

REVIEWED

SHARPSTAR 13028HNT

A sharp-looking, sharp-imaging astrograph



Ade Ashford checks out SharpStar Optics' new, lightweight 130mm, f/2.8 hyperbolic Newtonian astrograph.

At a glance

Optical design: hyperboloid Newtonian with two-element coma corrector/reducer
Aperture: 130mm (129mm, measured)
Focal length: 364mm (361mm, measured)
Focal ratio: f/2.8
Corrector type: air-spaced doublet, one ED glass element
Image circle: 44mm diameter, 6.9-degree field of view
Image scale: 6.35mm per degree, 567 arcseconds per mm
Back focus: 55mm
Focuser: 2.5-inch rack-and-pinion
Tube dimensions: 394mm long, 174mm diameter (end rings, 182mm diameter)
Tube weight: 4.3kg
Other features: foam-lined custom aluminium flight case; Vixen-style dovetail mounting bars; carry handle with piggyback camera rail; 1.25-inch eyepiece adaptor; M48 × 0.75 camera adaptor.
Details: firstlightoptics.com
Price: £1,649

Not content to sit on their laurels after manufacturing the first 150mm aperture hyperbolic Newtonian with an integral reducer-corrector, to deliver a full-frame-sized 44mm imaging circle at f/2.8 (see our review of the SharpStar 15028HNT in the December 2019 issue of *Astronomy Now*), China-based Jiaxing Ruixing Optical Instrument Co., trading as SharpStar Optics, is proud to announce the arrival of its latest f/2.8 astrograph – the 13028HNT.

Aside from possessing an aperture and focal length 13 per cent smaller (with a 25 per cent smaller light grasp) than SharpStar's debut model, the 13028HNT sports durable, dielectrically coated mirrors for enhanced light transmission, as well as a focuser that accepts screw-in 48mm filters and a new two-element reducer-corrector featuring one lens of ED glass for enhanced colour fidelity.



▲ A comparison of the size of the SharpStar 13028HNT, left, next to its larger predecessor, the 15028HNT. Both are stood on the SharpStar flight case that the 13028HNT arrives in.

First impressions

As befits its monetary value, the astrograph comes in a metal-cornered, foam-lined 56 × 33 × 30 centimetre, hard flight case to protect your telescope when not in use. Once I'd popped the latches on the lid of the review instrument I had an immediate sense of déjà vu: at first glance, the 13028HNT appears to be a scaled-down replica of its predecessor. You have to hand it to SharpStar: they certainly know how to manufacture eye-catching and exquisitely crafted products. Nor

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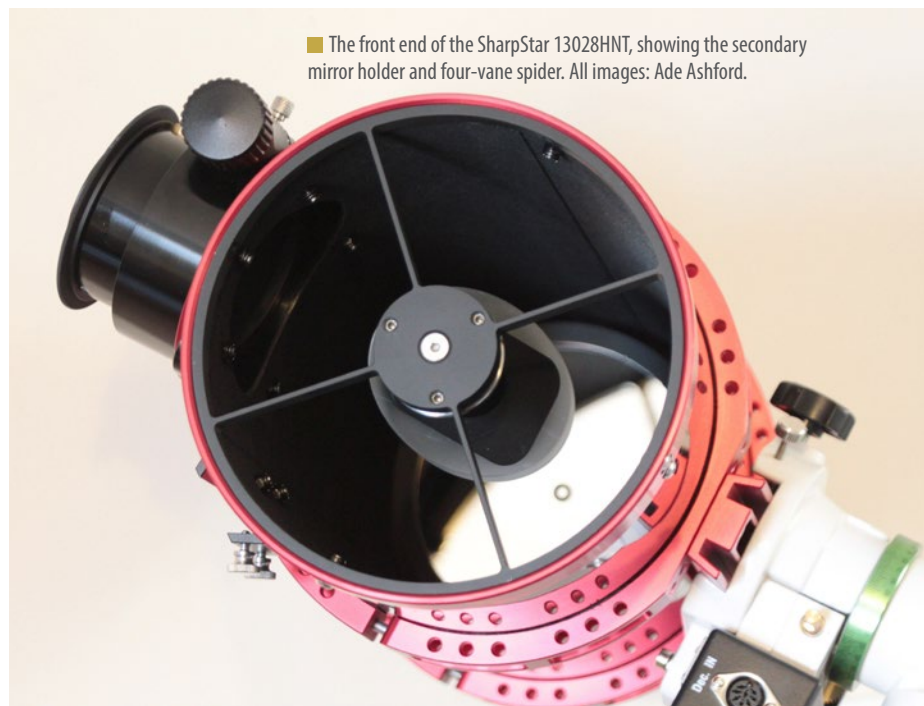
is it an instance of all style and no substance: SharpStar knows that a successful product requires both form and function.

