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My Wide-Field Dream Machine

Combining QSI, Starlight Instruments and Telescope Support Systems Components for an Optimum Wide-Field Imaging Rig

By Richard Wright

I am a photographer at heart. I love taking pictures, and this includes both astronomical targets and more terrestrial ones, such as birds, landscapes, wildlife, and, of course, unsuspecting friends and family members.

I work in the astronomy business myself, so I have a pretty nice inventory of weapons for astrophotography, but I also have a collection of choice camera lenses and DSLRs, one of which is modified for astrophotography, and one of which is not. Despite my own testimony and insistence to the contrary in the past, I've found I just don't like the modified DSLR for terrestrial photography. Yes, I'm THAT picky when it comes to my images.

For the "normal" photography enthusiast, there is a natural progression in astrophotography, and it is as predictable as death and taxes. First, you start taking nighttime pictures with your DSLR on a tripod. Then, you stick your DSLR on a telescope. Next, you mount your DSLR piggyback so you can take wide-field images with your high-quality camera lenses while tracking the sky, and then, in the final stage, you discover CCD cameras, and after a few awkward dates, you fall in love and find you "almost" never want to take DSLR images through your scope again. The credit card companies love this phase.

You can struggle and deny this eventuality all you want, but once it starts, you can just



Image 1

call hospice and try and make your budget as comfortable as possible before it's completely obliterated. (Sometimes spouses can force a period of remission, but it is often only delaying the inevitable.)

I have reached this last phase, and the only thing saving my modified Canon 5D

Mark II from Astromart is the fact that it has a very large chip, and one-shot color can still rule when your time and opportunities are limited. I like large chips. They give very wide and expansive fields of view and there are a LOT of really cool, really large objects that I would like to photograph – and the word



Image 2 - An early, less-successful configuration attempted to support the 200-mm lens with a bit of foam.



Image 3 - The Heart and Soul Nebulas (IC 1805 and IC 1848), captured with an early hardware configuration.

“mosaic” scares the heck out of me. You know what else gives you really wide fields? Shorter focal length optics!

The phrase “you get what you pay for” could be no truer anywhere than it is in the field of photography (astro or otherwise). The kit lenses that come with most consumer

DSLRs are good quality and perform well, and you may well be happy with them. I’ve taken lots of pictures with them I am still proud of, and I’ve piggy backed them on a scope for some decent enough longer exposure shots. The first time, however, I ever put a premium lens on my camera, the difference

was astounding. In the Canon family, I’ve graduated to the “L Series” lenses, and I find they excel for astrophotography as well as for terrestrial photo safaris.

My CCD camera is the QSI 683-ws8. I have the full set of Astrodon LRGB filters and the typical (Ha, OIII, and SII) trio of 3-nm

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Image 4 - A block of wood was the defining component of Franken Scope.



Image 5 - The California Nebula (NGC 1499) with the Franken Scope.

narrow-band filters. When QSI started selling an adapter that would allow me to attach my Canon lenses to their camera, I had a flash vision of super-wide field hydrogen-alpha images from my suburban backyard and went straight to their web site. There was some text there about why you might want to use a camera lens on a CCD camera, but all I could think was, “SHUT UP AND TAKE MY MONEY!”

My first attempt was to simply use the CCD camera mounted on my refractor just like I had done before with my Canon DSLR (Image 2). This was a bit awkward looking, and there was considerable flexing of the camera and lens. This was a proof of concept, after all, and I did manage to get a few subs of the Heart and Soul nebulas (Image 3). I could see right away this was exactly what I was hoping for, but mechanically, this setup was simply not going to suffice.

After a trip to a local surplus shop and a few finds at a star party swap meet, I devised the Mark II of my wide-field wonder, I called this “Franken Scope” (Image 4). An abomination to be sure, but I felt in the name of science I was at least headed in the right direction. My next attempt was the large California

Nebula (Image 5). I got it all in one frame!

By now you are figuring out I am not really gifted when it comes to things mechanical. I did what I could with the parts I had at the time ... and, again, the lens and camera were just flexing too much. I knew I needed something to brace that as well, and the block of wood was just to prove the concept. It helped, and I was able to shoot 10-minute subs for the California nebula image shown here.

It was on this target that I learned something important too about shooting through camera lenses. I had one of those UV lens covers that most photographers put on the end of their expensive lenses to protect the glass.

Those covers love to add glare, and my Ha of the Heart and Soul had some curious blurs. Removing it for the California nebula, I saw a significant improvement in image sharpness.

Another challenge was focus. Automating this would be tricky, and the lens was very sensitive to the slightest twist, making manual adjustments time consuming and error prone. It was at this point when, by happenstance, I found myself setup next to David Ellison at the Cheifland Star Party in November of 2012.

