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THE SKY-WATCHER EVOGUIDE 50ED WIDE FIELD IMAGING

By Dr. James R. Dire

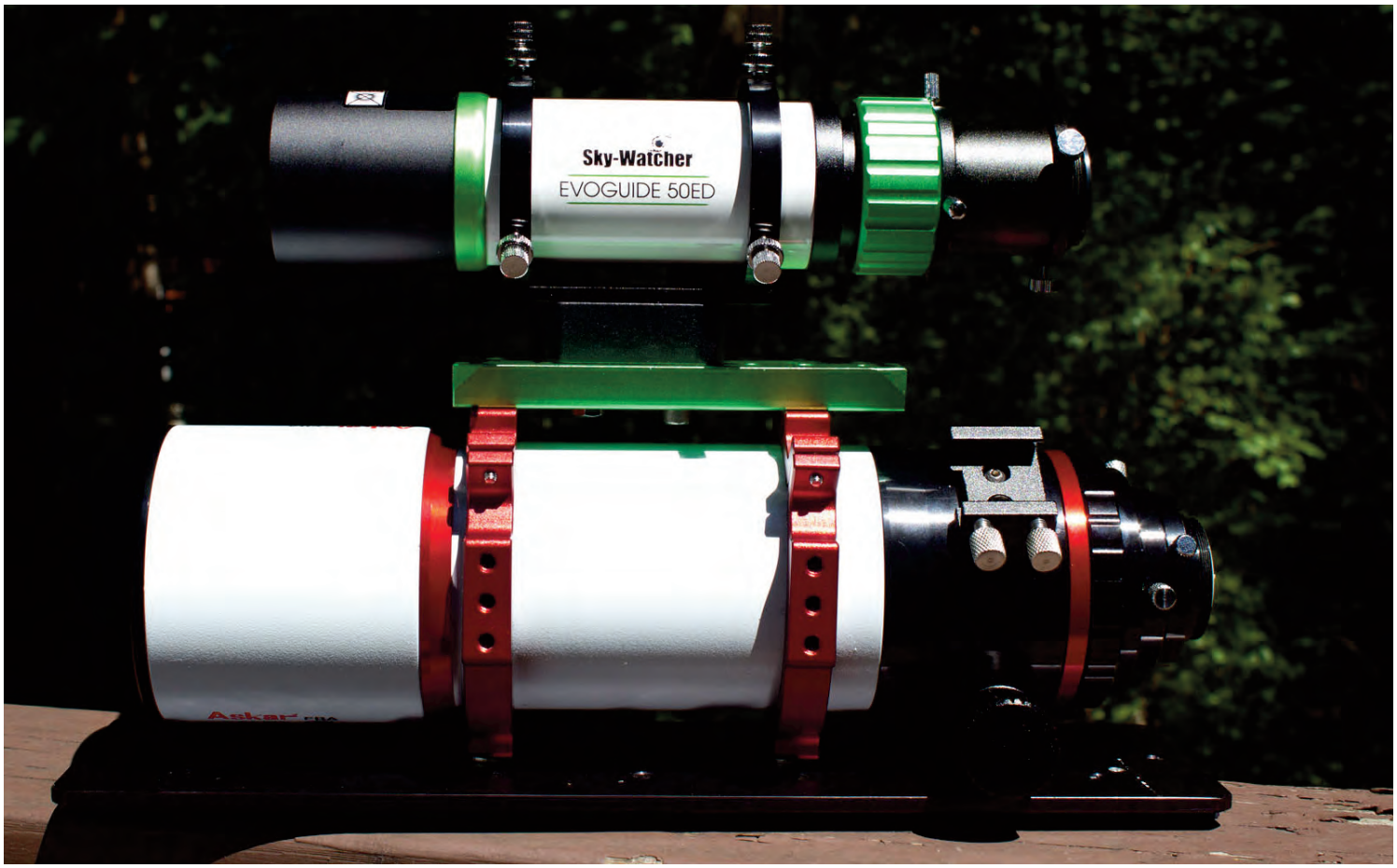

Image 1 - The Sky-Watcher Evoguide 50ED, a 50mm f/4.8 ED doublet telescope, comes with a Vixen-style dovetail plate, tube rings, extender tube that threads onto the back of the focuser, and dust caps.

