

Airy Disk's 106-mm Triplet Refractor

We test an apochromat from a new Canadian manufacturer. Does it live up to its marketing?



Airy Disk APO 106mm f/6.6 Triplet ED FCD-100

U.S. Price: \$1,890
airy-disk.com

What We Like

High-quality machining
Excellent focuser

What We Don't Like

Field coverage insufficient for
full-frame cameras
Optical defects visible in
corners of images

EVERY INDUSTRY GOES through fads. Currently, I'd argue that refractor telescopes seem to be the hottest thing going. Everyone wants one, and everyone is making them. I ran into a new player in this market niche at the Texas Star Party eclipse event last April. Cleverly named Airy Disk, their wares consisted exclusively of apochromatic refractors. I didn't have time to get a closer look at the star party, but fortunately I encountered them again at their booth at the annual Northeast Astronomy Forum (NEAF) where I had a chance to learn more. They weren't quite as "new" as I thought, as they've been making telescopes for years, but recently they launched their own branded line of refractors. While at NEAF I arranged loan of the company's APO 106mm f/6.6 Triplet ED FCD-100 along with two focal reducers.

◀ The Airy-Disk APO 106mm f/6.6 Triplet ED FCD-100 refractor includes tube rings, and two Vixen-style dovetails — one to mount the scope, the other for carrying additional accessories up top. Also included is a 2-to-1¼-inch eyepiece adapter.

In the Box

A few weeks later, the scope arrived in a foam-packed cardboard box. The build-quality of this refractor is impressive. The 106-mm (4.17-inch) objective is protected with a threaded aluminum lens cap — a nice touch. I can't tell you how many times I've had push-fit caps fall off and roll away down the driveway in the dark. The dew shield extends easily and is secured by a single polymer screw.

The focuser is one of the better focusers I've seen without paying a premium for an upgrade. It has knobs for both coarse and fine focus and a locking screw. The drawtube rides along three linear bearings for added stability and rigidity. Initially, the focuser was smooth and without any backlash that I could feel, nor did the view shift as I racked in and out of focus. I made use of that locking screw for heavier loads, but shortly after beginning the review I added an Optec DirectSync focus motor made specifically for this scope. Motorized, the focuser held any load I tried without issue. The focuser accepts 2-inch accessories and includes a 2-to-1¼-inch adapter as well. The field-flattener / reducers thread directly onto the focuser after the eyepiece adapter is removed.

The tube's matte-white finish gives the scope a clean feel that doesn't look cheap. Even the two flatteners show a nice attention to detail as each comes with threaded metal caps and an adjustable spacer. Also included are a pair of machined tube rings and a set of Vixen-style dovetail bars — one on the bottom for attaching to a mount and another on top for accessories.

The heart of the scope is its air-spaced-triplet objective lens featuring Hoya FCD-100 ED glass — a material prized for its color-correction capabilities. The telescope I received was a display model, and the first night out I found the optics a bit out of alignment. Since the scope doesn't allow collimation adjustment, Airy Disk quickly sent me a new objective assembly. At first, I was a bit taken aback by the idea of having to replace the lens, but my fears were unfounded. The lens cell screws off easily, allowing me to replace the objective without difficulty. Star testing showed the new objective to be in collimation.

Airy Disk provides analyses of each scope they ship, which is unusual in an instrument at this price. However, the documentation proved a bit confusing. One report showed an overall Strehl ratio of 0.976, which is surprisingly good for a scope at this price. A second, more detailed report was also provided but gave a Strehl of 0.894 instead. I'm not sure how to account for the different values.

Visual Performance

After replacing the objective lens, I spent a few days with the scope evaluating its visual capabilities. Bright stars in the middle of the field showed no color to my eye, and the views of the Sun with a Herschel wedge displayed crisp details in sunspots and granules across the solar disk. I also tried the scope with a Daystar Quantum Chromosphere filter and found the background did show a bit of haze. The appearance of a black background when solar observing is a very high bar to attain in scopes that aren't designed specifically for that kind of work. I've seen few scopes that could achieve this feat.

Views of the Moon were contrasty and sharp, with the lunar disk surrounded by black sky and a few stars. I used the bright limb as a critical color test and only at high power could I just catch some hints of red/yellow/orange against the dark of space. So far so good.

