use 2 separate conduits, one for data and one for power. Otherwise there can be degradation in data transmission due to interference if you run power and data together. Use fiber cable to the observatory, not ethernet cable. Fiber cable can be purchased in bulk very inexpensively. About 200 feet of fiber cable will cost \$75. The advantages of fiber are that it is much faster than ethernet and also will isolate any surges, lightning strikes etc so for example if you do have a house that gets hit by lightning, the observatory will not be affected.

Weather monitoring

This may be the most important equipment you will need outside of your imaging equipment. A cloud monitor and an all sky camera are the 2 essentials. A cloud monitor, such as the Boltwood Cloud Sensor, can be integrated with your control software. It can shut everything down if desired in the event of clouds coming in or it can also provide an audible alarm which you can easily hear through a remote connection. In either case this is critical because you do NOT want to get rained on and you cannot have rain without clouds. These monitors will also record humidity, wind etc so you can in many cases direct your system to shut down under any one of a number of weather related scenarios , for example , if the humidity exceeds 75% or so. An all sky camera which functions also during the day (not all of them do) is also very useful. Local conditions vary and this can confirm conditions are good for imaging. If you are fortunate to be in a community with other astronomers who already own cameras that record images on a website, then you can save some expenses there!

The Cloud Sensor provides weather data that can be integrated with your automation software. Note the audible alarm is checked for "cloudy". This can be heard through a remote connection.





All sky camera courtesy of Dimension Point Observatory which is about 100 yards from me. Several other links exist on this site including weather forecasts, local seeing etc . This kind of information is indispensable when imaging remotely. I am extremely lucky to have neighbors who already have these resources available!

Communications. Turning on and off

Invest in a good reliable router at your observatory site. This is the brains of your set up. Understand how to access it and identify all of the components of your network.

Turning on and off equipment remotely is actually easier than I thought it would be. Many “web based controllers” exist that you can connect to your network and enable you to plug in your equipment, computers , router etc . You access the controller webpage remotely and all of your outlets are identified (mount, camera etc) where you simply click the “on” switch to turn on!

Some of these controllers can also be configured through a feature called “autoping” to reboot your router should your internet drop (see below)



Remote computing is pretty mainstream now. Several ways of doing this exist. Team Viewer for example is a reliable and free option.

This is a simple to use web based outlet controller where you can turn on and off your equipment

Back ups and more backups. Emergency considerations

This is an ongoing learning process. Different methods will work for different setups. The bottom line is your job is to protect your equipment investment. Don't get rained on and don't suffer damage from electrical surges, wind etc. In other words you must always be able to shut down and close in a moment's notice and have your equipment protected from unanticipated surges, lightning strikes etc. Use industrial grade surge protectors. (For example “brickwall.com” etc) Best practice is not to take any chances if the weather is iffy. Use multiple forecasts for your area. Check local doppler radar maps. I make sure I am not going to image if there is a definite system moving in over the next 24 hours. Check humidity. You can get fooled. Just because you are in a desert region does not mean you can't have dew. At night the temperature can drop significantly to where you can definitely have dew formation, especially after a weather system has just passed. Here are some emergency scenarios and how to handle them.

Internet dropping- this is perhaps the most common issue. Digital Logger makes a web based controller you can program to reboot your internet if this happens. It can also reboot it successfully after a power failure

Power outages- these also happen periodically. Rarely are they long term but you must have back up battery power. A UPS unit (uninterruptable power supply) is a must for all of your equipment. Typically they can provide 2+ hours of additional power however the real purpose is to keep things going briefly until you can close your roof or dome and turn the equipment off. Some UPS units have a feature where you can connect a computer to them and program an instant notification via email or text to your home site when the main power supply goes down.

Equipment and software lockup. You should be able to cycle power off and on all of your devices if there is an operational hang. This should enable control to be restored. Computers can be set up to reboot if power is shut off and then turned back on again. This is usually accomplished in the Bios of your specific PC.

There are many other details to consider on the road to successful remoting but these are what I believe to be some of the key points. I hope this information is helpful to those who might be considering “going remote! “



Orion's Belt Remote Observatory, Mayhill NM

Going Remote

An Astrophotographer's Experience in the Sacramento Mountains

By Robert Kimball

I climbed up into Bill Stein's black Suburban. Seconds later we were speeding east through the San Augustin Pass; passed White Sands Monument; passed Alamogordo, and up the narrow mountain canyon to Cloudcroft. Fifteen minutes later we were at the gate to Bill's astronomy community. I find it an odd coincidence that the odometer showed we've come exactly 100 miles. Bill engages the four wheel drive, presses the gate opener, and we climb steeply onto a rough dirt road to a small yellow cabin. The street sign indicates we are on Galaxy Way. Perched twenty feet below the cabin is a gigantic shed. It is here that my telescope will huddle through the winter under cold, dark, clear skies.

