

# Sierra Remote Observatories Newsletter

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**SRO UPDATE:** As many of you may have noticed, we recently opened a new website at the same address. You'll find all the telemetry data you've come to expect is still there. We hope you will enjoy the new site!

### Visit us at:

<http://www.sierra-remote.com>

Video of [Planewave](#) installing a 0.7 meter CDK for NARIT (National Astronomical Research Institute of Thailand) at SRO: [https://www.youtube.com/watch?v=Q0bTL\\_D\\_c1A](https://www.youtube.com/watch?v=Q0bTL_D_c1A)



Above: Building 9: Opened for another night of Imaging

*"June 3, 2007 was first light from my telescope at SRO. This will be SROs' 10<sup>th</sup> anniversary of continuous imaging"*  
*Keith Quattrocch*  
*May 28<sup>th</sup>, 2017*

## SRO: Updating Our Infrastructure: Our Philosophy and History

For us at SRO there is nothing, not even our own astrophotography, which occupies more time and attention than improving our infrastructure. We believe SRO is environmentally unique, with 1 arcsecond summer seeing, great weather conditions (no summer monsoons), dark skies and average wind speeds of 1 mph. But for the remote imager and scientist, all this is meaningless if you can't easily and consistently access the site to run your telescope. Our philosophy has always been to continually improve each aspect of our infrastructure as new technology becomes available, investing in the best devices to monitor our seeing and weather and writing the specialized software needed to integrate everything properly. It's a matter of looking at our site as a series of replaceable parts and



Building 9 and 10 Getting Ready For Another Night Of Imaging And Data Collection

continually improving them. This article focuses on our infrastructure, and includes everything from site security to improved seeing monitors. Fortunately for us, there are 4 partners at SRO, each with a

different set of skills and expertise. Together, as a group, we can make sure our infrastructure is, if we dare say it, "world class".

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## In the Spotlight: Eric Coles

It's a pleasure to introduce Eric Coles to the SRO community. He's an accomplished scientist and has been successfully imaging with Mel Helm at SRO. Here's his remarkable story:

I got my first real telescope in 2011. There was an add online for a 12" Dob. I had no idea what that was, but it looked intriguing and I always wanted a "real" telescope. A quick trip to a nearby town and I had a new toy, "the cannon" as my grandkids called it. I lugged the cannon around the neighborhood for a few months setting up to look at the moon and the planets.

That was fun, but finding other things to look at was difficult. What I needed was a GoTo telescope. It would find objects for me. So, I got a Celestron 8" SCT Alt-Az GoTo. Now I could see whatever I wanted. It was light and easy to setup. It could be setup on my back deck or

carted to darker sites, like the Conway Observatory in Indiana. A new astro friend had invited me there. It was a reasonably dark site and I spent many nights the next eight months going to Conway to observe. It was a great period. I got to look through other observer's scopes and see what was possible. Along the way, I decided I needed a bigger scope, a 9.25" SCT. It was a little heavier, but could still be hauled to Conway. And of course, I had to have a whole bunch of EPs to go along with the new scope. This hobby was getting a little expensive.

One night at Conway I saw someone with a DSLR on the back of his scope. He was taking pictures that showed things I could not see through an eyepiece. I wanted to do that, and in any case, I was getting tired of looking at stars and galaxy fuzzballs. I bought a new Canon DSLR just for that

purpose. I was also told that an Alt-Az setup would not do for taking pictures, something about rotation. I needed an equatorial mount and probably a refractor. An Atlas mount, an H-alpha filter and a couple of refractors later I was taking pictures with the DSLR. That was great for about five minutes until I realized that if I wanted to take "nice" pictures, I needed a CCD camera. Now all purchasing hell broke loose. Just ask my wife.

Moving along, by 2013 I had an AP mount, two SBIG CCD cameras, two more SCTs, three refractors and my pride and joy, an AP 130 GT (how I got that is another story). And my basement was a telescope museum of unused telescope equipment. But I was taking "real" astro-photographs. Twenty miles west of Chicago about all we could do was narrowband imaging, RGB was out of the question.