Next, I performed a star test, which revealed a small amount of spherical aberration. During my visual tests



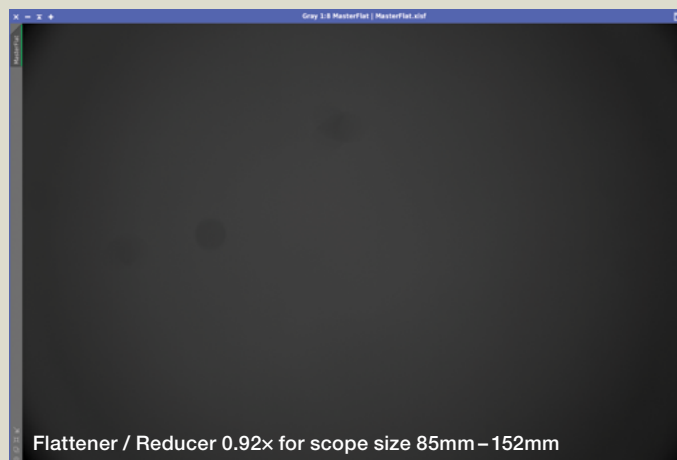
▲ *Left:* The scope includes two ring baffles to reduce internal reflections. A threaded aluminum lens cap protects the objective when not in use. *Right:* The heavy duty, 2-inch dual-speed focuser has a bracket for mounting a finderscope or guidescope, though neither are provided. The focuser and its 2-to-1¼-inch adapter use non-marring brass compression rings to secure eyepieces and star diagonals.



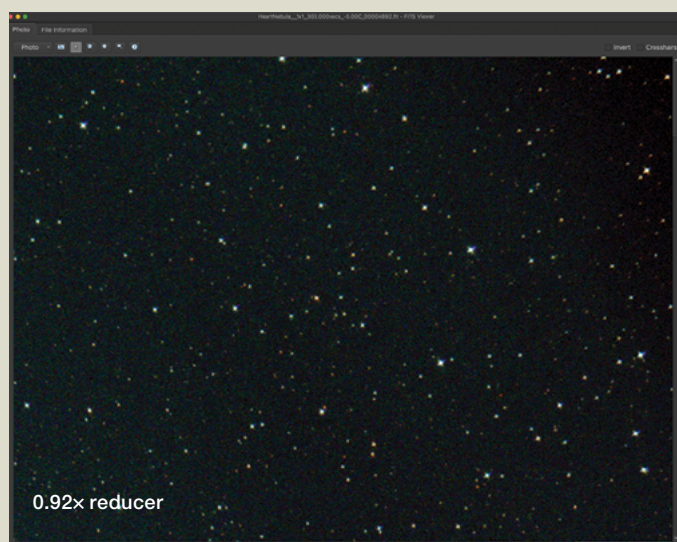
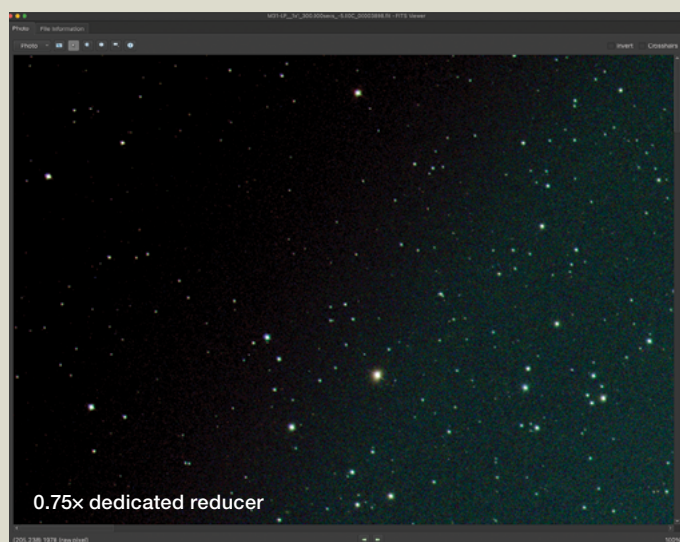
▲ *Left:* The rack-and-pinion focuser rides along three linear bearings that produce excellent rigidity. *Right:* a knurled thumbscrew located on the bottom of the gearbox locks the focuser in place.



▲ *Left:* The focuser's 2-inch adapter unscrews to reveal M63 threads that accept the company's optimal focal reducers (right).



▲ Both optional reducers produce slight vignetting that was easily corrected in post-processing with flat-field calibration frames.



▲ Stars in the images taken using both focal reducers appear round on a full-frame detector except in the extreme corners. While the stars were still acceptable with the 0.75× model, they appear unacceptably astigmatic with the 0.92× reducer. Users with APS-C cameras won't see these issues.

I didn't need to tighten the focuser's tension screw for just a diagonal and eyepiece.

