

# ASTRO-PHYSICS, INC

ASTRO-PHYSICS has been developing telescopes and accessories for the advanced amateur since 1975. We now offer an extensive line of precision telescopes and mountings, all with outstanding performance for a variety of observing needs. If you have decided that refractors fit your requirements, you will find our line of Apochromats to have the highest performance of any refractor on the market. Our telescopes were developed with the active observer in mind. We have concentrated on those things that make observing a joy: sharp high-resolution optics, rugged vibration-free mountings and easy to use effective accessories.

## HISTORICAL PERSPECTIVE

Astro-Physics has been at the forefront of optical design during the last decade. In the early 1980s, Mr. Roland Christen, founder and president of Astro-Physics, introduced the first high performance affordable apochromats to the amateur market. These early Astro-Physics refractors were quite revolutionary and were a major influence in the rebirth of refractors.

The more common achromats available at that time showed significant chromatic aberration even with focal lengths of f15. They were (and still are) very long and awkward, particularly if portability to a dark sky site is desired. Both 5" f15 or 6" f15 doublet tube assemblies (focal lengths of 75 and 90 inches respectively) require a substantial mount on a tall pier or tripod to accommodate the length of the instrument and counteract the torque reaction that is inevitable when the breezes blow. The chromatic aberration coupled with the enormous size and weight of these instruments and their mountings deterred many amateurs from using refractors larger than 4" in the 1960s and 70s.

As an avid amateur astronomer, Roland was dissatisfied with the telescopes that were available in the 1970s. He knew that even the achromats then available showed snappier images than his 8" SCT, but he wanted a shorter scope which could be used for photography as well as high definition planetary images. Over a period of several years, he designed and built several refractors with shorter focal lengths using a triplet design. The color correction was very good even as short as f6.

In the 1980s, Astro-Physics' optical designs evolved several times and with each new design, new levels of performance were achieved. The quality of construction of the tube assemblies, sophistication of the mounts and range of accessories have also improved each year.

In 1992, we were very proud to introduce our new line of refractor lenses which incorporate ED glass in various optical designs, each with their intended purpose. We believe that Astro-Physics refractors set the standard for optical performance, appearance and mechanical construction in an amateur telescope.

## ASTRO-PHYSICS DESIGN PHILOSOPHY

### APOCHROMATIC LENS DESIGN

Our objectives are APOCHROMATIC, which means that the images are essentially free of false color, both visually and photographically. We have chosen Super ED to be the heart of our optical designs because of its excellent light transmission and superior correction of all the monochromatic and polychromatic aberrations. Super ED is more advanced glass than the more common varieties used in commercial refractors. It has allowed us to use crown rather than flint for the outer elements. Normal ED (FK01) and even Fluorite doublets use flint glasses as the leading element, causing the color correction to be less than perfect, especially in the violet region of

the spectrum. These flints introduce false color that can be seen as purple halos around bright objects, or purple fringing along the Lunar edge and at the edges of bright craters. This color error can cause brighter stars to bloat on long exposure photographs.

The StarFire EDT design (which includes the 105 Traveler EDT) consists of three matched optical glasses to combine the colors of the visual spectrum into intense, sharp, concentrated images. The views are extraordinary. As you can see on the specification sheets, the superb color correction of these EDTs surpasses the fluorite doublets, particularly in the far violet part of the spectrum where Technical Pan films have their highest sensitivity.

The StarFire EDF design, available in 155mm diameter, was developed with the fast focal ratios of f7, for amateurs who long to achieve superb, wide field astrophotos. For avid astrophotographers, we offer these EDF refractors with giant 4" focusers to allow coverage of very large film formats with minimal vignetting. In the hands of knowledgeable astrophotographers, these instruments can produce superb, professional astrophotos of all your favorite deep-sky objects. Images are so sharp, it takes 30" x 40" enlargements to resolve the finest details. We also offer the 155mm StarFire EDF with the 2.7" focuser for individuals who desire the ultimate portable, versatile refractor, but do not require the larger focuser.

One of the important advantages of a short focal length is that the mounting can be smaller, lighter and more compact. The result is a highly portable refractor system with superior imaging qualities, ideal for a wide variety of astronomical work from high-power lunar/planetary to deep sky astrophotography.

## MOUNTINGS

Astro-Physics mountings are designed for solid stability under a variety of observing conditions. At the same time, the mounts are truly portable so that amateurs can transport them to their favorite dark-sky site and set them up quickly and accurately. The mountings break down into manageable sizes, but when set up, they are extremely rugged and steady platforms. We have also developed a very accurate worm gear set to insure smooth, effortless tracking of celestial objects for all visual and photographic purposes.

