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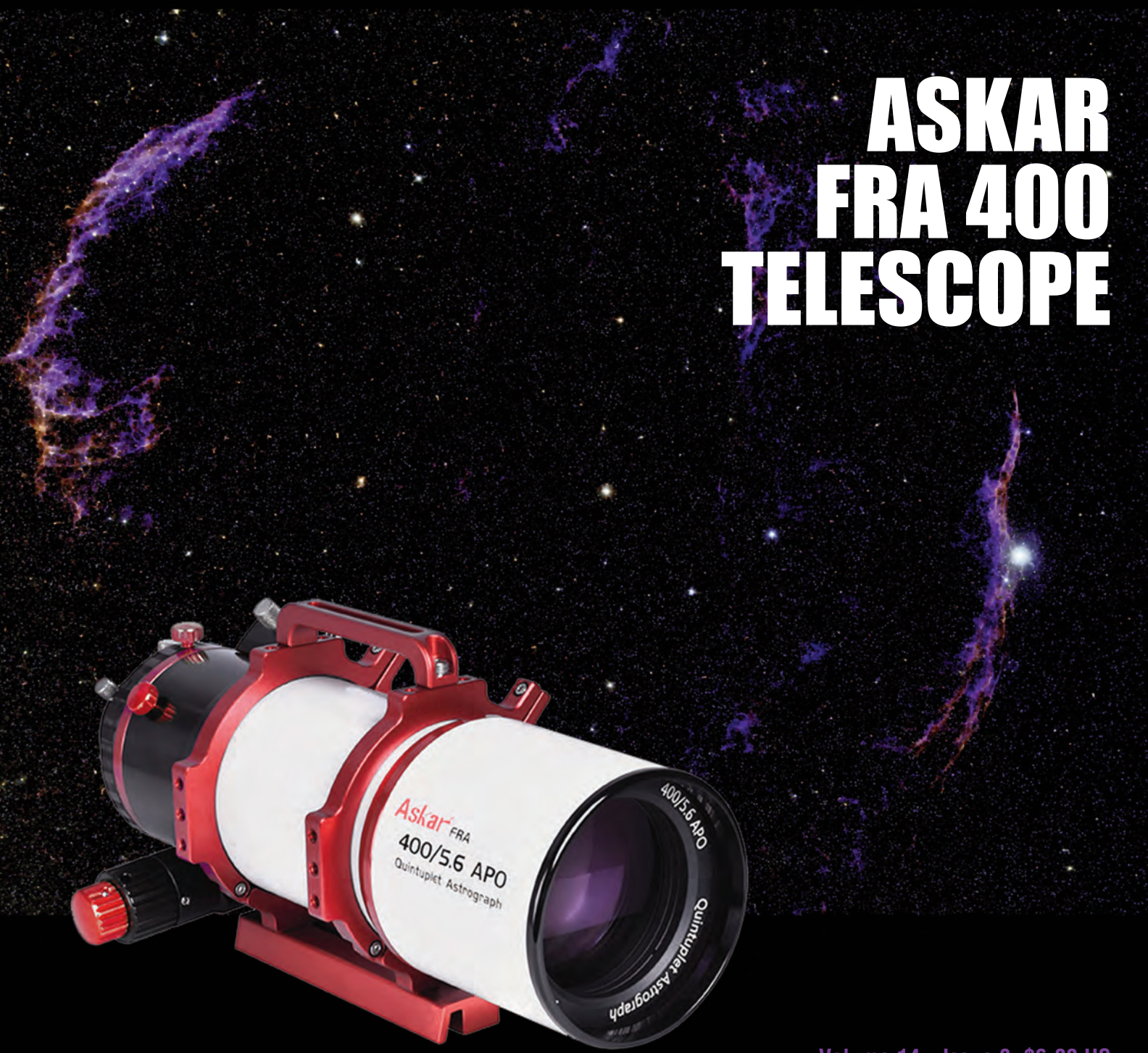

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Cover Images

In his article, Dr. James Dire test drives the new ASKAR FRA400. The background astro image is an 180-minute exposure of the Veil Nebula, a faint supernova remnant in Cygnus. It was taken by Dr. Dire with the ASKAR FRA400 on a Celestron CGEM II mount with a SBIG ST-8300C CCD camera. Guiding was done with a Stellarvue 70mm Apo with a ZWO ASI CCD camera.

