

Deep-Sky Imaging with Starizona's Hyperstar

How the New Forest Observatory Re-discovered the Hyperstar

By Greg Parker

I took my very first deep-sky HyperStar image of M42 (see *Practical Astronomer* magazine, December 2007 issue, page 8) back in November 2004 from my New Forest Observatory in Brockenhurst, Hampshire, U.K. (www.newforestobservatory.com), shortly after buying the SXV-H9C one-shot colour CCD from Starlight Xpress.

In fact, I bought the HyperStar to go with my Celestron Nexstar 11 GPS scope over two and a half years earlier as it was always my intention to carry out deep-sky imaging. My decision to choose the Celestron scope in the first place was dictated by this amazing HyperStar device. I knew nothing about imaging at the time, but the concept was really cool (to me at least), and the scope with the HyperStar fitted looked like such a strange beast that I simply had to own one, if only to see how this thing actually worked.

The first HyperStar I bought from Starizona had no adjusters at all, not for collimation or for camera rotation, and it now

seems incredible that the first time I bolted that HyperStar to the C11, I achieved almost perfect collimation. I won't bore you with my particular learning curve of first going to equatorial mounting and then finding out about taking large numbers of sub-exposures and adding them altogether; instead I'll go straight to the turning point of my HyperStar experience.

One evening I wanted to image both M81 and M82 in the same field of view, but this meant the HyperStar would need rotating. No bother! I reached into the dew-shield and gave the whole secondary cell assembly a twist of a few degrees. I then took a sub to see what I got, and of course it was disaster time! I had completely lost the collimation, the star shapes were all peculiar, and I walked away feeling sick – for about a week. When the panic finally subsided and common-sense returned, it was clear to me that there was a position of perfect collimation (there was at least an existence proof). So the prob-



lem now became, how was I to return to this “magic” position?

The whole secondary mirror assembly had a clearance approaching 1 mm all around its circumference within the corrector plate, so I drilled four holes in my beloved C11 and fitted four screw rods at 90 degrees to each other as shown in **Image 1**. These screw rods allowed the secondary mirror assembly to be moved around within that 1-mm clearance in the collector plate, and by trial and error I could once again return to a collimated optical system. Fortunately, it really wasn't too difficult to achieve reasonable collimation, although to tell the truth, I never managed to get back to the level of collimation that I hit the very first time just by pure luck.

Then there followed a period of two years imaging with this wonderful system, and together with Noel Carboni (Florida, U.S.A.), who carries out all the image pro-

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cessing work on my raw data, we turned out some pretty impressive HyperStar deep-sky images [Image 2 seen on pages 40-41, and the image on cover]. It should be noted that we were doing this at a time when the consensus opinion was that you simply couldn't take high-quality images with the HyperStar system! Many deep-sky imagers on the forums were adamant that the HyperStar simply wasn't up to the job. I tried to get the message across that it was capable of stunning images – if it was properly collimated to the optical system – but my words largely fell on deaf ears.

The large output of work that followed over the next two years formed the basis of two major Exhibitions of deep-sky images held at the University of Southampton and at the main exhibition hall in Brockenhurst. There were around 50 framed A1 and A2 prints presented at each venue. In addition to the Exhibitions, many of the HyperStar images appeared in U.K. astronomical publications, including *Astronomy Now* and *Sky at Night* Magazine. The New Forest Observatory also appeared on BBC TV's "Inside Out" programme and on ITV's (independent channel) Meridian News. Finally, HyperStar images also appeared in the national daily newspapers, the *Daily Mail* and the *Daily Express*, so the amazing images that were the result of the innovative HyperStar system were being brought to the attention of a large U.K.-based audience.

Towards mid-2006, I fancied a change. I wanted to be able to take images with a bigger CCD camera, the Starlight Xpress SXVF-M25C, which is a 6-megapixel CCD compared to the SXV-H9Cs 1.4 megapixels, and I was also getting more than a little tired of collimating my rather Heath-Robinson setup on a fairly regular basis. To this end I changed my imaging system completely to a Takahashi Sky 90 refractor at f/4.5 as the main imaging scope, and the large SXVF-M25C one-shot colour camera as the main CCD imager. My beautiful C11 was now relegated to the role of guide-scope!