The overall length of the SharpStar 13028HNT's optical tube, sans CNC-machined dust cap, is just 39.5 centimetres. Its red, anodised, aluminium end rings both fore and aft are 182mm in diameter, while the carbon-fibre tube has a diameter of 174mm. A quality touch is that all of the instrument's Allen head external bolts are made of rust-proof stainless steel for longevity. Best of all, however, is that the telescope is an answer to the prayers of those who only have access to mounts of low payload capacity, because the optical tube including tube rings and Vixen-style dovetail plate tips the scales at a particularly modest 4.3 kilograms.

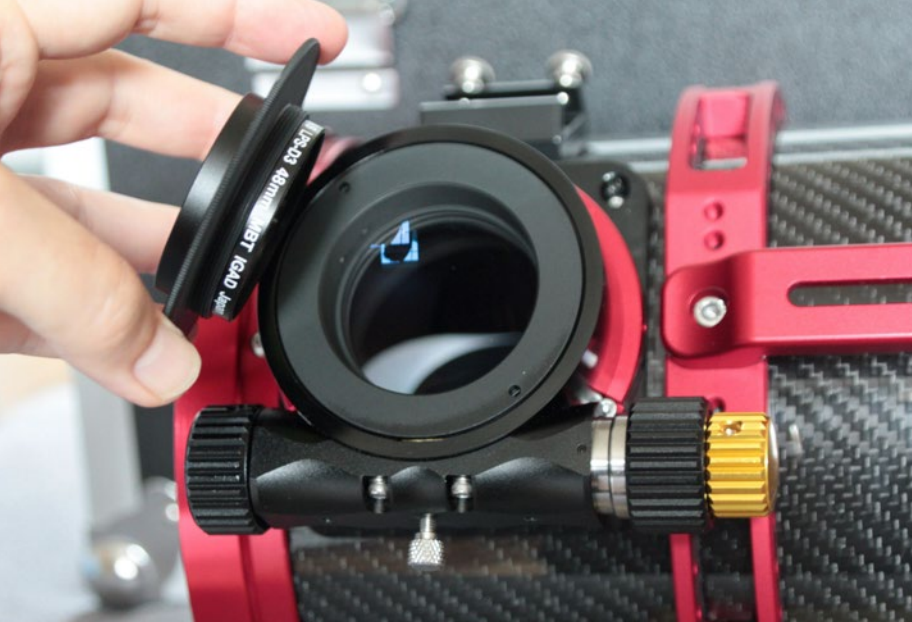
Key features

Part of the reason the 13028HNT is so light is that the instrument abandons conventional hinged tube rings, in favour of anodised, alloy tube clamps. These have been hollowed out by CNC milling, cleverly designed to be as light as they can possibly be while preserving rigidity and structural integrity. Hence, four C-shaped sections joined at their open ends by Allen-head bolts (tool provided) form the two tube clamps, their parallel spacing maintained by a 20-centimetre-long Vixen-style anodised alloy dovetail at the bottom and alloy handle (with integral piggyback DSLR camera rail) of identical length at the top.

The 13028HNT is not supplied with a finder- or guidescope, but there is a robust Vixen-style shoe to accommodate one. The low profile, 2.5-inch rack-and-pinion focuser has 22.5mm of travel, with dual-speed coarse and fine focusing knobs. One turn of the latter moves the drawtube 2.4mm. The drawtube is also engraved with a millimetre scale, which is useful when setting an approximate focus.



■ The front end of the SharpStar 13028HNT, showing the secondary mirror holder and four-vane spider. All images: Ade Ashford.

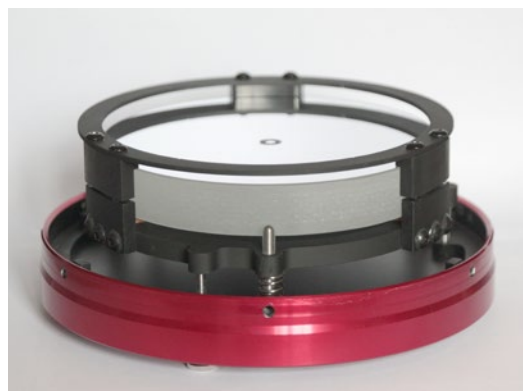


The focuser's base is equipped with three pairs of Allen head push-pull screws to collimate the drawtube and integral corrector-reducer, if required. (The review instrument was perfectly aligned out of the box in this regard.) You can also rotate the focuser for composing an astro-image, but you need a screwdriver with a small blade (not supplied) to first loosen three small, equidistant bolts, which is not the easiest thing to do in the dark.