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ATT Contributing Writers

James Dire has an M.S. degree in physics from the University of Central Florida and M.A. and Ph.D. degrees from The Johns Hopkins University, both in planetary science. He has been a professor of physics astronomy at several colleges and universities. He is the president of Methodist College in Peoria, Illinois. He has played a key role in several observatory projects including the Powell Observatory in Louisburg, KS, which houses a 30-inch (0.75-m) Newtonian; the Naval Academy observatory with an 8-inch (0.20-m) Alvin Clark refractor; and he built the Coast Guard Academy Astronomical Observatory in Stonington, CT, which houses a 20-inch (0.51-m) Ritchey Chrétien Cassegrain.

John O'Neill is an advertising and marketing consultant living in the Tampa Bay area. He is a board member of the Science Center of Pinellas County and a member of the St. Petersburg Astronomy Club and an organizer of Fall Star Party held in October at the Chie land Astronomy Village.

Stuart Parkerson has been the publisher of Astronomy Technology Today since its inception in 2006. While working primarily in the background of the company's magazine and website business operations, he has recently taken a more active role in contributing content covering industry news and other company centric topics.

Rob Pettengill, Ph.D. received his first telescope when he was eight and he has been a lover of the night sky ever since. Developing his own astrophotography images was a relaxing way to learn skills he needed for his professional research. He implemented signal processing algorithms as custom integrated circuits for medical applications and digital speech at Stanford and Texas Instruments and later built computer aided design and knowledge management systems for MCC and Schlumberger. He now applies what he's learned in computation, electronics, and imaging as an astrophotographer. He also enjoys urban sidewalk astronomy and traveling with his wife for dark sky adventures.

Shef Robotham lives in New England and is a retired electrical engineer who has numerous patents relating to lasers. He has been actively involved in astronomy for over 30 years covering optical, radio and astro-imaging. Other interests include music, HO trains, and amateur radio and a supporting wife of 50 years.

Mike Weasner started in astronomy at the age of six when his older brother, Paul, would show him the stars from their southern Indiana home. As a Christmas present in 1961, Mike's mother gave him an Edmund Scientific 3" Newtonian Telescope which he still uses today. When Mike was 14 Paul got him a subscription to Sky & Telescope which continues uninterrupted through today. He has a B.S. in Astrophysics from Indiana University and following college, he entered into the US Air Force, where he served as a fighter pilot, instructor, and a manager in the Air Force's Space Shuttle Program Office. He hosts the website "Cassiopeia Observatory" - www.weasner.com - where you can see reports of his sessions in his observatory, his astrophotography, and product reviews.

Mark Zaslove is a two-time Emmy Award winner and recipient of the coveted Humanitas Prize. Mark is a born-again astro noobie, who once had an Optical Craftsman scope as a kid, and is now recapturing his youthful enthusiasm (with a digital twist) and having a lovely time doing it.

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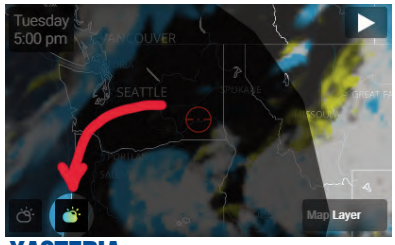

THE ASKAR FRA 400 TELESCOPE

By Dr. James R. Dire

Some of the best glass manufactured today is made in China and has been incorporated into refracting telescopes for many years by telescope makers around the globe. A new company that just came on the scene making telescopes is Jiaxing RuiXing Optical Instrument Company. Jiaxing is a suburb of Shanghai, China.