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*Eric Coles recent APODs (some with Mel Helm):*

*Ngc 3628 in Leo  
By Eric Coles and Mel Helm  
APOD May 3, 2017*



*Sh2-155 (The Cave Nebula) in Cepheus  
By Eric Coles and Mel Helm  
APOD March 23, 2017*



*Sharpless 249 in Gemini  
By Eric Coles  
APOD January 7, 2017*



*NGC 2403 in Camelopardalis  
By Eric Coles and Mel Helm  
APOD: February 19, 2016*



*NGC 7497 and integrated flux nebulae in Pegasus  
By Eric Coles and Mel Helm  
APOD October 12, 2015*



## Astrophotography Tip: When Enough is Enough: By Eric Coles

*When is enough data enough? What is a good starting L image for LRGB, and how do we generate a stacked image with the most detail?*

Astrophotographers always ponder the question, "how much data is enough?" We are anxious to see our "final" image. Therefore, there is a temptation to start processing as soon as possible. On the other hand, by collecting more subs we will likely get a better final image. So, when do we stop collecting and start seriously processing your image? There is no perfect answer for everyone, but this is the workflow I generally follow. This process requires a working knowledge of PixInsight (PI).

1. Introduction: The detail in an LRGB image generally comes from the L data, and in a narrowband image from the H-alpha data. These are the two filter data sets where I pile up subs to the endpoint described below.
2. For example, let's take an LRGB image of a galaxy. I always start off collecting L subs for a series of nights. After each night, the subs are

processed in PixInsight and a summed stacked image of all nights generated. Be sure to generate drizzle files when you process. We will address that a little later.

3. The Start: The stacked image from night one is analyzed with the PI script, SubframeSelector. That is the starting point of image evaluation.
4. The L subs are collected for a second night (one is never enough). The sum of nights one and two are processed and stacked. The one-night and two-nights stacked images are compared with the SubframeSelector. Let's say that the SNR increases by a factor of 1.7 (actual data). So far this is exactly what you would expect, nothing new.
5. Two nights of L is seldom enough. Therefore, I do a third night. Now I have 15-20 hours of L data. The three-nights of data is processed and a stacked image generated. I then compare the one-night, summed two-nights and three-nights stacked linear image as before. Let's say that there is a 70% improvement in the SNR from one-night to two-

nights, and a 35% improvement in SNR from two-night to three-night. But things are never uniform.

6. All nights are not created equal. And while three nights of L is usually satisfactory, the SubframeSelector may say otherwise. If there is only a modest improvement in say SNR from one to two nights, or two to three nights, then I go for an additional night, stack the data, do the comparison and make a judgement on collecting more L data or not based on the SubframeSelector analysis. This decision is usually obvious. When parameters like the SNR are starting to plateau, you are done collecting L data. Is that your starting L image? NO!

This is only the initial data collection to produce the final L starting non-linear image for the LRGB processing. Now you do drizzle integration. Why do drizzle integration? Because, it gives a final L image with a significantly higher SNR, less noise and rounder stars, ultimately producing a more detailed and pleasing image,

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## Current SRO Members

Everyone from SRO is in contact through the Yahoo users group, but it's always great to see everyone's name in one list.

In the original 8 private observatories (building 1-8) we have  
ExoAnalytic Solutions (in Building 1),  
BridgeSat (Building 2),  
ExoAnalytic Solutions (Building 3),  
ExoAnalytic (Building 4),  
Sandy Barnes (Building 5),  
Geoff Stone (Building 6),  
Dr. Fred Ringwald (Building 7),  
R. Jay Gabany (Building 8).

In the multi-telescope Building 9 we have:

Mel Helm (Pier 1)  
Mike Miller (Pier 2),  
Samuel Lising (Pier 3),  
John Kasianowicz+Rob Pfile+Daniele Malleo+Rick Stevenson+D. Ellison (Pier 4),  
Paul Mortfield (Pier 5),  
Dick Post (Pier 6),  
Rick Hendrick (Pier 7),  
Sofia/Univ. of Stuttgart (Pier 8),  
Steve Reilley (Pier 9),  
Brad Moore and A. Jankins with iTelescope.net (Pier 10),  
Murray Kenney (Pier 11) and  
Mike Hankey (Pier 12),  
Kevin Morefield (Pier 13) and  
Qingshan Li (Pier 14).

In Building 10 we have :

Steven Cullen (Pier 1)  
Keith Quattrocchi (Pier 2)  
Ari Larson (Pier 3)  
Jeff Lovelace (Pier 4),  
NARIT (Pier 8),  
Korean Astronomy and Space Science Inst. (KASSI) (Pier 12),  
Jeffery Lovelace (Pier 14), Mike Jeff Lovelace (Pier 17),  
Michael Perron (Pier 18) and  
Mel Helm (Pier 20).

As always, are proud to note you will recognize some important names from a diverse spectrum of astrophotography and astrophysics, from advanced imagers to telescope manufacturers and space industries.

