Stunned is the wrong word, though. Impressed? Sure. It's a lot bigger than the bantam-weight Borg 101ED I use (typically run at f/4) and nobody would call it "small". But, potential customers needn't be all that concerned with the size on many popular mounts. In its shortest configuration (with the dew shield removed), it's about 33.5" long (with the dew shield attached it extends to 42" long). The bare OTA clocks in at 12.8 lbs. Add the dew shield and you're up to 15.8 lbs. Toss in the rings and dovetail and you're at 18 lbs. Get it fully loaded with the finderscope and diagonal and you're right at 20 lbs. This is all right on par with typical 8" f/4 - f/5 scopes. Unlike those options, if you're really concerned with weight (e.g., if I were imaging with this on my previous mount, a Tak EM-10), you could replace the 3 lb dew shield with a piece of Kydex and be ready to image in 15 lbs.

Included Accessories

One of the things that struck me about the 127ED (and the Levy Mak Newt I got to play with for a bit) is that it's almost as if the manufacturer is spending a good amount of time and effort to think about what will make the owner's experience better. Go figure! Let me explain what I mean here. First, the fit and finish are excellent. Seams are tight, the mechanicals move smoothly, and the paint job is top notch. It goes beyond that though in that the included accessories are both excellent and well thought-out. The dovetail is setup to allow you to remove cone error (4 bolts on it let you square up the OTA if needed). The finder is not only optically very nice, but its reticule is illuminated. Nice! I just love the carry handle and the fact that they thought enough to stick a slot in it that allows you to mount accessories on it. 1.25" prism? Nope, a solid 2" 99% dielectric model for the diagonal. Finally, the case is just fantastic. As I said, it's as if they sat down to think about what the potential owner will actually do with the scope. We'll store it and need to bring it to a dark sky site (so a good case is a real plus). Even GOTO mounts need alignment stars (so a nice straight-through finder that lets us quickly center things is a plus). Astrophotographers will want to strap on a guide scope or piggy back a DSLR with a lens on there (so, some way to bolt something on is a real plus). Get the picture? It's a really well thought-out package in which nothing feels cheap, nothing seems missing, and nothing seems like it needs to be replaced out of the box. There's a lot of added value in the package.

Focuser

For an astrophotographer like me, the focuser is critical (and thus deserves its own heading). The focuser is typical of many imported scopes today, which is to say that it's a quite reasonable Crayford style with a nice 10:1 fine-focus knob mounted on one side. Motion of the 2" drawtube is smooth and there are adjustments available on it to suit the tension to your needs and taste. The drawtube has a range of 4.75" and I had no troubles reaching focus with my cameras (QSI 540 wsg, Canon DSLR, and QHY 8Pro tried) at prime focus, with a HoTech field flattener in place, or with any of my eyepieces. All fittings on the focuser and diagonal come with compression rings rather than simple set screws for secure, non-marring attachment of accessories.

There was never any thought of it slipping with any of the loads I put on it. Rigs like the DSLR and the QHY8 Pro were handled with aplomb. In it's full "wsg" format (filter wheel, shutter, and off axis guider), the QSI 540 clocks in at about 3 lbs and it handled it well. With that level of load, there is a small amount of flex, but the system remained quite usable.

Optics

While I'm no pro at star-testing (I don't consider myself qualified to judge a quarter vs. a third vs. an eighth wave of spherical aberration yet), I'm not entirely naive here either. The scope turned in a very nice star test. Collimation was spot on and there was no sign of astigmatism. Diffraction patterns looked nicely symmetric with the only clear difference being the color. Inside focus, there is a blue / violet halo surrounding the yellow / green core of rings. Outside focus, there is a yellow / green surround to the blue / violet core.