For nearly a year and a half I worked with the new setup and it was refreshing to

have such a large, flat, field of view with good star shapes across the whole 3.33×2.22 degrees this system gave me. I took some pretty fine images with this system, but these were marathon imaging sessions taking many hours of valuable imaging time to produce high-quality images. For example, the images of M31 and the Veil Nebula [Images 4 and 5 seen on pages 40-41] took in excess of 30 hours each of total imaging time, including narrowband data on top of the one-shot colour data. It should be noted that it took Noel Carboni about the same amount of time to process the data as it took me to acquire it in the first place. Taking images this way was proving to be very costly of our valuable time!

I was fortunate enough to be on a year's sabbatical leave from the University of Southampton during this period, so I could be out imaging every clear night, all through the night. But this luxury was due to come to an end in June 2008 and I was at a loss as to how I was to continue to turn out the volume of work.

On returning to the University in June 2008 there was an unexpected chain of events. I was to go out to Phoenix, Arizona, to accept some semiconductor deposition equipment for the University's new clean room facility. As we know, Arizona means Starizona, and I let Dean know I would be out there for a few days. To cut a long story short, Dean shipped the new version III HyperStar and a Starizona MicroTouch focuser to my hotel in Phoenix and I unpacked all the goodies the second I got back to the New Forest Observatory.

I know I shouldn't have attempted to get the HyperStar up and running whilst still jet-lagged, but I ignored my family's warnings and tried anyway. I managed to put the cog on the MicroTouch focuser the wrong

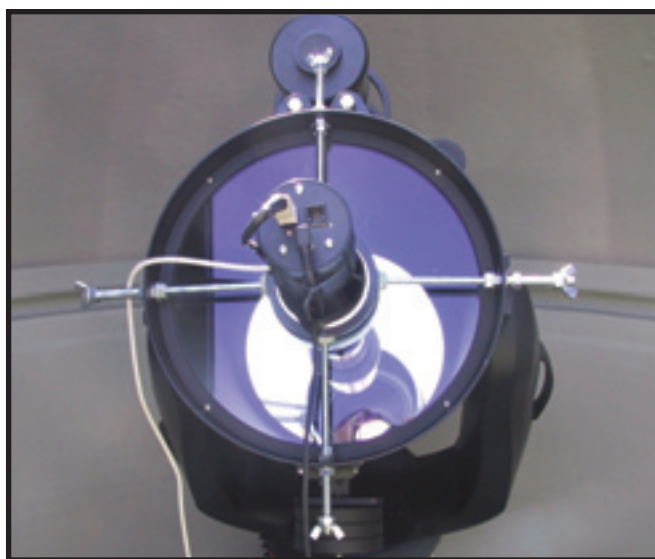


Image 1 The original Hyperstar Setup Showing the Added Adjuster Rods

way around, and I couldn't figure out how the HyperStar fitted to my scope, as I hadn't realised it came with the secondary mirror holder already fitted, and this needed to be removed to fit the HyperStar to the C11. Dean came to the rescue as usual, and a cou-

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ple of e-mails later and I managed to put my new HyperStar III system together – and of course it's just wonderful! The new version III Hyperstar fitted to the C11, prior to the connecting wires being brought out at 90 degrees to one another, can be seen on page 35.

The new version III HyperStar has collimation and camera rotation adjusters built-in, so it is a complete doddle to get excellent collimation, very quickly, with the help of CCDWare's *CCDInspector*

(www.ccdware.com). In fact, I got better collimation using just 15-minutes of setting up time with the HyperStar III than I ever managed to achieve with the Sky 90 and SXVF-M25C combination, so this was a very promising start.

First light for the new HyperStar was the central part of NGC7000, and for this image I used manual focus as I hadn't managed to set up the MicroTouch focuser at this time. Noel Carboni worked his magic on the raw NGC7000 data and the result can be seen in

Image 6 on page 40. I was highly impressed at the star quality corner to corner, and the small amount of vignetting present was no worse than that I had seen with the Sky 90 at f/4.5. But of course, the main thing was that this image only took 56-minutes of total exposure time! I had returned once again to the world of ultra-fast HyperStar imaging, and I can tell you, it was a great relief!