Coincidentally, Jiaxing was on the centerline for the July 22, 2009 total solar eclipse. I was in Jiaxing for that solar eclipse! Early in 2020, the Jiaxing RuiXing Optical Instrument Company released their first telescope model, the Askar FRA400 (**Image 1**). The FRA is an acronym which means Flatfield Refractive Astrograph, while the 400 represents the focal length of the instrument in millimeters. I decided to test one to see how it completes with other instruments in the same class.

Image 2 displays the finely crafted and adorned instrument close up. The optical tube is colored flat white. The focuser is black with red trim, which matches the red tube rings, handle, dovetail plate and objective cover. The diagonal, eyepiece and red dot finder are mine as the telescope just ships with the optical tube assembly and the aforementioned red-colored accessories. In addition, the telescope comes with a 2-inch to 1.25-inch adapter so it can be used with either size diagonal, and a M68 to M48 adapter to connect cameras with M48 threads onto the M68 threaded focuser.

As ornate as the telescope is on the outside, what's on the inside is even more impressive. The telescope is a 72mm f/5.6

Image 1 – The Askar FRA 400 telescope atop a Celestron Advanced VX mount.

Image 2 - Close up shot of the beautifully crafted and adorned Askar FRA400 astrograph.

Image 3 - The quintuplet optics has five elements in two groups with two extra-low dispersion lenses.

Image 4 - View with the focuser draw tube fully extended. The black knob is the course focus knob while the red one is for fine focus.

Image 5 - The telescope comes with a finder scope shoe. The red knob near the diagonal allows for 360 rotation of the diagonal.

Image 6 - The trim on the telescope is a good match for my SBIG ST-8300C and ZWO ASI CCD cameras.

Image 7 - With the SBIG ST-2000XCM CCD camera, the telescope dovetail plate and tube rings must place the telescope as high up on the mount as possible to balance the declination axis.

apochromatic refractor. Most quality Apos come with a three pieces of glass inside with one element made of extra-low dispersion (ED) glass. The Askar FRA400 has five glass elements in two groups, with two elements made with ED glass (**Image 3**). This combination provides the ultimate color correction and delivers an extremely flat field to the eyepiece or a CCD camera.

Image 4 shows the focuser fully extended. The telescope has a nice three-inch focuser with graduations on the drawtube to assist in tracking the focus position for various eyepieces or cameras. With the two-inch diagonal I found the focus point for most of my eyepieces was when the drawtube was almost all the way cranked in. The focuser has two speeds with course focus knobs on both sides and a fine focus knob on

Image 8 - The author tested the telescope visually against his 70mm f/6 Stellarvue Apo.

Image 9 - One-hour exposure of M81 and M82 with the Askar FRA400 f/5.6 Apo using an SBIG ST-2000XCM CCD camera.

the right side (colored red.) The red setscrew on the top right side of the focuser is used to lock the focus position.

I really like the handle attached to the top of the tube rings. It makes carrying the telescope easy as well as removing it and placing it back into the foam lined box the telescope comes in. The handle also can be used as a sight when slewing the telescope towards an object and with a low power eyepiece, which almost eliminates the need for a finder!

Optically and mechanically the telescope has excellent craftsmanship. There were only two things about it I would change. First the tube rings require a 2.5mm Allen wrench (included) to loosen or tighten them. Most other telescopes in this class have rings that can be removed with hand-turn screws. Second, the three

Image 10 - Twenty-minute exposure of M3 with the Askar FRA400 f/5.6 Apo using an SBIG ST-2000XCM CCD camera.

hand-turned screws that lock the diagonal onto the telescope are hard to reach and turn. They are too small in diameter to easily grip and don't stuck out far enough to get a good grip on them. Don't even think of tightening them with gloves on in cold weather. I found to securely attached my CCD camera with a two-inch noseplug, I had to use pliers to tighten them sufficiently, but not so tight to break the noseplug.

Image 5 contains a different angle view of the focuser. The red knob on the bottom of the draw tube is loosened to rotate a diagonal or camera up to 360 degrees! Also note the finder shoe on the top left side of the focuser housing. The shoe fits the dovetail sleeve for my red dot finder and my Orion 9x50 finderscope. Note the beefier knobs used to lock in the finder.

