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ATT Contents

Cover Images

On the cover is proud new owner Matt Harmston's setup of his SkyShed Pod – aptly named the "Riverside Space Port." As Matt notes in his article, "In the end, I wish I could have done this years ago. No hyperbole here: Regardless of timing, the POD is exactly what I needed for the Riverside Space Port.

In This Issue

Industry News/New Products

EXPLORE SCIENTIFIC FOCAL EXTENDERS

By Dr. James R. Dire

I own a small portable 70mm f/6 apochromatic refractor. I use the telescope for wide field imaging and as a travel telescope since it is small and compact. With its 420mm focal length, I can only achieve a magnification of 84x with my 5mm eyepiece. With a 2x Barlow and my 6.7mm eyepiece, I can achieve a magnification of 125x, which is respectable when I want to see Mars, Jupiter or Saturn.

When not travelling by plane, I have two telescopes I prefer to use when viewing planets. One is a 190mm f/5.3 Maksutov-Newtonian and the other is a 132mm f/7 apochromatic refractor. These two telescopes have focal lengths of 1000mm and 924mm, respectively. With my 5mm eyepiece, I can only achieve magnifications of 200x and 185x with these telescopes. On night of exceptional seeing, I like to bump the magnification up to 350-400x. I can achieve that with a Barlow!

For a quick review, the focal length of a telescope is the diameter of the objective multiplied by the f/#. The magnification is the telescope's focal length divided by the eyepiece's focal length. Keep in mind the maximum useful magnification of a telescope is:

- Maximum magnification = 2 × objective diameter in mm
- Maximum magnification = 50 × objective diameter in inches.

So with a 2x Barlow, I can get a much greater magnification from my telescope without owning a shorter focal length eyepiece. Another advantage of using a Barlow is that longer focal length eyepieces tend to have better eye relief and larger exit pupils than shorter focal length eyepieces. Therefore, using a Barlow with a longer focal length eyepiece takes advantage of those features.

Image 1

Whether they are called Barlows, telenegatives or focal extenders, they are essentially doing the same thing. They are single or compound lenses placed in front of a telescope focal point diverging the light, effectively increasing the focal length of the telescope. The first Barlow lens was invented in 1834 by the English physicist and mathematician Peter Barlow (1776-1862).

Original Barlows were single element concave lenses. The suffered terribly from chromatic aberration because different colors were refracted different amounts. Most Barlows sold in the last 50 years have two elements, making them achromatic. The best ones have three elements to keep all of the colors focusing at the same point!

Some telescopes are sold advertising extremely high magnifications. Recently, I saw a 60mm f/15 refractor advertised online able to achieve 675x. It comes with a very poor 4mm eyepiece. With the 900mm focal length objective, the 4mm