We are in Mayhill, New Mexico and there is astronomy going on everywhere. On the south side of the valley is New Mexico Skies, a large enclave with a long white row of domes and several large sheds. All are filled to the brim with gleaming telescopes. These are outrageously expensive setups, but there's not a soul in sight. Lynn Rice, the proprietor, greets us warmly and gives us a deluxe tour of every building. She thanks us profusely for calling before we arrived. (Clearly this is very important to her.)

In one of the domes is a huge mount carrying perhaps 12 Takahashi FSQ 106 refractors each with its shiny new SBIG camera. I'm told this is the Qatar National Observatory. The large sheds are packed with setups, all unique, awaiting silent commands to come alive as the sun sets.

In the adjoining house we find a communal area that is both a library, and a small dining area. This cozy lair once hummed with astrophotographers. Now it languishes in disrepair. Sadly, this astronomy community exists only in the virtual world of the Internet.

On the north side of the Mayhill valley are a series of astronomy communities with homeowner's associations and strict covenants such as no white lights after sunset, shades down after sunset! Bill's property is in Stars End, a dark refuge consisting of roughly twenty irregular lots. I am sure my William Optics 110 refractor is the smallest telescope to be found here. Directly behind Bill's cabin, a huge new dome is springing up. Its thirty inch aperture telescope will undoubtedly be the largest on the block.



Across the valley at New Mexico Skies

During the day, I race up and down a path to the observatory carrying parts of my setup through knee-deep weeds. Bill sits at his computer opening and closing the roof. It is groaning and grinding along its track. We adjust the limit switch and discuss how to shim the track to make the roof's journey smoother.

Down the center of the observatory, north to south, are three evenly spaced piers. These are all occupied. I carefully select a small open space just east of the other scopes. I try to visualize all these telescopes moving and eventually become convinced that mine will never collide with the others.

The whole afternoon I've heard nothing but our voices, but now that the sun is setting new sounds whisper in the distance. I hear vents opening and then the soft whir of fans as the observatories push out the heat of the day. Finally, the creaks of domes turning, shutters opening, and the unique sound of mounts slewing, call out in the twilight. Somewhere, distant fingers tap at keyboards and our community comes alive.



Bill Stein's Observatory

I digress for just a paragraph. Walking down Ipperwash Beach, Ontario, Canada, when I was about eleven years old, I saw a group of people gathered around a modest Newtonian telescope. I managed to get my first glance at the moon after a little pushing and shoving. The hook was set deep.

A year later, I was looking at Saturn through my own home-built three inch telescope with a mirror purchased from my tattered Edmund Scientific catalog. I ground several mirrors, trekked to Shawinigan Falls, Quebec for my first solar eclipse, and entered the University of Michigan as an Astronomy major. Fast forward to 2011, my wife and I are in Las Cruces and after an astronomy hiatus of thirty years, I'm looking up again!

Of course, everything has changed. No more film processing, no more sighting along the tube, no more star hopping to Messier objects. Now Astromart is my best friend. I buy a nice Losmandy G11 equatorial mount (once owned by Kirby Benson), then a decent William Optics FLT 110 refractor. I attach my Sony DSLR and I am ready for serious astrophotography. WRONG! I learned quickly that getting exceptional astro-photographs is an iterative process. Iterative intellectually and iterative financially.

Four years and perhaps \$10,000 dollars later (my wife questions this figure) most of the hurdles have fallen away. I set up my equipment, plug in five power cords and four USB cables, boot up the computer and it runs almost all the time. The key phrase here is "almost all the time." Strange things occur seemingly with random vindictiveness. I respond with religious zeal. Soon I have a rich doctrine of what needs to be plugged in first, which cables go in which port, and still it never reaches the perfection of my dreams. Before going remote there is much more to be done. I can't drive two hundred miles round trip just to restart my computer or plug in a cable!