My SBIG STF-8300C CCD camera with a ZWO guide camera attached to an off axis guider are mated with the telescope as shown in **Image 6**. The red themes on the telescope blend in nicely with these two cameras! Unfortunately, I could not get a good balance around the declination axis with this setup. If the dovetail plate were two inches longer I could balance it. Fortunately, I have a longer dovetail plate already that fits the bill. I like the fact that the tube rings lift the focuser high enough up so that the focuser sits above the dovetail plate with no operation interference.

I next attached my SBIG ST-2000XCM CCD camera to the Askar FRA4000 (**Image 7**). This has always been my favorite CCD camera due to its internal guide chip. This camera also better balances around the dec axis.

First light with the Askar FRA400 (**Image 8**) allowed me to compare it to my Stellarvue 70mm f/6 telescope (see ATT volume 11, issue 2, 2017) at a dark site in Central Illinois on a night with above average seeing and transparency. I used two Explore Scientific 82° eyepieces; a 14mm (29x) and a 6.7mm (59x) along with an Explore Scientific 2x focal extender (118x). Switching the eyepieces between the two telescopes allowed for a side-by-side comparison.

The optics in the Askar FRA400 delivered superb views! Stars were pinpoint throughout the field of view as they were in the comparison scope. Star colors were great and I would say the star colors were more apparent in the Askar FRA400 than in the Stellarvue.

Due to the small aperture, I concentrated on star clusters and bright nebula such as M57 and M27. At the higher powers, M13 was resolved into many stars. Galaxies like M51 were visible, but not much detail can be picked up with a 72mm telescope. However M31 filled the entire 14mm eyepiece and was quite impressive.

The 6.7 mm eyepiece with the focal extender provided outstanding views of Jupiter and Saturn. The colorful bands on Jupiter and its Galilean moons really stood out. On Saturn the rings were superb, the Cassini division was resolved and Titan was readily captured.

Next I tested the Askar FRA400's imaging capabilities. I discovered there wasn't enough back focus for my SBIG ST-8300C CCD camera with the off axis guider setup in Image 6, so I used the ST-2000XCM CCD camera shown in Image 7 since it has an internal guide chip. My first image was an hour exposure of M81 and M82 (**Image 9**).

Two to three hours of data would have been preferable. But with this

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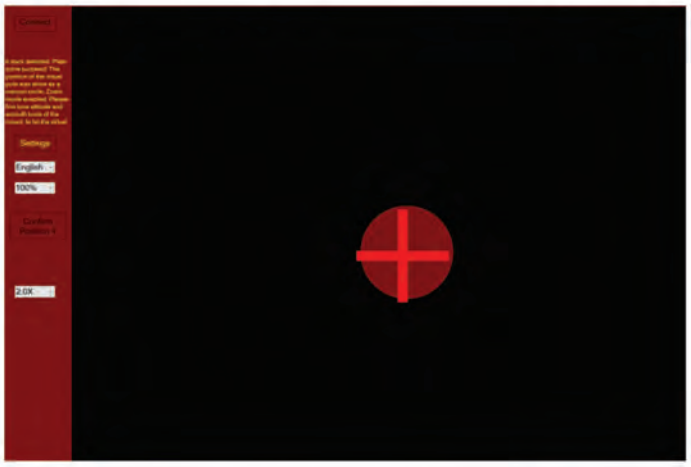

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Image 11 - The author's set up for imaging with the ASKAR FRA400 on a Celestron CGEM II mount with a SBIG ST-8300C CCD camera. Guiding was done with a Stellarvue 70mm Apo with a ZWO ASI CCD camera.

image, the exposure was long enough to exam the system for some general conclusions. The image shows no hint of chromatic aberration. In addition, no field curvature is present attesting to the success of the 5 element optical system. There is a good assortment of star colors, red, blue, yellow and white stars!