The instrument's cross-shaped, four-vane spider and secondary-mirror mount is CNC-machined from a solid piece of alloy, so it's reassuringly rigid and stable. A central countersunk Allen-head bolt enables secondary rotation about the primary mirror axis, while three Allen-head grub screws adjust the secondary tilt to allow for collimation (the tools for this are provided). Furthermore, the 65mm, minor-axis elliptical flat is cemented to its holder with the correct offset that has been preset at the factory to accommodate the steep light cone

▲ A close-up look at a user-supplied M48 filter threaded into the drawtube adaptor of the focuser.

▼ A view of the rack-and-pinion focuser, which has 22.5mm of travel and two knobs, for coarse and fine focusing.



▲ The primary mirror cell. Note the spring-loaded nature of the push-pull thumbscrews for collimation.

that converges from the primary mirror. The tube interior is also flocked to totally suppress any light scatter.

Improved mirror-cell design

Some early adopters of this instrument's predecessor, the 15028HNT, discovered a slight flaw in the design of the primary cell, which permitted the mirror to tilt at certain tube orientations, thereby disturbing precise collimation. Thankfully, the primary cell of this astrograph is an entirely different design that doesn't have this issue. The 13028HNT's two-centimetre-thick hyperboloid primary has durable, high-reflectivity dielectric coatings and is permanently centre-marked for collimation.

Unlike the 15028HNT, where the primary rested on three domed copper studs, the rear face of this instrument's main mirror rests on three cork pads arranged equidistantly around its periphery. Three vertical posts at 120-degree intervals, featuring curved profiles concave to the primary's edge, prevent any lateral movement. Each post has on top of it a rubber grommet that barely touches the front edge of the mirror, preventing movement forwards or back. Finally, a full-aperture circular mask (actually, 129mm in diameter) bolted to the top of the posts ensures that the only diffraction in the optical train arises from the 1.75mm-thick secondary spider vanes.

Reducer-corrector design

Another new feature of the 13028HNT compared to its predecessor is in the optical design of the refracting f/2.8 reducer-corrector that is built into the focuser's drawtube. In the 15028HNT, this was a multi-coated, air-spaced triplet. However, in the case of the review instrument, a new air-spaced doublet design employing one ED (extra-low dispersion) glass element provides a high degree of colour correction with a slightly higher light throughput, owing to one less piece of glass in the optical train.

Furthermore, the supplied general M48 × 0.75 thread adaptor unscrews from the focuser drawtube to reveal a female M48 thread underneath, with a sufficient gap between it and the rear element of the reducer–corrector to install a standard 48mm filter. For example, if your sky is predominantly light polluted by white LEDs, you could use a 48mm IDAS LPS-D3 filter in the 13028HNT when imaging with a one-shot colour CMOS camera or a DSLR. When using the latter, you also need a DSLR-M48 ring adaptor appropriate for your camera to ensure that the 55mm back-focus requirement is satisfied.

Collimation

The three Allen keys required to service and maintain the 13028HNT are all included. The approach to collimating the instrument is the same as its larger-aperture predecessor and is not difficult, providing that you follow a methodical approach. Detailed instructions for the 15028HNT can be downloaded from the support page on sharpstar-optics.com. I strongly recommend that you also invest in a Cheshire eyepiece or a laser collimator, the latter being slightly easier to use – particularly out in the field when it's dark.

SharpStar provides a 1.25-inch adaptor that screws onto the drawtube for the collimating tool of your choice. As previously mentioned, adjustment of the astrograph's secondary mirror requires the appropriate Allen key(s), but collimation of the primary mirror requires no tools since it features three pairs of spring-loaded push-pull thumbscrews on the rear of the instrument. The 13028HNT required minimal adjustment on arrival, but needed no subsequent collimation despite frequent handling and transport over bumpy, rural roads.

Test performance

The instrument is designed to deliver a fully corrected, 44mm-diameter image circle that corresponds to the diagonal dimension of a full-frame (36 × 24mm) sensor. However, I suspect that most users are likely to use sensors no larger than APS-C format (22.3 × 14.9mm), either in