David had the most over-mounted instrument on the field. A Paramount ME with a QSI CCD camera and a Pentax lens on

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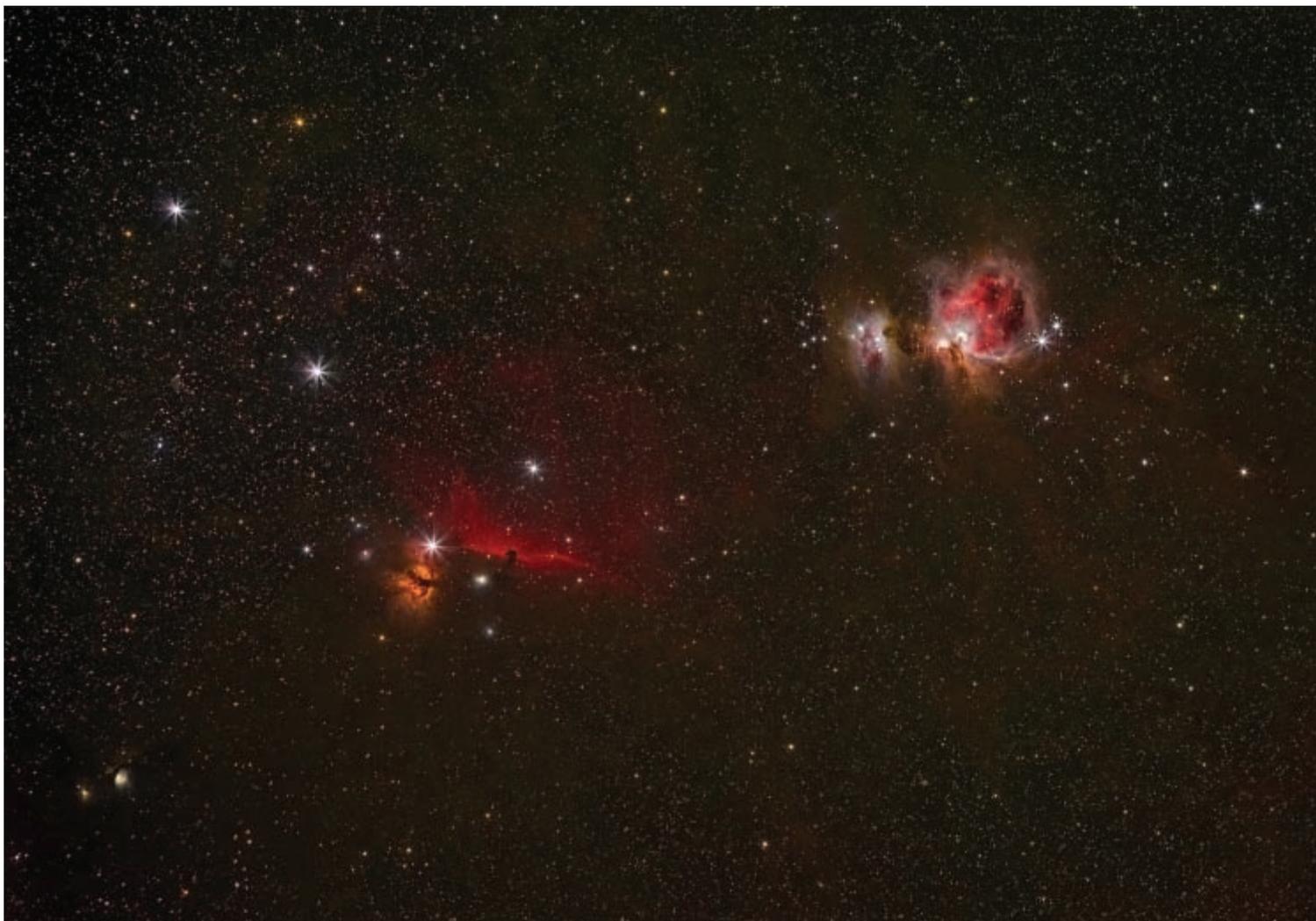


Image 6 -This image spans a huge field that encompasses the Orion (M42) and Running Man (NGC 1977) Nebula region and the Horsehead (IC 434) and Flame (NGC 2024) Nebula region, as well as the reflection nebula, M78, and placed first in the 2013 Winter Star Party wide-field astrophotography contest. It consists of 5-minute subs totaling one hour.

it. A man after my own heart! But what's this? He had a focuser motor off to the side and a belt looped around the lens collar. David had designed this prototype mounting hardware, and it was about to be manufactured by Starlight Instruments with a customized version available from QSI with risers specifically for their camera housings. It was well thought out with small blocking bracers that could slide in and out to keep the camera from rotating, and a bracket off to the side for a focus motor. David was very proud of it and showed me all the little things they'd done to accommodate a variety of cameras and lenses, how the little bracers slid in and out, how to tighten it down and how rigid everything was. All I could think was, "SHUT UP AND TAKE

MY MONEY!"