My second target was the globular cluster M3 (**Image 10**). With only a 400mm focal length, the Askar FRA400 did an outstanding job of resolving this star cluster.

The Askar FRA400 worked quite well with the 2-megapixel ST-2000 CCD camera. But to better see how flat the field was I really needed to test

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Image 12 - The full moon shot through the ASKAR FRA400 telescope.

Image 13 - Globular cluster M13 shot with the setup in Image 11. The exposure was 40 minutes.

it with the 8.3-megapixel ST-8300C camera. I decided to mate my Stellarvue 70mm Apo to the Askar FRA400 and use the Stellarvue as a guide scope. The setup is shown in **Image 11**. The entire payload with cameras weighed in around 20 pounds, only half the rated capacity of my Celestron CGEM II mount (see ATT volume 11, issue 1, 2017).

The first night of imaging with this setup was during a full moon (**Image 12**). Except for the bright moon, the sky conditions were excellent for astro imaging; although deep faint objects were not reachable.

The Great Hercules Globular Star Cluster, a.k.a M13, appears in **Image 13**. This cluster is actually bigger than M3, but appears smaller in this image compared to Image 10 because the ST-8300C camera has a much larger field of view. In this 30-minute exposure, stars are pinpoint to the very edges and star colors are very crisp.

Since both of my CCD cameras use M42 threads, I wasn't able to make use of the supplied M68-M48 adapter until I ordered a ring that converts M48 to M42. **Image 14** shows the supplied M68-M48 adapter. The ring that holds the 2-inch diagonal, also hosting M68 threads, is removed from the focuser drawtube and the M68-M48 adapter screws onto the end of the drawtube. The M48 threads will work with a standard DLSR camera T-ring. But for my CCD cameras the M48-M42 ring also shown in Image 14, does the trick! I no longer need to use the CCD camera 2-inch noseplug nor have to worry about tightening the three setscrews to hold either of my cameras securely attached to the fo-

Image 14 - The accessory on the left screws onto the end of the focuser to attach a 2-inch diagonal or a 2-inch to 1.25-inch adapter to use with a 1.25-inch diagonal. The accessory in the middle screws onto the end of the diagonal to connect to a camera with M48 threads. The adapter on the right is the author's M48-M42 adapter allowing him to attach his CCD cameras to the telescope.

Image 15 - The Askar f3.9 (0.7x) focal reducer (must purchase separately).

Image 16 - The focal reducer has M68 threads to attach it directly onto the focuser.

cuser.

My last imaging tests were conducted with an Askar 0.7x focal reducer (**Image 15**). This is one of the best focal reducers I have used. It has M68 threads that attach it to the end of the focuser drawtube (**Image 16**).

Using the focal reducer brings the focal length down to 280mm and the focal ratio to a very fast f/3.9! This system is ideal for extended faint celestial objects. I first targeted the entire Veil Nebula, a faint supernova remnant in Cygnus. **Image 17** is a 180-minute exposure of the Veil taken with the setup in Image 11. I was impressed at the results

I took some sky flats with the reducer. Like the sky flats I took without the reducer, there was no noticeable brightness variation across the field of view. There were some round donuts caused by dust on the CCD cover inside the camera, but those are to be expected and are one of many reasons do take flat field images for astro image processing.

My final test image was of M31, the Andromeda Galaxy taken with the reducer and the ST-8300C camera. I did 2x2 binning, which renders the color CCD chip into a monochrome image. My 30-minute exposure appears in **Image 18**. The image produces about the best resolution of M31 that can be obtained with a 72mm diameter telescope!