To achieve these performance criteria, we combined the latest technology with time-tested design concepts. The basic mounting configuration was engineered with proper vibration and strength of materials criteria. As in a good building design, all loads are channeled into massive load-bearing cross sections to their final destination - the ground. This is done in a way that minimizes weight and size while maximizing rigidity. Examples of this are the tension rods on the piers and thrust bearings on the polar and declination axes that transfer a tremendous amount of load in relation to their size. To this stability, we have added a drive that is accurate and sophisticated enough for the most demanding application. We started with a custom-manufactured fine-pitch worm gear and added a high-resolution stepper motor with a modern push-button controller that makes tracking the stars a snap, even for beginners.

## ACCESSORIES

To these basic telescope components, we have added a whole list of accessories that make our telescopes versatile. From camera adapters to telecompressors, we have carefully designed them for their functionality and compatibility. They are all tested and proven in the field under actual observing conditions.

## ASTRO-PHYSICS FACILITIES AND STAFF

In September 1990, our dream of moving into a new, specially designed facility came true. Since Astro-Physics is one of the few telescope companies that actually make most of the items in their product line, we needed a building that would allow us to perform each function in the most efficient manner.

Over the years, we have assembled a staff of talented, skilled craftspeople dedicated to producing very high quality products. They take personal pride in their accomplishments and your satisfaction.

### OPTICAL PRODUCTION

We manufacture all of our telescopes in our modern optical facility, so our telescope optics are 100% AMERICAN-MADE. We use only precision "A" grade optical glass, which has high light transmission characteristics and is free of striae and imperfection. Each time we begin a new production run of lenses, Roland computer-optimizes the design based on the melt characteristics of the glass. Our opticians adjust the tooling accordingly to achieve the desired curves.

Our lenses are polished on pitch and hand-corrected. Each lens is tested, polished and retested repeatedly throughout the production process. We continue until the desired performance is achieved. During the final figuring stage, the lens is evaluated with a laser interferometer. We do not employ mass-production techniques; each lens is treated individually. This process is very time-consuming, but there is virtually no other way to attain the level of resolution, definition and contrast that advanced amateurs demand.

The combination of the apochromatic lens design, careful, precise optical production techniques, high-transmission multi-coatings and well-baffled tube assemblies results in a clean optical system with superior contrast and light grasp.

### MACHINING CAPABILITIES

Most of our components are machined in-house on our ultra-modern 3-axis CNC (computerized numerical control) lathe and CNC machining center. Our highly skilled machinists maintain very accurate tolerances so that parts fit together precisely with no slop. As a result, our mountings are very rigid and our focusers are smooth with no wobble.

### TUBE ASSEMBLY

Our tube assembly department carefully installs the baffles to be sure that the placement is effective to eliminate stray light, then paints the interior of the tube with a flat black paint. Your lens cell and focuser are squared onto the tube to be sure that the telescope is properly collimated.

### MOUNT ASSEMBLY

Our mount assembly department is staffed by a highly competent professional telescope makers who are also advanced users and observers. Consequently, they understand how a precision mounting should feel and be adjusted. This experience is brought to the construction of each mounting. The components of our hand controllers are carefully soldered to the circuit boards and tested prior to shipment.

### PACKING AND SHIPPING

When you receive your order, you will discover that a great deal of care was given to the safe packing of each item. It is very rare that any item is damaged during shipment.

### OFFICE PERSONNEL

The office staff will be your primary source of information regarding products and prices, estimated delivery dates and the status of your order. If we can be of assistance to you in any way, please ask.

*Astro-Physics offers unique, unobstructed, highly corrected optical systems designed to give a lifetime of observing pleasure. When choosing a telescope, we encourage you to compare, side by side, optical and mechanical qualities with scopes of similar and even greater size.*

## ASTRO-PHYSICS, INC

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## ASTRO-PHYSICS

### 105 mm f6 TRAVELER EDT REFRACTOR (4.1" aperture)

Imagine a refractor with a 105mm (4.1") aperture, focal ratio of f6, in a tube assembly that has an overall length of 19"! The 105 Traveler EDT is the culmination of years of optical research by Roland Christen of Astro-Physics aimed at developing a very fast and portable telescope that will allow you to enjoy sharp, high-contrast images wherever you go. The 105 EDT has a fully machined tube assembly with a permanently aligned lens cell. Its construction is extremely rugged to allow it to withstand all the handling that is typical of airline travel. The lens uses a special new Super ED glass (ED stands for extra low dispersion,  $V_d > 90$ ) that allows colorfree performance at the f6 focal ratio. Images of stars and planets are presented in their natural colors, and daytime objects appear sharp and contrasty without annoying purple fringes.