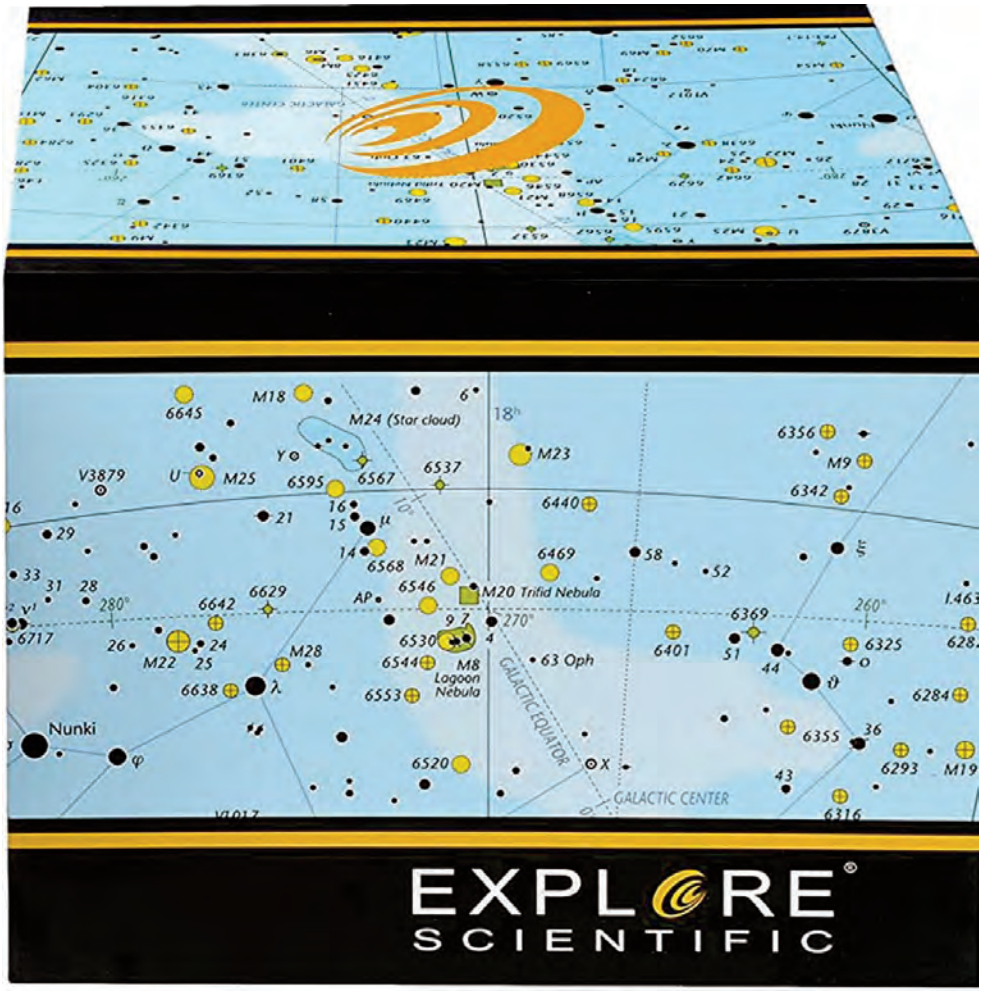

Image 2

eyepiece yields 225x. This already exceeding the maximum useful magnification of a 60mm refractor. The manufacturer throws in a cheap plastic 3x Barlow with this telescope, which they argue can triple the 4mm eyepiece's magnification to 675x. Mathematically the magnification is calculated correctly, but a 60mm refractor will never work at this magnification!

There are some great high quality Barlows sold today. It pays to get a good quality one and know when it is useful to use it. I recently purchased an excellent 2x model from Explore Scientific, which they call a Focal Extender (**Image 1**). I purchased the model with the 1.25-inch diameter barrel versus the 2-inch barrel since most of the eyepieces I would use them with have 1.25-inch barrels. Plus the ones with 2-inch barrows cost about $100 more. Their focal extenders can be purchased in either barrel size with 2x, 3x and 5x magnification factors.

As did all my Explore Scientific eyepieces, each focal extender comes in the standard and cool Explore Scientific box (**Image 2**). The box has molded foam to keep the eyepiece safe during shipping. In addition as can be seen in Image 1, each comes with a set of dust caps and a nice soft, felt storage bag.

In **Image 3** I compare the Explore Scientific Focal Extender with three other Barlows I currently own. Prior to purchasing the Explore Scientific Focal Extender, the best Barlow I owed was the one on the left, a Meade, three-element Telenegative. The two in the middle came with small telescopes I purchased. Both only have two elements. The leftmost of the two has metal components, while the rightmost is all plastic materials. This Barlow came with a brand new telescope I obtained in the spring of 2020. The telescope came with 21mm and 10mm Plossl eyepieces. It makes no sense using the Barlow with the 21mm eyepiece and using it with the 10mm eyepiece exceeds the maximum useful magnification of the telescope. I was quite surprised to find the Barlow in the box!

Visually, the Explore Scientific Focal Extender is made much more rugged than the other three and probably weighs as much as all three combined. The upper part of the barrel is serrated for better gripping, very useful when wearing gloves! The two Barlows in the middle each only have one setscrew to hold the eyepiece. The Meade Telenegative originally had three setscrews similar to the Barlows in the middle. But when I obtained it used they were missing. The only replacements I could find with the proper thread size are the Allen screws shown. Of course the Explore Scientific Focal Extender's setscrews have large diameter easy to grip set screws.