I have tested myriad telescopes 65-75mm in diameter. The Askar FRA 400 is among the best on the market today. The Jiaxing RuiXing Optical Instrument Company only offers one model telescope as I write this article. But they don't have to offer another model. They produced a winner in their first attempt. The Askar FRA 400 makes a great portable travel scope for visual use and is an outstanding instrument for wide-field astronomical imaging. ATT

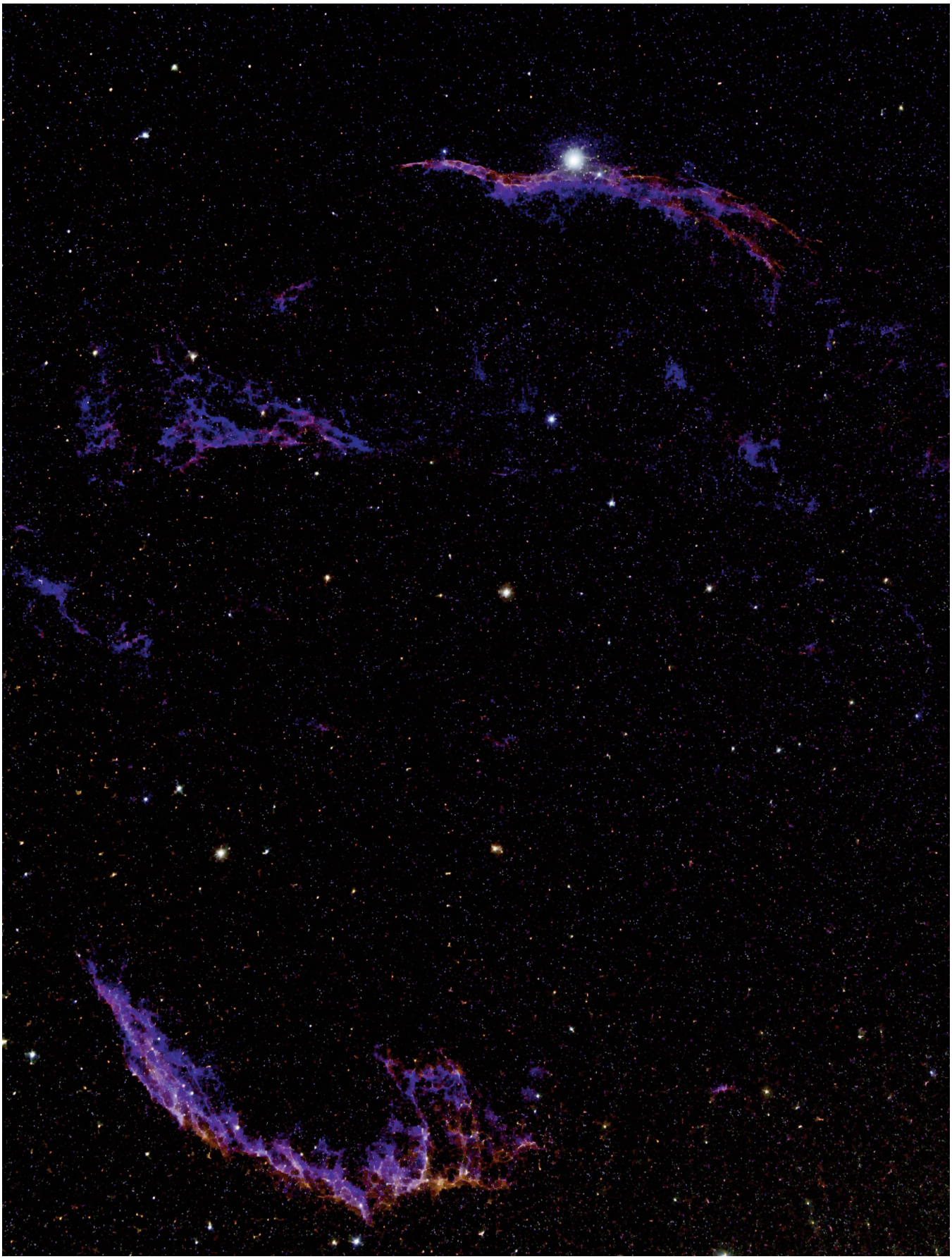

Image 17 - Three-hour exposure of the Veil Nebula taken with the focal reducer and the SBIG ST-8300C CCD camera.

Image 18 - Thirty-minute exposure of M31 taken with the focal reducer and the SBIG ST-8300C CCD camera with 2x2 binning.