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Home / The William Optics Zenithstar: 66mm f/7 ED Triplet Apochromatic Refractor

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The fully multi-coated ED triplet lens and retracted dew-shield.

Like many amateur astronomers, my first telescope was a little 60mm long-focus refractor that my parents gave me for Christmas when I was a boy. For months before it arrived I thought about it constantly and couldn't wait to get my hands on it. Several years later, I was drooling over the ads for an 8" Schmidt Cassegrain. After that, it was a 13" Newtonian. I never thought I would once again be looking forward to seriously using a 66mm refractor! However, I bet that I am not the only astronomer to feel that I have somehow bizarrely managed to come full-circle in the hobby.

Small refractors are enjoying a resurgence at the moment, which might sound strange considering that most astronomers today are thoroughly aware of the aperture-is-king rule. There is no denying the fundamental law of optics, which states that the more light an instrument can collect, the more you can see. Indeed, there really is nothing quite like getting a good look at the Orion Nebula, for example, through a 20" Dobsonian from a dark-sky site but how many of us can enjoy such a privilege often?

It is a sad fact that many of today's amateur astronomers find their observing limited by increasingly light polluted skies, as well as the routine demands of work and family life. Therefore, the ability to observe the sun, moon, planets, and brighter deep-sky objects at a moment's notice is an immensely attractive one, and this is a role well suited to small to medium aperture refractors: Sharp optics, combined with rapid cool-down times, little need for routine collimation and rugged mechanics result in instruments that you can take out to the back garden at a moment's notice, or around the world to enjoy pristine skies or an exotic eclipse.

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William Optics is one of astronomy's younger players, but over the past few years they have developed a solid reputation for building small, high-quality refractors. Their new line of Zenithstar refractors includes 4 new models: a 105mm ED triplet apo, an 80mm doublet achromat, and two 66mm telescopes—a 4-element ED Petzval semi-apo, and an ED triplet apochromat. Several months after their introduction, I had already heard a great deal of praise for the 66 Petzval semi-apo; but I have been in the market for an ultra-portable apo in the 60mm-75mm range and the Zenithstar happened to come along at just the right time.

Intrigued by the prospect of an ED triplet apochromat under 70mm, I decided to go ahead and order one. Several weeks later the telescope arrived, well-protected and packed neatly into an attractive black nylon travel case no bigger than an average laptop bag.

What's in the Box?

The standard Zenithstar 66 Apo package includes: the optical tube assembly, 1.6" 1.25" adapter, 45° correct-image 1.25" prism diagonal, as well as a 20mm (66°) eyepiece and a small nylon carry bag with pre-cut foam spaces for the scope and several accessories.



The scope, 45° diagonal and 20mm eyepiece all fit neatly into the supplied case.

The Mechanics:

Eschewing the typical white paint job used for most telescopes, the ZS 66 Apo, like its other siblings in the Zenithstar range, is coated in a lustrous black finish. Similar to the new 105mm ED triplet apo, the ZS66 uses a richly contrasting gold on the focus wheels and lens cap - an overall aesthetic which is quite striking. This really is a very sleek looking and beautiful little telescope.

The overall fit and finish of the ZS 66 Apo is superb, and, in my opinion, it matches any other small premium refractor on the market. Built to last several lifetimes, the entire optical tube assembly is hefty and extremely well built. Aside from the dust plugs and eyepiece caps, there is no plastic anywhere. The entire scope is made from precision CNC (computer numeric controlled) aluminium components and finished with a tough, glossy black anodising. This looks great, but I quickly noticed that it also manages to show off every smudge and fingerprint you leave on it. I should also mention though, that the supplied case includes a soft cleaning cloth—a thoughtful touch from WO, and a practical remedy for keeping the telescope in its best condition.

The retractable dewshield is well blackened on the inside and slides forward and back with just the right amount of tension—giving adequate dew prevention while also allowing the overall length of the OTA to

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shrink from 16.1" to 13.6" which is useful for travel and storage.



A side view of the scope with the dew-shield retracted; a great travel-size telescope.