So far we have had a terrible summer weather-wise in the U.K., so I have only managed to take three further images since that first light image, including this latest one of the Coathanger Cluster shown in **Image 7 on page 40.** Taken on the July 27 2008, this used the amazing MicroTouch focuser which really takes the pain out of finding focus with low f-number systems. This image is only composed of 71 subs at 2-minutes per sub, yet the extremely faint reflection nebula LBN 130 can be seen lying just above the Coathanger.

I should point out that the depth of focus with my setup is somewhere between 7 and 8 microns, where the diameter of a



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human hair is around 80 microns. So, you are trying to position a large, heavy, 11-inch diameter mirror to an accuracy approaching one-tenth the diameter of a human hair. Doing this manually with an electric focuser is an extremely frustrating business. Clicking on an icon and seeing the focus lock into an FWHM of 1.3 after just a few seconds is great fun! I am now really pleased to have a finely-tuned HyperStar imaging system at the New Forest Observatory once again, and I will keep this particular setup for a very long time to come.


But is there anything that can be done to improve the HyperStar system still further? I think there are a couple of things that will make the HyperStar perfect, for me at least. Firstly, it would be nice to be able to change the 2-inch filter through a slot in the side of the adapter nose piece. This way you could change filters without having to remove the CCD camera and break into the optical train. I believe Dean already has this small design change under consideration. The second change I'd like to see is the HyperStar

made to accommodate a full 35-mm sized CCD – but then again, deep-sky imagers always want more and more, and it might be physically impossible (I don't know) to fit a 35-mm sized CCD to an 11-inch diameter f/2 system using a HyperStar lens assembly.

There is a book explaining how I took all the original HyperStar images and the system tweaks I used to bring the best out of the setup called *Making Beautiful Deep-Sky Images*. It is part of the Patrick Moore "Practi-

cal Astronomy" series published by Springer and is available through Starizona.

A second book will be published by Springer in January 2009. This is a large format coffee-table book of HyperStar and Sky 90 deep-sky images called *Star Vistas*, (www.starvistas.com) with Forewords by Sir Arthur C. Clarke, Sir Patrick Moore and Dr. Brian May. This is a "pretty picture" book, pure and simple.

Until next time, I wish you all clear skies and happy imaging. 

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Image 2



Image 5



Image 6



Image 7



Image 3





Image 4

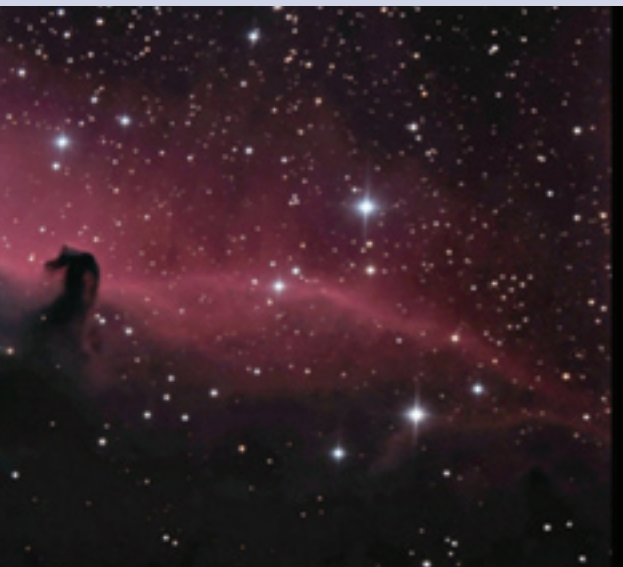


Image 2 – A 4-frame HyperStar Mosaic of the Pleiades

Image 3 – A 3-frame HyperStar Mosaic of the Horsehead Region

Image 4 – M31 Using the Sky 90/M25C

Image 5 – The Veil Nebula Using the Sky 90/M25C

Image 6 – First Light for the HyperStar III at the NFO

Image 7 – The Coathanger Cluster Courtesy of the HyperStar III