What's on the inside is more important than what's on the outside. **Image 4** shows the guts of each Barlow. The Meade one has pretty good quality glass. The two center ones, not so much. Plus they have much smaller diameter lenses, which stop down the amount of light reaching the eyepiece. The Explore Scientific has the largest lenses and their quality is excellent. When placing the Explore Scientific Focal Extender in front of a diagonal, the large diameter glass ensures that the entire light cone passes through to the eyepiece!

Unlike most Barlows, the Explore Scientific Focal Extender yields the same magnification factor whether placed in front of or after a diagonal. Plus the Ex-

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14"(355.6mm) f/4.5 Plate Glass Sandwich Mirror:	~~$1,380~~	$850
14"(355.6mm) f/4.6 Plate Glass Sandwich Mirror:	~~$1,300~~	$850
14"(355.6mm) f/5.0 Plate Glass Sandwich Mirror:	~~$1,200~~	$750
16" (406.4mm) f/4.0 Plate Glass Sandwich Mirror:	~~$2,185~~	$1,350
16" f/4.5(406.4mm) Plate Glass Sandwich Mirror:	~~$1,900~~	$1,150
16" f/5.0(406.4mm) Plate Glass Sandwich Mirror:	~~$1,650~~	$1,050
18"(457.2mm) f/3.5 Plate Glass Sandwich Mirror:	~~$2,750~~	$1,925
18"(457.2mm) f/4.0 Plate Glass Sandwich Mirror:	~~$2,415~~	$1,725
18"(457.2mm) f/4.1 Plate Glass Sandwich Mirror:	~~$2,250~~	$2,125
18"(457.2mm) f/4.2 Plate Glass Sandwich Mirror ;	~~$2,200~~	$1,600
18" (457.2mm) f/4.5 Plate Glass Sandwich Mirror:	~~$2,100~~	$1,500
20" (508mm) f/3.3 Plate Glass Sandwich Mirror:	~~$3,920~~	$3,000
20" (508mm) f/3.7 Plate Glass Sandwich Mirror:	~~$3,500~~	$2,500
20" (508mm) f/4.0 Plate Glass Sandwich Mirror:	~~$3,230~~	$2,500
20" (508mm) f/4.2 Plate Glass Sandwich Mirror:	~~$3,050~~	$2,000

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Image 3

plore Scientific Focal Extender is much better suited for photography than typical Barlows. That's why they come in 2x, 3x or 5x sizes. Planetary photographers are more like to want the 3x or 5x magnification factors. This avoids having to use eyepiece projection to obtain sufficient image diameters.

I visually tested the 2x Explore Scientific Focal Extender using my 190mm f/5.3 Maksutov-Newtonian telescope on a night with excellent seeing. I placed my 24mm Explore Scientific 68° eyepiece into the 2x Focal Extender which yielded a magnification of 83x. I compared the view using my favorite eyepiece for this telescope, a 13mm Televue Ethos yielding a very close magnification (77x).

I pointed the telescope at various star clusters, nebulae and galaxies. Because the Ethos has a 100° field of view, the true field of view through it was much greater than the eyepiece-Barlow combination. However the quality of the views were equal. Stars were pinpoint in both and the colors were indiscernible. Both had great contrast and displayed the same detail in faint galaxies.

Image 4

I next put my 8.8mm Explore Scientific 82° eyepiece in the Explore Scientific Focal Extender yielding 227x and compared the view through my 5mm Televue

Image 5

Nagler eyepiece at 200x. My target was Saturn which was high about the south horizon. Both combinations had excellent views of Saturn. I could not find one view better than the other.

My final test of the Explore Scientific Focal Extender involved using it for imaging. **Image 5** shows two pictures of the Moon I took with my 70mm f/6 apo. Both were taken with a Canon 600D camera. The left image was prime focus and the right image was with the Explore Scientific Focal Extender in the optical train. I have never had good results imaging through a Barlow in the past. The Explore Scientific Focal Extender did an excellent job.

I don't think I have a need to keep any of the other Barlows in my personal inventory. I am extremely impressed with the quality and performance of the Explore Scientific 2x Focal Extender. It's a keeper! ATT