## SRO Infrastructure: Continued from Page 1:

Here are some of the most recently updated items:

**Cyclope Seeing Monitor:** This is a professional grade seeing monitor from Alcor Systems which is being used at a number of professional observatories. It is a robust and sealed system with built in temperature and humidity detectors which allow it to clear any dew from its window. It is reliable and accurate. You can learn more about the unit at [Alcor's website](#). Mel has spearheaded our acquisition of the Cyclope and is testing the device. The data we are getting from Cyclope is similar to our older SBIG seeing monitor but far more accurate. You will soon be able to see this data on our telemetry link (by summer).

**Internet Service:** Initially we believed we were fortunate to have T-1 internet at SRO, but as the number of clients exponentially increased, we became worried this might eventually prove to be inadequate. Fortunately, 3 years ago our Internet Service Provider upgraded us to fiber optic internet and additionally eased their internet throttling which brings our available bandwidth to even higher rates than would normally be possible. Currently we have 100 Mbps/sec speeds for uploads and downloads.

**Satellite Backup Internet:** We have also contracted with satellite internet backup in the unlikely event of the fiber optic internet crashing. This has not happened and is unlikely to do so. Nonetheless, we have endeavored to make all our critical systems at SRO redundant or backed up, so that our clients will not lose contact with their telescopes in the event of a major communications problem.

**EUDA All Sky Camera:** Later this summer we be installing a professional grade All Sky camera from Alcor Systems. This camera has an 8 MP cooled chip camera equipped with a filter wheel which is especially useful for cloud detection. You can see the Alcor cameras in use at Kitt Peak and other professional observatories by going to <http://www.astrosurf.com/cavado/re/meteo/current/allSkys.html>. Our camera should be up and running by the end of the summer.

**Internet Security:** We have

taken measures and recent changes to make our site safe and secure. Those changes remain proprietary and we do not share information regarding our security systems for obvious security reasons.

**Precision Time Server and NTP:** We now have added hardware to our local network that offers both Network Time Protocol (NTP) and Precision Time Protocol (PTP). Geoff Stone, who performs photometry, has made these updates. This has been helpful for those engaged in precision astrophotography, such as those involved with occultation studies and satellite tracking.

**Documentation:** Although not strictly a "physical" update, we have written informational packages on how to get set-up and running at SRO, largely put together by Larry and Geoff. These documents have made startup at SRO much less complicated.

**Weather Station Update:** Over the years we have always had difficulty integrating precision humidity measurements with cloud and rain detection in a reliable and repeatable manner. To remedy this, last year we installed a RainwiseMK-III-LR weather station along with an AAG cloud and rain detector. This hardware is now integrated using AAG WeatherCenter software which allows a single "Boltwood" file to be assembled even though the data comes from separate sources. Now, when the roof closes because of high humidity, you can go to the new weather section of the SRO web site and find out what happened. This same data is used with our custom roof automation software. If you are interested in historical data, you can see the RainWise data at the following sites: <http://www.rainwise.net/weather/sro> and <http://www.wunderground.com/q/zmw:93602.1.99999?sp=KCAAUBER13>

**Roof Control:** As most of you already know, roof control is an area that we have spent a great deal of effort on. SRO uses an intelligent roof management system based on the commercially distributed 'm1OASYS' roll-off roof controller coupled with a custom developed roof management application that monitors weather utilizing a number of weather

telemetry capture devices. Current weather conditions are then evaluated once every few seconds for any kind of actionable changes in conditions; i.e., cloud cover, humidity, dew levels, and/or precipitation. Should an actionable weather change be detected, the roof will then be closed to protect our clients' equipment from any kind of adverse conditions. Once good observing conditions have been re-established, the roof will then re-open to provide optimal client access to productive observing time. This year we have improved the roof control application both by rewriting its logic used to talk directly to the M1 Oasys system and by installing direct precipitation detection into the M1 itself. We consider the direct precipitation detection particularly important since precipitation roof closure is no longer computer dependent and will activate even with full network failure. It is worth mentioning that Larry has worked hard on programming these changes.

**Technical Support:** No discussion of infrastructure would be complete without discussing technical support. We have Sam Miller, who has been a full time employee of SRO for 2 years now and before that has been with us since 2009. He has grown with the observatory and has now been trained in the workings of most of the telescopes, mounts and cameras in use at SRO. He is also skilled in handling computer and networking issues. He now has an assistant, Alec Gray, who helps Sam keep all our telescopes running. The owners are also frequently on site. Most issues can be solved on site. Machine shop services provided by SRO. Because we are relatively close to a major metropolitan area, we also have access to local experts. For example, [PlaneWave](#) is only a few hours away by car.