First, I decide to tackle the hardware problems. To focus, I can't stumble around to the front of the scope to put on a Bahtinov mask when I'm "remote." I buy a precision Finger Lakes Instrumentation auto focuser. What a joy it is to watch it systematically hone in on perfect focus. I learn for the first time how dramatically the focal point changes as temperatures rise and fall. Now my stars are sharp, but always slightly elongated. After many email exchanges with Eric Chesak, I come to believe what he told me in his first email. I've got flexure between my guide scope and my imaging scope. I buy an Astrodon Monster MOAG off axis guider. Eric mills a special holder for my guide camera. Finally, round stars! John Kutney suggests I buy a powered USB hub to address my persistent USB problems. I follow his advice

and add new high grade USB cables and even little magnetic “chokes.” Now things are talking to each other politely. As a finishing touch, I buy a compact Intel NUC (Next Unit of Computer) computer. No monitor, no keyboard, no mouse, and most importantly, no battery. Now I have the telescope hardware to go remote.

Next, I clean up the software side of things. Initially, if I wanted to image M57, the Ring Nebula, I’d arrow up and down on my hand controller until I found M57 and stand back. The mount makes some awkward motions and heads towards Lyra. If I did my polar alignment carefully, the ring will be in the camera’s field of view, not centered, but at least I’d be close. Unfortunately, that’s not good enough. I need to be spot on. That’s where “plate solving” comes to the rescue. If I had been told thirty years ago that ultimately my telescope would “read” the stars and position itself, I would have said you were crazy. But that’s the miracle of plate solving. My camera takes a picture of the stars, and the plate solving software searches through a catalog of stars, makes some elaborate calculations, and then commands the mount to make the necessary adjustments. I select Sequence Generator Pro for my capture program because plate solving is built in. For guiding I use the tried and true Phd2. (For a while I use Steve Barks’ “GuideDog” guiding software.) I have PemPro for recording and correcting my periodic worm errors and Astro Physics Command Center (APCC) to replace my hand paddle. Next, Bill Stein introduces me to a real game changer, TeamViewer. TeamViewer allows me to access Windows 10 on my NUC from Las Cruces using my Apple MacBook Pro. It is a miracle! Two or three clicks and I’m sitting in Mayhill. (TeamViewer is free software for non-commercial users.)

I’ve written computer software programs over the years, but I never really needed to learn about the technical workings of the Internet. This is a new challenge. Bill has his computers, mounts, and cameras running 24/7. I’d like to be able to turn mine off and on. I’m also afraid that somehow my telescope will lose its spatial orientation, so I buy a Foscam to monitor the “Parked” position. I fire up YouTube for instruction and watch the “AckwardHamster,” carefully explain how to log in to my modem, set up port forwarding, and purchase a DDNS (dynamic Domain Name System) address. I make it work on my home router, but I am not confident enough to breach the firewall on Bill’s router. I connect the Foscam onto Bill’s LAN (Local Area Network) and view it with TeamViewer. To turn everything on and off, I buy an IP switch. Again, I confront new complications and router settings. Then on a dropdown menu, I see something about Google Hangouts. I learn that I can assign a gmail address to my IP switch and then I can send it text commands. “Set on 1” turns plug one of my IP power switch on. “Set off 1” turns it back off. It’s so simple! I plug my NUC into “Plug 1” and my DC power supply into “Plug 2” and I’m ready to “rock and roll.”

“To open or not to open, that is the question.” I’ve been set up at Bill’s observatory for two moon cycles and the weather has not cooperated. Gone are the days when I could look up to check the weather. The astrophotographer directly behind Bill has a great website with sky monitoring equipment. I consult the Clear Skies Chart for Mayhill, then access our neighbor’s All Sky Camera and the Seeing Monitor. When all these look good, I shoot a text to Bill to see if we’re opening. Bill is collecting variable star data and seems less concerned about the seeing than I am. I want the seeing and transparency to be perfect. Bill often takes sky flats at dusk or dawn to calibrate his data. Consequently, he opens and closes the observatory most of the time and I just shoot anytime I want. Tonight, Bill is in Costa Rica so I use TeamViewer to access his computer and click the “Open” button. On my Foscam I watch the roof slowly open. I initiate my imaging sequence and head to bed. At 4:00 am my phone vibrates. I wake up, stagger dull-eyed to my computer and click the “Close” button. When I take responsibility for opening and closing the observatory, I toss and turn most of the night. Waking up and finding three inches of snow on our equipment is a recurring nightmare.

The nights are lengthening now as we approach the winter solstice. I discover that unlike in my backyard, I can image several targets on the same night. I start with a target in the East and follow it across the meridian to the west; then I head East again to pick up a new target and repeat the process. On a clear night, I can image for around ten hours. I’ve had to spend a lot more time picking targets than I expected. Besides my selected targets, I’ve been imaging comet 46D/Wirtanen as it approaches perihelion. Seeing it brighten night after night is thrilling.