The optical design of the 105mm EDT objective is identical to the StarFire EDT refractors. It consists of a positive element of Super ED glass surrounded by two matching hard crown meniscus lenses. The two outer elements are chosen so that the combination is free of coma, spherical aberration and other higher-order aberrations. All surfaces are spherical, which results in a very smooth overall figure. Under steady viewing conditions, you will see a hard white Airy disc at focus surrounded by the first diffraction ring. Inside and outside of focus, you will see an evenly illuminated, expanded disc with concentric Fresnel rings, the outermost ring brighter and wider than the rest. The two air-glass surfaces have a multi-layer anti-reflection coating that results in overall light transmission greater than 97% in peak visual wavelengths. On most nights, the settling down time for the lens is 10 to 15 minutes, and even in sub-freezing conditions, it rarely takes more than 45 minutes to stabilize.

#### PERFORMANCE

The 105 Traveler EDT is an awesome performer both at night and during the daytime using powers as low as 12x or as high as 400x. Based on light gathering area alone, the Traveler has 36% more light grasp than a 3.5" Maksutov and 10% more light grasp than a 100mm refractor. During the daytime, delicate detail and vivid colors of flowers and wildlife are a true joy to observe. During the night, the high light transmission of the extremely pure optical glass becomes immediately apparent. With a 2" widefield eyepiece, we have seen the entire Veil Nebula, including the very faint inner region, all in one eyepiece field of view. The North American Nebula region is so bright and clear, it looks like a deep-sky astrophoto. Pop in a high power eyepiece, and you will be rewarded with truly stunning views of the Moon and planets. Jupiter will amaze you with sharp resolution of the bands, festoons, white ovals and the Great Red Spot. This scope shows detail on Saturn and Mars that rival views in much larger instruments.

The Traveler is a fabulous astrograph. With a Pentax 6 x 7cm camera, you can capture 5.6 x 6.6 degrees of stunning star fields, clusters and nebulas at f6! If a faster focal ratio in a 35mm format is desired, use our Telecompressor for f4.5, or a 2x Barlow for f12 exposures.

Whether traveling to exotic eclipse locations, your favorite camping spot, bird watching expeditions or just into your backyard, this little gem will provide you with hours of observing pleasure.

#### MECHANICAL CONSTRUCTION

The mechanical construction of the Traveler makes this scope completely trouble-free and keeps the optics permanently aligned. Its gorgeous tube assembly is precision machined in our shop with the most modern CNC equipment available. There are no fragile die casts in this telescope. Our expert machinist transforms solid, aircraft-quality aluminum into a fully baffled tube assembly with no less than 12 knife-edge baffles in the focuser drawtube alone. We have endeavored to achieve the highest absorption of stray light possible to give you the maximum contrast. The black exterior finish of the tube and dewcap will retain its deep, lustrous beauty for many years. You will appreciate the unique design and fine craftsmanship of this telescope.