We hope this review will give you a sense of our attention to the details of a seamless and efficient infrastructure. Environmentally, there is no question that SRO is unique and well suited for remote astronomical imaging and data acquisition. However, without a sound and robust infrastructure the site would be essentially useless. For this reason we are continually upgrading the infrastructure of SRO.

A few of SRO's telescopes:



Dick Post's 24 inch [Planewave](#) on a Mathis mount.



Samuel Lising's Starfire 130



SOPHIA's 24 inch Officina Stellare on an Astro Physics GTO 3600



Korean Astronomy and Space Science Institute's 24" OGS

## Eric Coles: In The Spotlight: Continued From Page 1

That was fine by me. I started with H-alpha and added both sulfur II and oxygen III filters. I could do both the detailed Ha and Hubble Palette images. I could image right from my back deck, weather permitting. All I had to do was roll out my setup and I was ready to image remotely from the warmth of our great room. I racked up a lot of targets over the next eighteen months and found a place to post them on Astrobin (<http://www.astrobin.com/users/coles44/>). This was really an exciting time. There was a lot to learn about imaging and especially about processing. And I dug in deep.

The SRO epiphany: I had joined The Astro Imaging Channel Sunday night presentations. On January 25, 2015, Mike Miller gave a presentation on remote imaging from the SRO. THAT'S WHAT I WANTED TO DO! On the 26th I wrote an email to the SRO general

mailbox looking for an imaging partner. That same day Mel Helm wrote back and suggested we could share his observatory. A few emails later we came to an agreement. We would use the 16" RCOS with the Chronos mount. I purchased a new SBIG STXL 11002 camera with a guiding filter wheel and a full set of Astrodon filters. On March 19, 2015, we started to capture our first object, M81. I was thrilled.

I basically started out knowing hardly anything. There were other issues. Operating an expensive telescope remotely, with all the things that could go wrong was intimidating. I must say that Mel was very patient during my learning curve. We got into the swing of things and started to pile up tons of great data and a few decent images. After a while I even learned Guide 9 and how to set up the imaging parameters for new targets in ACP. This

was all a lot of fun and it was especially satisfying to see these images emerge. They have brought me untold pleasure. Mel also introduced me to APOD submissions. That has worked out reasonably well, although I have no idea how an APOD is selected. I'm just happy and pleased when it happens. A Penultimate Thought: Astroimaging has given me more than just a portfolio of pretty pictures. My background is as a research scientist and I was always interested in anything about the workings of the universe. Imaging has given me that extra dimension in understanding the cosmos. The Final Thought: My parents were both artists, and I always thought I should be some kind of artist, but I couldn't even draw decent stick figures. What happened to those genes? Apparently, they were just waiting for a telescope and a CCD camera to be expressed.

## Eric Coles: Astrophotography Tip: From Page 2

all other things being equal (Peter Drucker says all other things are never equal. But that's another story). You can look up drizzle integration to learn more about its history and process.

At this point you have a considerable number of subs of your image. Along with the subs, you have generated drizzle files by checking the appropriate box during processing. Now you run the DrizzleIntegration process, on the all the final registered images, using the PI default parameters. Look up how that is done—it is well described online. Be patient, the two parts of the process takes some time to run. Take your final drizzled image and Resample (a PI process) to 50% of the original size. Now that has the same pixel dimensions as your original stacked image, with a much higher SNR, less noise and rounder stars than your summed stacked image without drizzle. You should

verify that using the SubframeSelector script comparing the stacked images from all summed nights and the resampled drizzled image described above.

*The question is: IS THIS YOUR STARTING NON-LINEAR L IMAGE IN YOUR LRGB PROCESSING? Answer: ALMOST.*

OK, there is a little more to do. Star registration makes some compromises depending on the optics of your scope. The world is not perfect. We have to live with that. So, let's reduce those compromises and improve star registration by reducing the stars used in the registration to your area of interest, likely the center section of the FOV. Let us assume we are imaging a galaxy that occupies about 50% of our FOV. Now take your alignment reference image, not the stacked image, and crop (DynamicCrop) to the key area where you want the most detail in the image.

Make sure there are plenty of stars in that area. Save that file as Crop 1. In PI, align all the calibrated (NOT REGISTERED) subs to Crop 1. Be sure to check Generate Drizzle Files when you do that. Take those cropped registered images and go through the drizzle integration process again. The cropped/drizzled image will inherently have tighter stars and more detail in that region than the full FOV drizzled image. Of course, you must feather in the Crop 1 image with the full FOV image to produce your final L image for LRGB processing. Hint, you can use the PI Mosaic process in PI to do this combination.