Last year, I reviewed the Sky-Watcher Evoguide 50ED (**Image 1**) in this magazine (Astronomy Technology Today, Volume 15, Issue 9, pages 45-58.) I am so impressed by this little telescope's capabilities; I have to write more about it.

First let me review a little about the scope. The Evoguide 50ED is a 50mm f/4.8 doublet telescope with one extra-low dispersion (ED) element. The telescope has a 248mm focal length. While primarily designed to be used as an autoguiding optical instrument, the telescope can also be used as a visual finderscope and as a wide-field, imaging instrument. The Evoguide 50ED may be found as an Evoguide 50DX; its

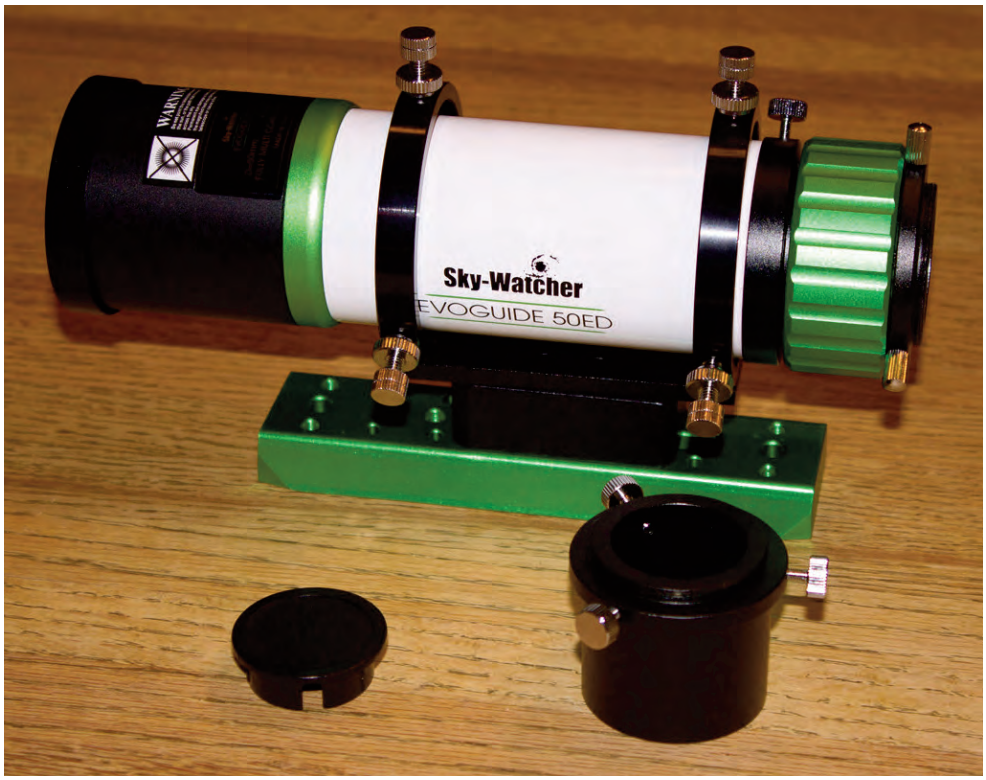

Image 2 - The extender tube has T-threads (M42), male on one and end female on the other end, to securely attach accessories to the telescope.

the same scope! The telescope comes with tube rings, a Vixen-style dovetail plate, two dust caps, and a finder stalk that fits many telescope finder brackets.

As can be seen in Image 1, the Evoguide 50ED has a helical focuser. There is a threaded extension tube attached to the back end of the focuser for use with an eyepiece. Everything on the back end connects with M42 T-threads (**Image 2**), so any accessories or cameras that have M42 threads can be firmly attached. The focuser and the extension tube both have three locking screws for attaching 1.25-inch eyepieces or a camera noseplug onto the telescope.