Three moon cycles into my remote imaging, I ask myself, “Was this worth all the time and effort.” The answer of course is “yes!” Even if I never get an image worth sharing, I have enjoyed hiking up the learning curve. The truth is, I’ve gotten a number of very pleasing images.

I post my first image on Astrobin so that fellow astrophotographers can view it. It’s a ten hour image of the Vulture Head Nebula in Taurus (LBN 777). I watch the site closely to see if anyone views it. In seconds, my phone is “binging” as the “likes” pour in. (When someone “likes” an image, an email notification is sent to the poster.) Fifty-five fellow astronomers view my image and twenty click the “like” button. I realize how silly I am, but each time a “like” comes in, I smile. This can be a lonely hobby and

a little praise always feels good. I post an eighteen hour 2 X 3 mosaic of the Bubble Nebula in Casiopeia (NGC 7635) and again my phone is jumping. The four images I post are all reviewed favorably. The highest Astrobin praise comes when I attract “followers.” I have a modest number of followers at this point.

I’m surprised how much less processing I do on my remote images. I’m a big PixInsight advocate and its Dynamic Background Extraction (DBE) tool has always been my best friend. Imaging in the city of Las Cruces, I have light gradients galore from street lights and porch lights. DBE does a fantastic job removing this annoying noise. As I image in Mayhill, the gradients are gone and the subtle features of nebulae emerge. Nothing beats good data from a clear, dark sky.

I have met the challenge of going remote. My equipment performs reliably and everything is connected to the Internet. It has all worked flawlessly and the images are the best I’ve ever taken. It is not for everyone, but I consider “going remote” a stunning experience.



My little refractor (top-right) in Bill’s Observatory

Robert Q. Kimball (rqkimball@me.com)

Photo of the Month



NGC 1499

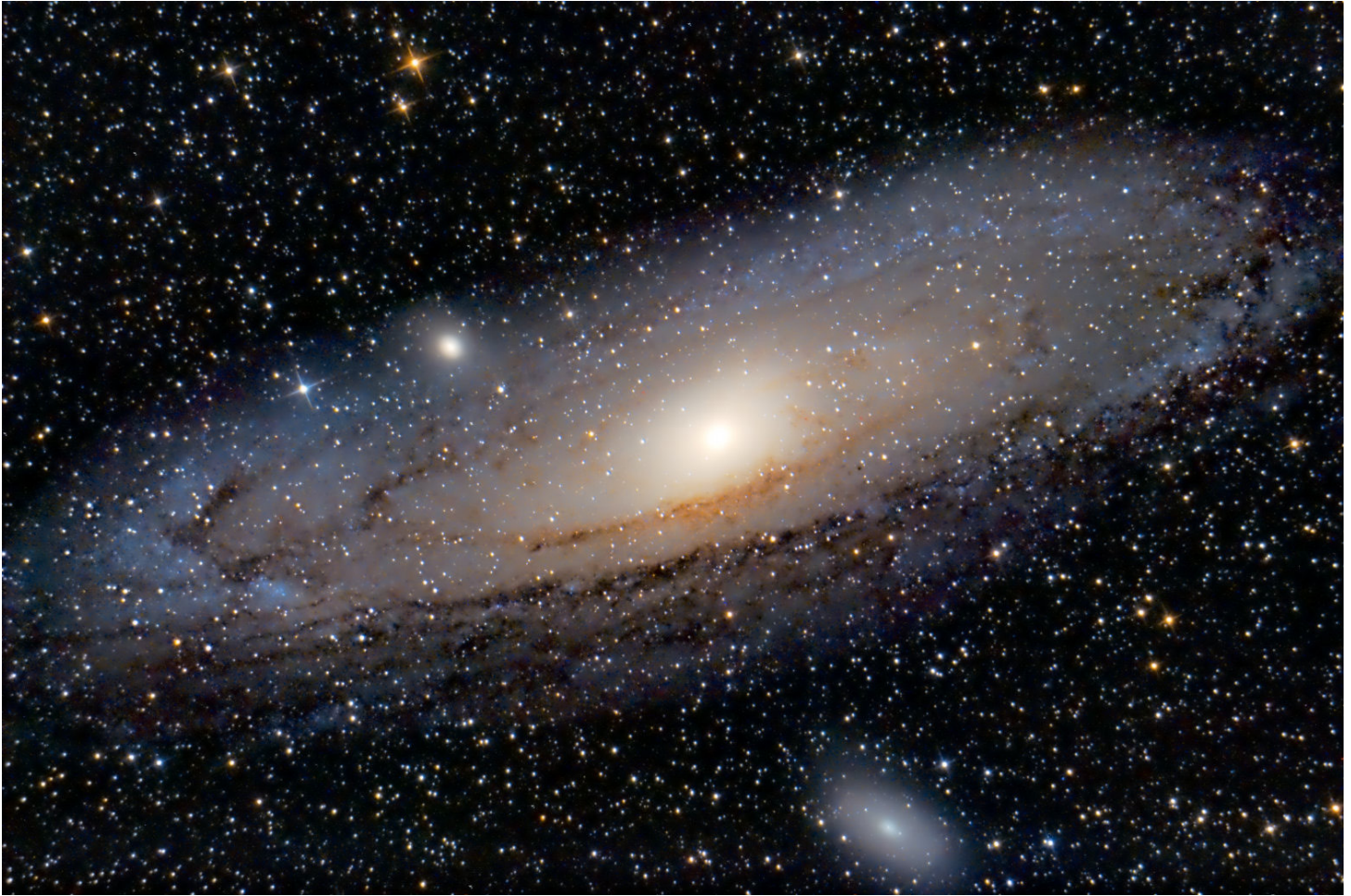
The California Nebula (NGC 1499) is an emission nebula located in the constellation Perseus. It is so named because it appears to resemble the outline of the US State of California on long exposure photographs. It is almost 2.5° long on the sky and, because of its very low surface brightness; it is extremely difficult to observe visually (Wiki). Image was taken over two days in the Cosmic Campground on November 6-7, 2018. There were clear skies and cold nights.