Of course, I had to have one, and I was probably the first person to order it as soon as QSI sent out an announcement that it was available for purchase on their web site. There was a slight delay in the availability, and QSI and Starlight were kind enough to deliver it in person, as it turns out, at the Winter Star Party where I was wanting to try it out for the first time.

My QSI was already committed and was on the Veloce RH-200 (my other dream scope) making me proud with other images. I still did not have a focus motor at the time, but I put a Canon 200-mm *f*/2.8 L series lens on my modified Canon 5D Mark II. I mounted this and a guide camera directly to the versa-

plate of a Paramount ME, and took first place in the wide-field astrophotography contest with the wide field image of Orion shown in **Image 6**.

This is a huge field, with both the belt and sword regions showing up well with only 5-minute sub exposures (one hour total stacked). I knew this was the beginning of a whole new realm of astrophotography for me.

Back home, I put the QSI on and went back to work on my backyard narrow-band investigations. The WS-8 body on my QSI sits pretty high, and despite the camera being held rigidly in place by the braces that come with the bracket, the lens itself is long and it does flex. I eventually added the Robofocus motor as well, and the belt pulling on the lens



Image 7 - The completed Wide-Field Dream Machine incorporates Telescope Support Systems camera-lens mount ring, Starlight Instruments QSI-camera mounting hardware, a Starlight Instruments-sourced motor-focus system based on a design by David Ellison and a Canon lens.

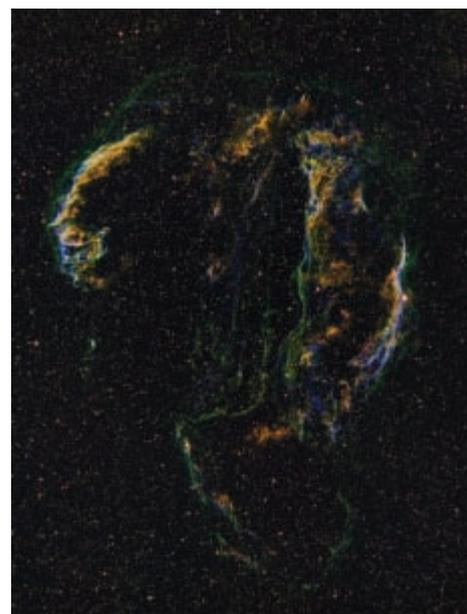


Image 8 - The Cygnus Loop, which spans nearly 3 degrees, is framed perfectly by the author's new wide-field imaging system. (See image on cover)

adds just a little bit of tilt as well. At high focal ratios especially, just the slightest misalignment will give you an unevenly focused field.

Speaking of which, I've used this particular lens at both $f/2.8$ and at $f/4$. The wisdom is you should stop down the lens a bit to sharpen up the image. It's really hard to give up $f/2.8$, but I can testify that $f/4$ is still no slouch, and I'm quite happy with the image quality I'm getting by using more of the center of the lens.

Another factor, if you go this route, is the "trick" to set the f-stop on the lens. You have to do this on a live camera, and as soon as you power down the camera, or finish an exposure (at least on my Canon), it opens the lens all the way back up. What I do is set the f-stop where I want it, and start a long exposure. Then in mid exposure I simply remove the lens from the camera, and then power off the camera. Now the lens is where I want it.

My last piece of the setup came at NEAF just this past April. I went booth hopping during one of my breaks from my own booth duty and chanced upon Telescope Support Systems. They machine rings, brackets and all manner of knick-knacks. I saw a big ring that I thought would fit my lens, and actually went

over to the Canon booth with it to make sure trying it on the lenses they had there. A one-inch block on the bottom and a reverse dovetail bracket, and I felt I had everything I needed.

Image 7 shows my completed Wide-Field Dream Machine. The ring on the front holds the lens very firmly, and allows me to tweak the alignment to ensure a good field all the way across the chip regardless of focal ratio. I mounted the guide camera directly to the versa plate off to the side and put on a couple of Dew-Not dew straps originally intended for eyepieces. They do the job quite well.

One last caveat is that the lens I used does

not move back and forth or change in overall physical length when you focus – all focus action is internal. This is important; if it did, the ring on the front would restrict focus movement. Altogether now, I have the perfect system for wide-field color and narrow-band imaging. My "proof is in the pudding" shot is the Cygnus Loop image shown in **Image 8**. 12 hours of narrow-band imaging over a period of two weeks. 20-minute guided subs every clear morning as soon as Cygnus would clear my roof line from the backyard. My wide-field dream machine is now fully operational, and I have a list of targets as long as my arm! **ATI**

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