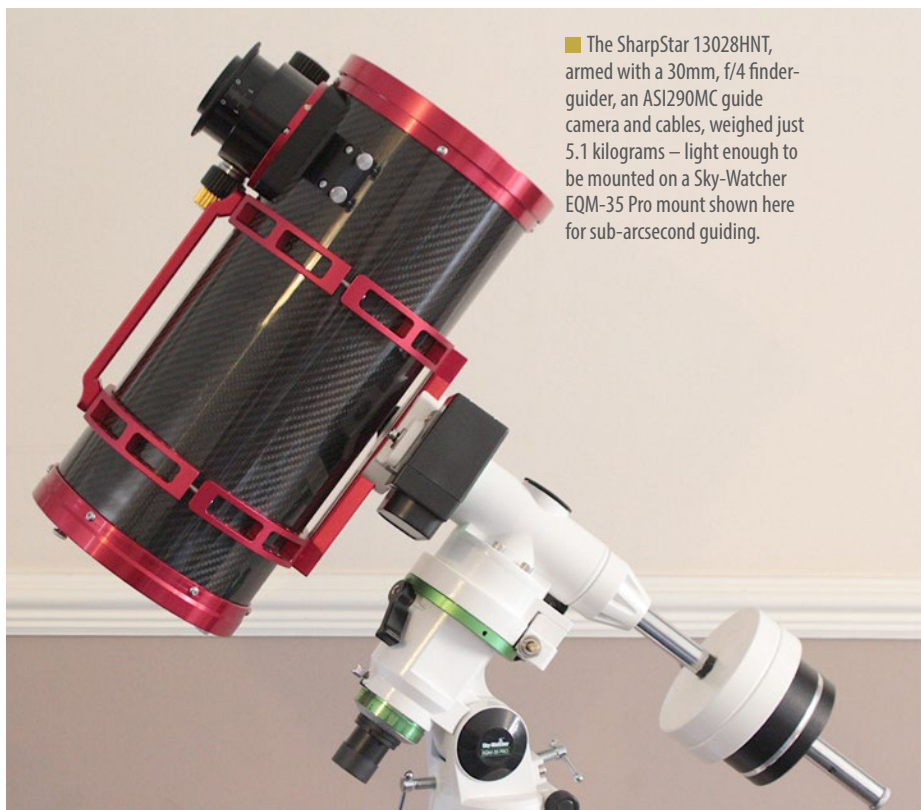
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▲ The rear of the telescope that houses the primary mirror cell, and the thumb knobs used for collimating it.



▲ A side view of the 13028HNT, with a Canon 5D DSLR (top), 30mm finder-guider and an ASI290MC guide camera.



■ The SharpStar 13028HNT, armed with a 30mm, f/4 finder-guider, an ASI290MC guide camera and cables, weighed just 5.1 kilograms – light enough to be mounted on a Sky-Watcher EQM-35 Pro mount shown here for sub-arcsecond guiding.

the form of dedicated CMOS astro-cameras or DSLRs. Hence, I used an astro-modified APS-C Canon 550D DSLR that, on paper at least, should deliver a 3.51×2.35 -degree field of view. (For comparison, a full-frame DSLR will field 5.63×3.76 degrees.)

Adding my Canon 550D, as well as a 30mm, f/4 finder-guider, an ASI290MC guide camera and cables, to the mass of the 13028HNT produced a surprisingly lightweight payload of just 5.1 kilograms. So I chose a modest and eminently transportable Sky-Watcher EQM-35 Pro GoTo mount to carry it all, driven by a ZWO ASlair Pro WiFi controller. Using multi-star autoguiding with this setup delivered respectable sub-arcsecond tracking.

On a Moon-free night from my favourite Bortle class 3 rural location in mid-Norfolk, the 13028HNT and an unfiltered Canon 550D camera taking three-minute exposures at ISO 800, revealed eighteenth-magnitude stars in the vicinity of the Andromeda Galaxy. Furthermore, plate-solving the Canon's $5,184 \times 3,456$ -pixel images revealed a true field of 3.54×2.36 degrees. Therefore, the review astrograph had an actual focal length of 361mm and a resolution

of 2.46 arcseconds per pixel (the Canon 550D has 4.3 micron-sized pixels). Star images were pin-point sharp to the extreme corners of APS-C sized frames, too.

Concluding thoughts

The improved light transmission afforded by the SharpStar 13028HNT's dielectric mirror coatings, in conjunction with the new two-element ED reducer-corrector, ensures that this f/2.8 astrograph delivers a respectable imaging-speed to payload-weight ratio for its price, which will certainly tempt refractor-users and owners of smaller mounts to consider this well conceived and implemented hyperbolic Newtonian. The 13028HNT's improved primary mirror-cell design eliminates mirror flop, and a focuser drawtube adaptor that now accepts screw-in 48mm filters makes shooting with one-shot colour CMOS cameras or DSLRs much easier.

Ade Ashford has travelled the globe writing about astronomy and telescopes, serving on the staff of astronomy magazines on both sides of the Atlantic. His first *Astronomy Now* review appeared over a quarter of a century ago.

▼ This image of the Andromeda Galaxy (M31), with its companions M32 and M110 is a slightly cropped and stacked composite of nine 180-second subs captured with the SharpStar 13028HNT and an astro-modified Canon 550D DSLR. No filters were used.