After all that you have your best resolution luminosity image, the key to a fine image. Now the fun part, the RGB data, LRGB combination and correction and digging out the details of the LRGB image. Just a few more fun hours of processing.

### A Few of SRO's Telescopes, Continued:



ExoAnalytic Solutions' 14 inch [PlaneWave](#) CDK



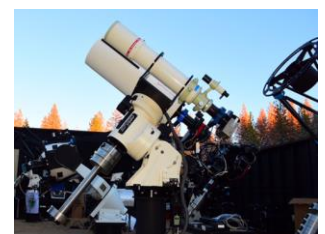
Building 9 at full capacity



SOPHIA's 24 inch Officina Stellare Ritchey-Chretien Telescope



NARITs [PlaneWave](#) CDK 700



David Wiener's 12" RC and Takahashi

## A BRIEF SUMMARY OF SIERRA REMOTE OBSERVATORIES

**Corporate Address:**

Sierra Remote Observatories  
1865 East Alluvial Ave  
Suite 102  
Fresno, CA 93720

**General Questions:**

[SROinfo@icloud.com](mailto:SROinfo@icloud.com)

**Support:**

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612-889-4737 (PST)

**We're on the Web!**

[www.sierra-remote.com](http://www.sierra-remote.com)



Sierra Remote Observatories (SRO) is a dedicated site for state-of-the-art robotic/remote astronomical data acquisition and imaging. We are uniquely located in the center of California's Sierra Nevada Mountains, about 50 miles south of Yosemite National Park. In addition to having excellent darkness and seeing, SRO's location is unique in being within an hour of a major metropolitan area and international airport, making access to the facility and to expert personnel unusually easy. At nearly 5000 feet, on top of Bald Mountain, the site was chosen for its excellent seeing conditions and accessibility. Summer intrinsic seeing quality FWHM measures 1.0 arcsecond. The site is very dark at 21.78 magnitudes/sq arcsecond, V band. With excellent seeing, an extremely low incidence of thunderstorm activity, average wind speeds of only 1 mph, maximum wind gusts averaging only 10 mph, no summer monsoons, on-site services, an average of 237 photometric nights each year and easy access, Sierra Remote Observatories offers the professional scientist and amateur imager an excellent imaging location. Since first light in May of 2007, SRO has continuously operated multiple observatories for both professional research and amateur imaging.

There are 8 individual observatories which each house one or two telescopes and larger observatories (two completed and full, a third to be constructed this year) which each contain 14 telescopes of various sizes, ranging from a 0.7 meter [PlaneWave](#) CDK700, to smaller refractors. The larger observatories are uniquely designed with 9 foot ceilings, making any contact of the ceiling and telescope virtually impossible, regardless of the position of the telescope. The operation of the roof in each building is automated and will close under any adverse weather conditions and reopen when the weather improves. Custom [AstroHaven](#) clamshell dome observatories for 1 meter class telescopes have been designed and can be made available within 3-6 months. Machine shop services and on-site technical personnel for repairs are available.

## An Updated Word From the Owners

We hope you've enjoyed SRO's sixth newsletter. They will be coming out every 6 months (biannual), giving us a chance to update everyone on what's new at SRO. The four of us (Keith Quattrocchi, Mel Helm, Larry Van Vleet and Geoff Stone) appreciate the many kind words and great work that has come out of SRO. We never imagined that APODs would be weekly events. And we never thought that serious peer reviewed studies would emerge from SRO from our many professional astrophysicists. What we did hope was we'd find a

quiet, dark and clear place to image. That we found, and much more.

One of the most rewarding aspects of our work at SRO is getting to know all the members and seeing the remarkable work they produce. With clear skies it seems everyone becomes an advanced imager and most far surpass any skills we (the owners) might collectively have. It is equally rewarding to see the incredible research produced at SRO by our professional astrophysicists.

We have focused on perfecting our infrastructure and getting

the word out regarding what we offer. We have spent a lot of time with roof control, with Geoff and Larry adding a great deal of expertise in the area of programming and networking. Mel has focused on infrastructure and upgraded our roof motors, weather detection systems and has everything backed up on virtual computers. He recently installed a Cyclops seeing monitor. I have spent a lot of time with marketing issues. Sam Miller, our full time on-site technical expert, has done a lot to help those who need it, and is on-site whenever he's needed. Together we hope to make SRO better and better as time goes by. Most of all we want it to remain a friendly and collegial site known for its clear and dark skies.