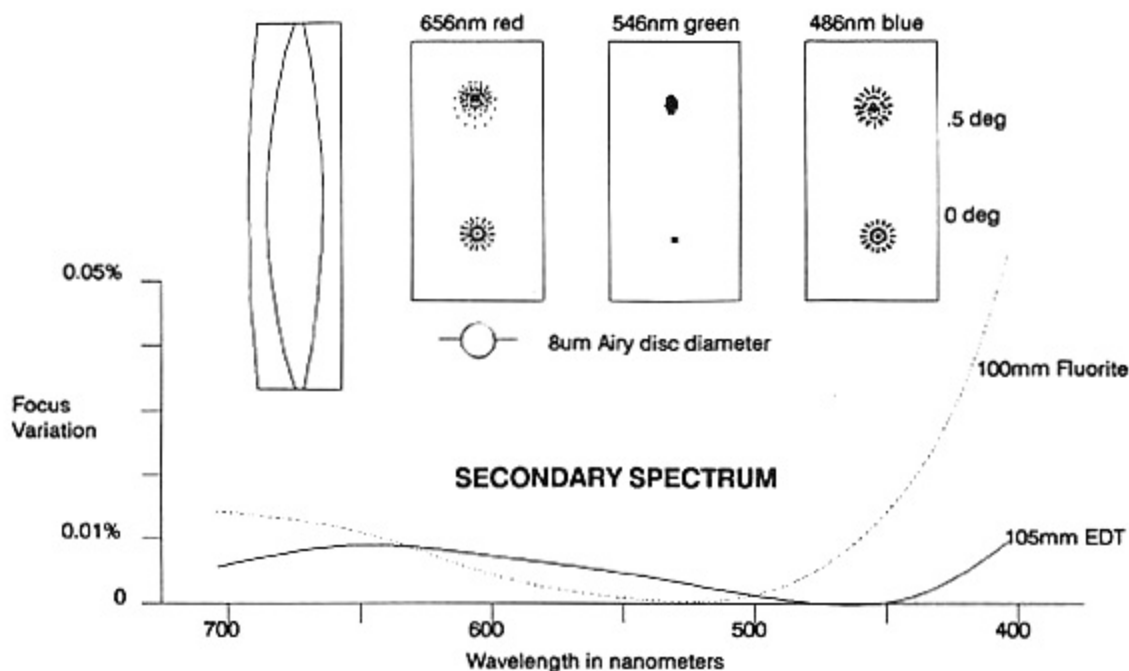


105mm Traveler EDT, 400 Mount, Aluminum Tripod

Our superb Astro-Physics focuser is a very finely crafted unit with several unique features. The components are machined to extremely high tolerances, assuring that there is no wiggle between the drawtube and housing. More than a dozen knife-edge baffles are machined into the wall of the drawtube and painted flat black in order to maximize contrast by essentially eliminating any internal reflections. The inside diameter (I.D.) of the drawtube is 2.7", which allows the avid astrophotographer to use a medium-format camera to capture images in a 6 x 7cm format with minimal vignetting. You can use standard accessories with the 2" and 1.25" adapters. Recessed brass locking rings are installed at each thumbscrew location. As you tighten each thumbscrew, the brass locking ring clamps onto the part that has been inserted. Consequently, your focuser drawtube and 2" and 1.25" accessories are held securely in place. This is particularly important considering the heavy and expensive accessories that you may use. As an added advantage, the brass will not mar the surface of your accessories.

We invite you to compare the optical performance and mechanical construction of any other scope of comparable size on the market today. You will find that the Astro-Physics 105 Traveler EDT is the finest, most versatile scope of its size.

## 105mm f6 TRAVELER EDT SPOT DIAGRAMS FOR VISUAL WAVELENGTHS, 0.5 DEG FIELD



### SPECIFICATIONS:

Color correction:	Less than 0.01% focus variation from 706nm to 405nm
Clear aperture :	105mm (4.13")
Focal length :	610mm (24") (actually f5.8)
Resolution :	1.1 arc seconds
Coatings:	Multi-layer, overall transmission greater than 97% in peak visual wavelengths
Magnification range :	12x to 400x
Tube assembly:	Black finish, 19" aluminum tube; fully baffled, permanently aligned cell construction; engraved focuser
Focuser type:	2.7" Astro-Physics rack and pinion focuser, 4.5" travel; 2" and 1.25" adapters; 2.5" extension
Telescope length:	48cm (19") with dewcap fully retracted
Weight with dewcap:	9 lbs. (4 kg)
Carrying case type:	Custom padded bag
Case outside dimensions:	21" x 10.8" x 7" (53cm x 27cm x 18cm)
Weight of empty case:	3.5 lbs. (1.6 kg)
35mm prime-focus field:	2.3 x 3.2 degrees @ f5.8
35mm telecompressor field:	2.9 x 4.1 degrees @ f4.5
35mm field with 2x Barlow:	1.1 x 1.6 degrees @ f11.6
6 x 7cm prime-focus field:	5.6 x 6.5 degrees @ f5.8

Specifications are subject to change without notice.

### FEATURES OF THE OPTICS

- Very high corrections of spherical and chromatic aberrations
- Visual and photographic focus is identical, eliminating the need for light absorbing filters
- Clear, colorfree glass types result in brighter, more contrasty images
- Stunning lunar/planetary and deep-sky views
- Ideal for 35mm and medium-format deep-sky astrophotography
- High-resolution optics are a good match for fine-grained Technical Pan emulsions

### FEATURES OF THE TUBE ASSEMBLY

- Felt lined dewcap slides over cell for storage
- Fully baffled tube and focuser assures highest contrast
- Giant 2.7" focuser allows coverage of 6 x 7cm formats
- 2" and 1.25" adapters with brass locking ring, 2.5" extension
- Beautifully machined parts with lustrous black finish
- Aluminum lens cover to protect against dust
- Sturdy padded carrying case will fit in airline overhead storage compartments. Case has location to insert padlock

### SUGGESTIONS

#### 400 German Equatorial Mount with Dual Axis Drive

This portable mount is perfect for visual and photographic studies in either the Northern or Southern Hemispheres.