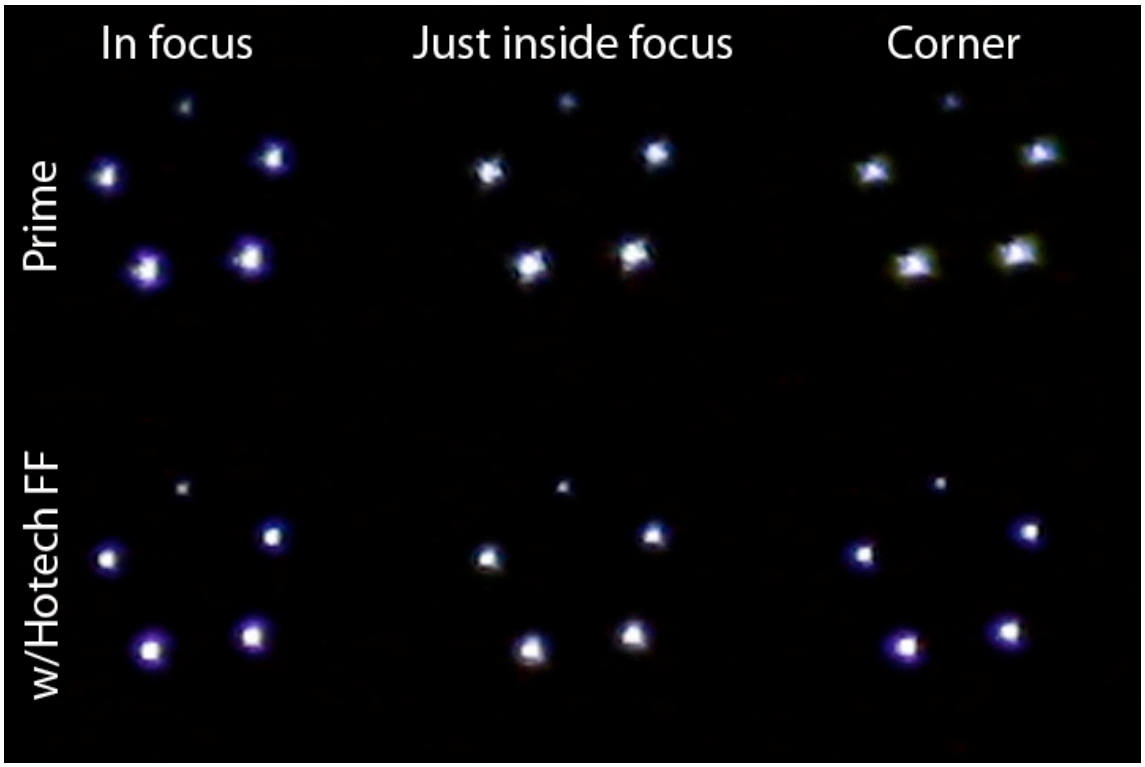

Figure 2: Single frames from an artificial star test (Hubble Optics 5-star artificial star) taken at best focus in the center of the frame (left), just inside this focus point (middle) and at best focus but from the corner of an APS-sized frame (right). Individual frames were taken both at prime focus (top) and with the addition of a Hotech SCA Field Flattener (bottom). The slight deviations from round here are the result of thermal effects ("local seeing" effects) and not a cause for concern.

At focus, stars were crisp and chromatic aberration (CA) was minimal. In typical use visually, there is no CA to worry about or become distracted with. For example, one night with an eyepiece to the scope, I was hard-pressed to detect much if anything on

Vega and the lunar limb was clear (turbulence would sometimes bring a slight hue to the surface). This is no achromat. It's not perfect, but it's darn good. For example, on another night out, Sirius did have a detectable violet halo at best focus using my 11 mm Nagler, but it was the kind of thing you could find when looking for, but it didn't present itself as an issue on its own. One thing to note here is that the chromatic aberration (or CA, caused by a shift in the focal position for some colors relative to others) could entirely disappear with a tiny shift of the focuser.

The images of a Hubble Optics artificial star shown in Figure 2 show this effect well. Here, on the left, we have the 5 stars taken at best focus where the violet halo can be seen. In the middle, the focuser has been moved in ever so slightly and the overall image is a fraction of a hair less sharp. As you can see, the image is now free of any spurious color. Astrophotographers with optics that have a curved focal plane will often focus not dead-center but a bit off-axis to split the difference and get a better image overall with the center of the frame being a bit inside the plane and the edges being a bit outside (rather than the center being at the plane and the edges being far off the plane). Instead of a focus position that varies spatially, with CA the focal position varies by wavelength. Here, the difference is small enough that many may intentionally or implicitly split the difference here and choose a focus position that brings more wavelengths very close to focus. (Of course, "best focus" is in the eye of the beholder. If we or our cameras are more sensitive to blue and violet, the middle panel is the "in focus" image.) All this means is that if you're using a one-shot color camera like a DSLR, you'll probably want to check a color image when doing the final focus to make sure you've take out that violet halo and are more like the middle panel. Honestly, your long-exposure shots won't be harmed at all as they will have seeing and tracking causing more softening than that touch of focus

Off-axis, the ES127 really shines. With the focuser in the "in focus" position (left panel), I moved the artificial star image to the upper-right corner of an APS sensor (Canon Rebel XSi). We can see that the stars' focus has shifted a touch (no more violet) and that there is some distortion, but the amount is really quite small (these images are magnified considerably). This is considerably better than I had expected. Typically, as we move away from the center of the FOV, the stars will become at the very least, slightly elongated, aiming inwards. The ES127 does a very nice job at staying clean here in the corner. This was backed up by test shots of a Norman Koren MTF chart that showed a small 25% drop in the LPI that could be resolved in the corner of the frame (this is a good bit better than my Borg doublet at prime, but not as good as the Borg gets with its dedicated reducer / flatteners that take it to < 10% of a drop). What error the ES127 has here was very nicely addressed by a Hotech 2" SCA Field Flattener (ES has their own flattener in the works). As you can see from the bottom panel in Figure 2, the corner image looks exactly like the center image. But really, the corner performance at prime is very good and far better than I anticipated.

Real World Visual Performance

Amateur astronomers can be a hypercritical bunch. If Scope A and B perform identically in all respects except that A out-performs B when Sirius is viewed at the edge of a 31

mm Nagler, we'll often say that A is better than B. This can then go on to let us justify to ourselves why we might pay a lot more for A (for that extra bit of performance, etc.). I can certainly understand this line of thinking, but I also have a very pragmatic side (hence the software I write). So, barring attempts to make it show any faults, what is the scope like?

In short, it's a great scope. No 5" scope is going to let my naked eye resolve M51's arms from my urban yard. What 5" can do, the scope does very well. There are no annoying glares or flares from the moon or neighbor's lights. Contrast is excellent and stars are tight and round with no errors that draw your attention. The moon is a joy to cruise at any magnitude my skies could support. The scope mechanically and optically disappeared and I could focus on whatever I wanted to observe.

Figure 3: Test shot of M42 taken with the ES127 ED and a QSI 540 wsg camera using Baader LRGB filters, a Starlight Xpress Lodestar, a Losmandy G11, PHD Guiding, and Nebulosity