William Optics have done something a bit different on their 2 smallest new refractors; rather than employing a standard 1.25" focuser, (or even a 2" both the ZS 66 Apo and semi-apo are built around a 1.6" (40.6mm) diameter focuser - the standard for SCTs. This feature not only allows the use of 1.25" eyepieces and accessories, (using the provided step-down adapter) but also opens up a wide range of SCT accessories - from field flatteners to 2" diagonals. While some may find the logic somewhat unconventional, I feel that it is a useful compromise.

The focuser is a Crayford-type, and it deserves particular mention as one of the finest I've ever seen on a small telescope. It is extremely smooth and precise. The tension was pre-set at the factory and has a very solid and positive feel - without any slop or backlash. One of the best features is that the entire focuser can be both locked, *and* rotated - a full 360°. This is a beneficial feature, and can be immensely critical for photography as well as visual observations. The drawtube can be racked out just over 60mm, which is a fair amount of travel on a telescope of this size.

Although no tube rings are supplied, I found no problem mounting it on a lightweight Swarovski/Manfrotto tripod or similar rig using only the 20 screw holes on the bottom of the L-bracket at the base of the scope. I also attached it to an EQ-5 equatorial mount with a wooden tripod, a set-up which proved essentially unshakeable.



Truly first-class mechanics and a very attractive scope overall. The little Crayford-style focuser is a great compliment to the optics. Note the large textured focus wheels, 1.6" - 1.25" visual back with compression clamp, and a separate silver thumb-screw (top) for rotating the entire focuser. Underneath the focus wheels is another screw for locking the focuser.

The Optics:

The apochromatic objective lens is a triplet design with the central element made of ED glass for improved colour correction. Looking at the objective head on, I noticed that it is a broken triplet, (a bit of optical slang used to describe a three-lens objective where two of the glass elements are in contact, and the third is separate). In the Zenithstar, for example, the first and second lens elements are air-spaced, while the second and third elements are in contact. This design is an interesting compromise between a fully air-spaced and a completely cemented or oil-spaced lens. It can make the fabrication of the lens slightly easier than a fully air-spaced objective, while also helping to control spherochromatism. This type of optical design is simply a scaled-down version of the bigger flagship of the Zenithstar line, the 105 ED triplet apo. The combination of a small 66mm aperture and a medium (f/7) focal ratio helps to provide excellent colour correction. I did notice one little quirk, but I get to that in a moment.

Despite having 3 lens elements rather than the usual doublet objectives employed by the majority of today's refractors - the overall contrast was first-rate. This is the product of several factors: the optical design, decent baffling and efficient multi-coatings on all air-to-glass lens surfaces. The Zenithstar66 Apo, similar to other William Optics refractors, uses a matte black insert with stepped baffles to help block stray light. This seemed to work quite well; for example, when sweeping the skies around the moon on nights of good seeing, the lunar edge would suddenly burst into the field of view without much warning.



The high-transmission lens coatings, matte black interior and stepped baffles work well and help to create very sharp, contrasty images.

Star Test/Colour Correction

Considering the fact that this small telescope had literally travelled half-way across the world in order to reach me, I was initially concerned about the alignment of the lenses because there is no means for the user to collimate it (but apparently it can be done by William Optics specialists). Surprisingly, the very first night that I had it was clear, and I discovered very quickly that collimation was spot-on.

In focus at high power stars looked pure white with a perfectly round Airy disk surrounded by a first diffraction ring and hints of a second. In moments of steady seeing, stars on either side of focus presented smooth, concentric and almost perfectly identical diffraction patterns, with only a slight amount of extra-focal colour surrounding the bright first diffraction ring. Overall, I was really impressed by the quality of the objective figure. The little triplet lens in this particular scope definitely has one of the best star tests that I have seen yet on just about any telescope in this price range. (Better, in fact, than plenty of other scopes that I have used which cost significantly more?)

As I mentioned, there were a few minor quirks that I noticed. In particular, I found the colour correction to vary ever so slightly, depending on the thermal equilibrium of the lens, the stability of the viewing conditions and the eyepiece that I was using. For example, at 100x and over, a portion of the lunar edge

(but not the shadows along the terminator) would appear to have a very thin, faint bluish fringe, or high-contrast terrestrial scenes would display shadows with a vaguely purple tint. But then, I would come back to the same target later, (often with the same eyepiece) and find that any evidence of chromatic aberration had apparently vanished.