Astrophotography Tests

To assess the scope's photographic capabilities, I used the supplied optional accessory optics, starting with the awkwardly named "Flattener / Reducer 0.92× for scope size 85mm - 152mm." It's made with two extra-dispersion (ED) glass elements and is priced at \$250. This adapter takes the scope's native focal length of 700 mm down to 644 mm, changing the effective focal

ratio to f/6. The back focus is listed as 55 mm. The second adapter is a 3-element 0.75× Flattener / Reducer made specifically for the 106mm APO (\$280). It brings the focal length down to 525 mm and the focal ratio to f/4.95. The back focus requirement for this adapter is listed as 55 to 60 mm, which I found rather odd, as corrective optics typically require a very precise spacing to do its job properly. Performance certainly wasn't acceptable within this entire range, which brings me to an interesting feature integrated into both corrective lenses. They each have adjustable

spacers built right into them. You can dial the space between the correctors and your camera from 0 to 5 mm in increments of 0.05 mm steps, and the motion is quite smooth. After some adjustments, I established 57.5 mm as the best spacing. Of course, your mileage may vary.

Your camera attaches directly to either reducer with T-threads, and both units accept 2-inch filters (another nice touch). If you have a color camera, you can connect a UV/IR filter or a light pollution filter directly to the reducer. The 0- to 5-mm adjustment seems like an

ideal benefit as well because putting one of these filters in line changes the back focus by the thickness of the filter's glass, usually about 1 mm or more.

All this sounds like it would be quick to dial in and start imaging, and I had a full-frame color camera on hand that I was anxious to try with this scope. In practice I found that I had to experiment quite a bit to find the optimal spacing with both adapters. I made sure I started with the minimum recommended spacing of 55 mm between the camera and the reducers. I anticipated adjusting the spacing by as much as 1 mm when using with an UV/IR blocking filter or a light pollution filter. However, I had to spend a good bit of time adjusting the spacing, refocusing, and then evaluating the corners of images to see how the change affected the star shapes. Corner stars showed significant distortion initially, looking bloated and cross-like rather than round. The goal was to minimize these to acceptable levels. With each spacing change, refocus was necessary and, just like finding focus, I could clearly see the correction in the corners of the images get progressively better, and then start getting worse.

This brings me to the performance of the scope with a full-frame sensor. The scope is described as capable of illuminating a full-frame (24×36 mm) detector, but marketing being what it is, you may not get quite what you expect. I would say the scope's corrected field coverage is closer to full frame than to a cropped sensor, but it's no match for any of my premium refractors. I could adjust the spacing such that stars at the edges of the field were close enough to being round that they could be corrected with software in post processing or cropped out after stacking. This level of performance was the same with both reducers, although the 0.75× flattener was substantially better than the 0.92× model, most likely because it was designed specifically for this scope rather than for a range of optics. The stars in particular degrade quite rapidly at the very corners where you can see chromatic aberration and distortion. Again, this is only in the extreme cor-

ners of the field of view.

I also tried the scope with a monochrome sensor, though not a full-frame unit. I used the Player One Poseidon-M with an APS-C-size detector and did some imaging with a Chroma 3-nanometer hydrogen-alpha filter. The 28-mm wide field was well-corrected from corner-to-corner. No optical distortions were visible at all in this smaller field.

Final Thoughts

For visual use, the Airy Disk 106mm is a fine scope. The build quality and the focuser are excellent, and the instrument looks and feels like a high-quality telescope. The views were quite satisfactory to me as well, and better than many refractors I've tried at this price. For twice the money, the next tier of refractor quality will give you a solid and noticeable incremental improvement, but certainly not twice as good.

As an astrograph, I did find the "full frame" claim to be a bit of a stretch, particularly with the 0.92× flattener. The horizontal and vertical edges from such a sensor were decent enough and can be easily corrected in processing.



▲ Both the optional 0.92× flattener / reducer (left) and 0.75× (right) have built-in extensions with index marking that allow precise adjustment of the spacing between your camera and the rear element of the corrector.

The corners, however, were truly bad on the 0.92× flattener, showing badly distorted stars. Corners with the 0.75× reducer were much better but not perfect. On the other hand, if you typically work with smaller sensors, this is an excellent scope even with these limitations. Given that it's one of the lower-cost refractors of this size on the market, I'd consider it a great value.

■ If Contributing Editor **RICHARD S. WRIGHT, JR.** could only keep one telescope, it surely would be a high-quality refractor.



▲ This image of The Andromeda Galaxy, M31, was captured with the Airy Disk 106mm and dedicated 0.75× reducer and a full-frame Player One Zeus camera. With this combination the outer 1/8 of the field required some cropping to remove distorted stars in the corners of the frame.