This little scope is so versatile. It can be used as a straight though visual finderscope or as an autoguider scope. Neither of these functions benefits much

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Image 3 - Full frame image of the Moon taken through the 248mm focal length Evoguide 50ED with an SBIG ST-2000XCM CCD camera.

from the fact that it has an element of extra-low dispersion (ED) glass in its objective. But if using it as a wide-angle imaging scope, the ED glass is essential to minimize chromatic aberration. I must state, this little telescope has the best color correction of any sized ED doublet I have ever tested! I viewed the Moon threw it and imaged old Luna. Either visually or on the image, I detected no false color (**Image 3**)!

Image 3 was taken without the use of a field flattener. However, the Moon was centered on the image and in the sweet spot of the field of view where no field curvature should be present.

Field curvature is an aberration in optical systems where off-axis light does not come to focus at the same time on a flat imaging sensor when on-axis light is perfectly focused (**Image 4**). The smaller the focal ratio of an optical system, the greater the aberration!

As can be seen in Image 4, the focal surface for a lens system would be curved. But camera digital sensors are flat. So without corrective optics, any off=axis stars would not be points, but would be elongated in the radial direction from the center of the image. The effect would be greater for stars closer to the edges of the image. Since the Evoguide 50ED has a focal ratio of f/4.8, it should, and does suffer from field curvature.

As an aside, the focal ratio of the human eye, an optical system with its own lens, varies from about f/2.1 to f/8.3, depending on how dilated the pupil is. The eye doesn't need a field flattener because the imaging sensor, a.k.a. the retina, is curved perfectly to keep off-axis light in focus!

I know of two field flatteners on the market made for the Evoguide 50ED. Sky-Watcher makes one specifically for the Evoguide. Their field flattener has 17.5mm of back focus, which would make a perfect fit for screwing into the T-threads of my SBIG ST-2000, SBIG ST-4000, and SBIG STF-8300C CCD