Takahashi Epsilon 180 / FLI ML 16200 /

L 16x5min / RGB 16x3min / Ha 36x5min / OIII 33x5min /SII 25x5min.

By John Kutney

Photo of the Month



M 31 The Andromeda Galaxy NGC224

Taken at Arenas Valley, NM in January 2019 using 6" F/4 Newtonian, High Point Coma Corrector, Rebel T3i camera, ISO 1600.

9x300s subs acquired with SGP, stacked and processed in PixInsight and GIMP. 45 min integration time.

By Kent DeGroff

Photo of the Month



M74 - NGC 628 (spiral galaxy in Pisces) Distance: 30 million light years

Telescope Takahashi TOA-130F @ f/7.7

Mount Takahashi EM200 Temma II

Camera QSI 690wsg @ -15C

Filters Astrodon Tru-Balance I-Series LRGB Gen 2 Guider SX Lodestar

Settings 14x10min L (bin1x1); 3x5min ea RGB (bin2x2); AstroArt5, CS4 (slightly cropped, 10xdarks/flats/fdarks/bias)

Date/Location 7 November 2018 - Las Cruces, NM

Credit: Jeffrey O. Johnson

<http://jeffjastro.com>



NGC 6914

I continue to refine the Sobel Operator contribution to the images. In this case, the hydrogen structure was blended with the Luminosity channel, in about a 2::10 ratio.

OTA: Star-Fire 175 (f/8) Camera: FLI - PL16070AE Observatory: Deep Sky West
EXPOSURES: Red:7 X 900 sec Blue:8 X 900 Green:6 X 900 Lum:16 X 900 Hydrogen:25 x 900

Total exposure 15.5 hours Image Width: ~1.25 deg
Processed by Alex Woronow using PixInsight in 2018

NGC 6914 is the blue reflection nebula at the center of the picture. It owes its blue color to the Rayleigh scattering—the same phenomena that colors our sky. The red cloud is an extensive emission nebula, which, in part, is ionized by a group of young stars, the Cygnus OB2 association. According to Wikipedia (slightly altered)...

Cygnus OB2 is an “OB association” that is home to some of very young, most massive and most luminous stars known. It also includes one of the largest known stars, NML Cygni. The region is embedded within a wider region of star formation known as Cygnus X, which is one of the most luminous objects in the sky at radio wavelengths. The region is approximately 1,400 parsecs from Earth.

The young star cluster is one of the largest known and the largest in the northern hemisphere. Although the associated nebula is over ten times more massive than the Orion Nebula, which is easily seen with the naked eye, Cygnus OB2 is hidden behind a massive dust cloud known as the Cygnus Rift, which obscures many of the stars in it. This means that despite its large size, it is hard to determine its actual properties. The estimated number of massive stars range from 50 to 100.

The Cygnus Rift, aka Northern Coalsack, is a dark, background-obscuring cloud that is similar to the dark equatorial clouds seen in many edge-on galaxies. Parts of it can be seen in the left part of, and below the blue cloud in, this image.

Image. The estimated cloud size is about 1 million solar masses. Alex