For the record, I am being quite tough on the issue of colour correction, and I would like to stress that this refractor is unquestionably apochromatic in terms of the modern commercial appellation. All telescopes will be affected to some degree by poor seeing, cool-down times and different eyepieces. Indeed, there are numerous other popular apos out there today with more colour. Ultimately, I believe that the ZS Apo is simply a bit more sensitive to these factors than some other scopes. In fact, William Optics rates this lens as colour-free up to 200x? but I found that once the views stabilised, I could push it up to 230x on the moon and Mars with excellent detail, contrast and colour correction.

Admittedly, British skies are not renowned for their stability, but in an effort to get an objective idea of this refractor performance I decided to set up my Orion ED80 doublet apo next to the smaller Zenithstar 66 ED triplet for a direct comparison. I tested them both out on the Sun, the Moon, Mars and some brighter deep-sky objects, as well as real and artificial stars and some daytime targets too.

My Orion ED80 is a good sample of this popular apo; it also arrived in essentially perfect collimation and shows only a trace amount of violet fringing on the brightest blue-white stars at high power, and little to none on the moon or planets. As expected, the larger scope had slightly brighter images and a larger image scale and both telescopes deliver clean white stellar images in focus, but I soon realised that there were some vital differences.

The first thing that slightly surprised me was the overall contrast in the little triplet. Looking at the sun, using Baader Astro-solar safety film with both scopes, the background sky in the ZS 66 was almost perfectly black, while it appeared a lighter shade of grey in the 80 ED. The difference in contrast was quite noticeable. The solar image in the bigger refractor also seemed to suffer a little more from some false colour.



Side-by-side solar viewing with the ZS66 Apo and an Orion ED 80

Although the Zenithstar colour correction seems more finicky and susceptible to adverse seeing than the Orion, there is more to consider than chromatic aberration alone when viewing many astronomical targets. Again, when viewing the lunar landscape and trying to look through the mushy atmosphere at Mars, I noticed that (when the seeing settled for both scopes) the little ZS always gave a sharper image with better contrast. This added visual punch made a significant difference when trying to resolve fine surface features. And while the 66mm scope can quite match the 80mm in terms of resolution, I could push the Zenithstar further with better results.

This was also confirmed looking at an artificial star at high power with both refractors side-by-side. The overall figure of the 80 ED lens is descent, showing smooth, even and concentric diffraction patterns, with a bright outer ring and no signs of astigmatism. Overall, the spherical correction is not bad, but the ZS is clearly superior.

The excellent control of both chromatic and spherical aberration was definitely noticeable in actual use; whether I was viewing the Moon or Mars, or the leaves on a distant tree, the Zenithstar 66 apo

consistently snapped to focus, yielding some of the sharpest views that any instrument of this size, regardless of its price, would be capable of showing.

Focusing with the f/7 focal ratio is a bit more forgiving than shorter instruments which have a thinner focal plane. And although it doesn't have quite the wide-field capability of its main 60mm competitors like the Tak FS60C and TV 60, both of which are approx. f/6, it does have a slightly larger image scale. (When looking at the moon, sun, or planets with these smaller scopes, you need all the help you can get!)



This little photo of the moon can hardly begin to do this scope justice, but I thought I'd add it just to give some indication of the typical contrast between the jet-black sky and the (somewhat underexposed!) moon.

In the Field

Attaching the 45° correct-image prism diagonal and 20mm eyepiece which come supplied with the terrestrial version of this scope, there was plenty of focuser travel in either direction to allow the little apo to focus from +/- 20 ft. to infinity. In this configuration, the Zenithstar yields bright, sharp high-contrast images, and thus makes a terrific spotting scope. I did find (unsurprisingly) that dropping in successively higher power eyepieces into the prism diagonal exaggerated any image aberrations, resulting in noticeable false colour and a breakdown in sharpness. - It should be stressed that this is purely the result of placing a prism in the light-path, and not caused by the objective lens itself.