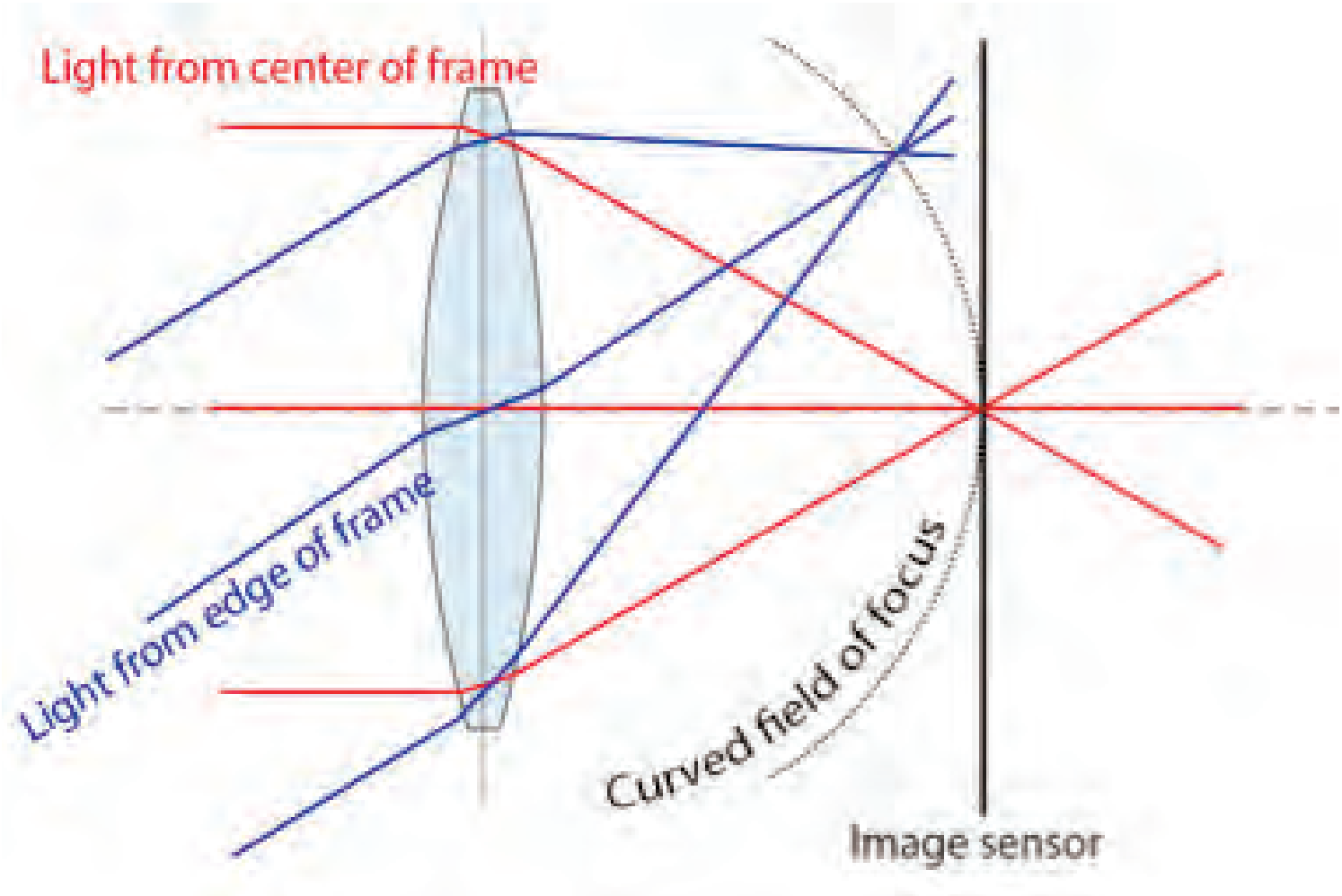

Image 4 - Field curvature means the focal surface of an optical system is a curved surface, not a flat plane like digital imaging sensors.

cameras. My cameras, like many on the market, have the digital sensor 18mm from the front of the camera. Unfortunately, these field flatteners have been out of stock for a long time. None were available when I did my initial review of the Evoguide 50ED. As I am typing this follow-up article, they are still on back order.

The other field flattener on the market for the Evoguide 50ED is the Starizonia EVO-FF (**Image 5**). I purchased version 2 of the EVO-FF, which requires 55mm of back focus. I like the 55mm of back focus on the EVO-FF since I can use it with my SBIG cameras or with my Canon 40D and 600D camera, which have their sensors much farther than 18mm from the front of the cameras. Both of these field flatteners correct the field curvature for APS (28mm) or small sensors.

So how well does the field flattener work? To test it, I attached the telescopes pictured in Image 1 to my polar aligned Celestron CGEMII mount for some imaging. I connected my SBIG STF-8300C CCD camera to the Evoguide 50ED first without the field flattener and then with it. I did not have the correct combination of 42mm spacers to exactly achieve the 55mm required between the field flattener and the 8300 CCD sensor. But it was within a few millimeters. I attached an autoguider camera to the larger 70mm telescope in Image 1 and proceeded to take some long exposures.

Image 6 is a 30-minute exposure roughly centered on M27, the Dumbbell Nebula. Examining this image shows that in the center one-third of the image, the stars are fairly circular and small. About halfway between the center and the edges, the stars start to appear distorted. On the left and right edges and in the four corners, the stars are grossly deformed. This is the typical

effect of field curvature on a flat sensor!

Image 7 is also a 30-minute exposure centered (better) on M27, this time with the use of the field flattener. Notice how much nicer this image appears compared to Image 6. The stars are mostly circular throughout the field of view. The only elongated stars I see are in the upper left-hand corner. I need to look around for some 1mm and 2mm M42 spacers so I can get the distance between the field flattener and imaging sensor exactly to 55mm. The few millimeters I was off may be what caused the slightly elongated stars in the upper left corner.

I am very pleased with the quality of images obtainable with this small telescope. I look forward to some more wide field deep space imaging, as well as trying it out on lunar and solar eclipses over the next few years. ATT

Image 5 - The Starizonia EVO-FF field flattener is designed for use with the Evoguide 50ED scope.

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Image 6 - Thirty-minute guided exposure of M27 taken with the Evoguide 50ED using an SBIG STF-8300C CCD camera. This image was not captured using a field flattener.

Image 7 - Thirty-minute guided exposure of M27 taken with the Evoguide 50ED using an SBIG STF-8300C CCD camera with the EVO-FF field flattener.