Attaching a 1.25° 90° mirror diagonal produced two noteworthy changes: first, the image was once again pristine and colour-free, and second, the scope had to be racked essentially all the way out in order to reach focus at infinity with most eyepieces. This was not too much of a problem for my TMB Monocentrics or Vixen Lanthanums, or even most generic prisms and orthoscopes but I couldn't get my 8mm TeleVue Radian to focus without adding some sort of extension tube. Clearly, this telescope really needs to be fed the prism diagonal that came with it or, better yet, a 2° diagonal, in order to perform at its absolute best.

A word about diagonals: I ended up buying one of the WO 2° SCT models; in part to match the overall look of the scope, but also to use 2° eyepieces - one of the great joys of this small apo. The space in the supplied case is actually cut to include a 2° diagonal and I must admit that I love being able to easily carry around the refractor, diagonal, two (smaller) 1.25° eyepieces, one 2° eyepiece, a Barlow and a solar filter, all in one sharp little case. At the time of writing, William Optics informed me that they are in the process of crafting an adapter which will allow customers to use standard push-fit 2° diagonals if they wish. (And trust me, you really will want to have 2° capability with this refractor!)

With the very minor exception of the 1.25° diagonal, the Zenithstar 66 Apo is an absolute joy to use. With a 32mm TeleVue prism, the scope yielded a 3.3° (approx.) field of view, with images crisp and clear across most of the image plane. There is a little field curvature - but you will find this, at least to some degree, on any triplet refractor on the market. It will be interesting to see how this scope performs on deep-sky astrophotography, and with a suitable field flattener or focal reducer, this refractor should prove to be an eminently capable, and highly portable astrograph.

Out in the field, this scope's main competitors will naturally be the Takahashi FS-60C, and the TeleVue 60. Even considering the addition of a 2° WO SCT diagonal, the Zenithstar 66 still comes out the clear

winner in terms of price. This is all well and good if money is the principal concern, but I also feel that, in terms of optical performance, it certainly holds its own in the company of these fine scopes.

I must confess that my primary interest is lunar, solar and planetary observing and imaging (it a good thing too ?considering that I live in central London!) and I really wanted a rugged, portable apochromat that I could take anywhere at any time and still expect satisfying views of these targets at the highest possible powers. Actually, I feel that its performance is probably closer to 70mm than to 60mm. (Now I realise that it is technically only 1mm over the half-way threshold, but it just *feels* bigger.) And although I wasn't planning to see much at all on the planets, this scope can take a lot of magnification well and make the most of its modest aperture.

I have had my Orion ED 80 for a while, and I love it, but found that its slightly oversized build (and the suitable mount it requires) was often keeping me from taking it on trips abroad or out to the countryside. I needed a telescope which gave me zero excuses to leave it behind, and the Zenithstar's sharp optics and 3.5lb, 13.4" frame leaves no room for argument.

So, overall, how useful is this scope? For those of you who really have to be able to cover the full range of observing and imaging activities, you should probably consider something a bit larger ?particularly if portability is less of a concern. Indeed, there are plenty of 80-110mm apos out there that are quite portable and also give you greater reach. Practically all of which will also reach much further into your bank account too!

The ZS 66 Apo could be a luxurious first scope for someone entering the hobby who wants a beautiful, high-performance terrestrial/astro scope. Ultimately though, I think that this little apo is worthy of serious consideration by the growing majority of today's amateurs who own at least one larger telescope, but require a thoroughly portable, high-quality second scope. What it lacks in aperture, it more than makes up for with its razor-sharp views, outstanding mechanical construction and portability. It really is exquisitely well-built, and practically deserves to be considered a functional sculpture. When you combine this elegant versatility with its comparatively low price, (and the included accessories!) I can see little reason for most serious amateurs not to own one.

It has been said many times over that the most important scope in any astronomer's arsenal is the one that they will use most often. I feel that I have already wasted too many beautiful observing opportunities, both at home and abroad; gazing up at a glorious night sky or distant vista ?wishing that I could have been bothered to bring along or set up a telescope. Now, thanks to the new Zenithstar 66 Apo, those days (and nights) are over?

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