#### Diagonals and Binocular Viewers:

Prism diagonals have aberrations which degrade image quality. Since this is especially noticeable in scopes with fast focal ratios, we recommend the 2" Precision Mirror Diagonal for the Traveler. If you use a binocular viewer (which has prisms), place a Barlow between the focuser and binocular viewer.

#### Eyepieces:

Plossls, Orthoscopics, and Widefield eyepieces show sharp images only in the center of the field. These are fine as long as you realize this limitation. If you object to astigmatic images at the edge of the field, we recommend TeleVue Nagler and Panoptic eyepieces. These oculars have the best flat field images and will bring out the most in your 105 Traveler EDT. Use our 2" (2x) Barlow to double your magnification.

	magnification	actual field of view	exit pupil
35mm Panoptic	18x	3.8 deg	5.3mm
22mm Panoptic	28x	2.4 deg	3.8mm
13mm Nagler	48x	1.7 deg	2.2mm
9mm Nagler	70x	1.2 deg	1.5mm
7mm Nagler	90x	0.9 deg	1.2mm
4.8mm Nagler	131x	0.6 deg	0.8mm

A 35mm Plossl can also serve as your finder.

Please refer to the brochure for descriptions of these items and additional accessories.

## ASTRO-PHYSICS

### 130mm f8 STARFIRE EDT REFRACTOR (5.1" aperture)

The 130mm f8 StarFire EDT is a very portable, lightweight refractor with a Super ED triplet objective that is highly corrected for false color (chromatic aberration). The color error is less than 0.01% from 706nm to 405nm, compared to a 2-element Fluorite apochromat with 0.05% and a Doublet Achromat with 0.45% color error over the same spectral range. In an age when Fluorite is being hyped as the best lens material for fast refractors, it is significant that Astro-Physics has developed a non-Fluorite objective with 5 times better chromatic aberration at a fraction of the cost of Fluorite. Super ED glass (ED stands for extra low dispersion,  $V_d > 90$ ) is a real glass, not a crystal like Fluorite. ED is a harder, less fragile material with a much lower expansion coefficient than Fluorite. Unlike Fluorite, ED glass is not affected by atmospheric contaminants and acids. It is for these reasons that all the world's major camera manufacturers are incorporating ED glass into their best lenses.

The extremely high color correction of the Super EDT design allows the construction of a relatively short-focus objective that is superior to long-focus achromats in contrast and definition of subtle planetary detail. The EDT lens is also perfectly matched to the characteristics of the fine grained Technical Pan emulsions which have their peak sensitivity at 405nm. With our matching accessories, you can create impressive astrophotos on 35mm and 6 x 7cm film formats.

The optical design of the 130mm EDT objective consists of a positive element of ED glass surrounded by two matching hard crown meniscus lenses. The two outer elements are chosen so that the combination is free of coma, spherical aberration and other higher-order aberrations. All surfaces are spherical, which results in a very smooth overall figure. Under steady viewing conditions, you will see a hard white Airy disc at focus surrounded by the first diffraction ring. Inside and outside of focus, you will see an evenly illuminated, expanded disc with concentric Fresnel rings, the outermost ring brighter and wider than the rest. The two air-glass surfaces have multi-layer anti-reflection coatings that result in overall light transmission greater than 97% in peak visual wavelengths.

#### MECHANICAL CONSTRUCTION

We have incorporated several significant improvements to the tube assembly to make it easier to transport and set up in the field. The dewcap slides over the lens cell for more compact storage. An aluminum dust cover protects the optical surface when not in use, and a foam-fitted carrying case will help retain the beauty of your tube assembly for years. The tube is fully baffled and painted with light-absorbing flat black, and it features our adjustable push-pull cell.

Our superb Astro-Physics focuser is a very finely crafted unit with several unique features. The components are machined on our own CNC to extremely high tolerances, assuring that there is no wiggle between the drawtube and housing. More than a dozen knife-edge baffles are machined into the wall of the drawtube and painted flat black in order to maximize contrast by essentially eliminating any internal reflections. The inside diameter (I.D.) of the drawtube is 2.7" which allows the avid astrophotographer to use a medium format camera to capture images in a 6 x 7cm format with minimal vignetting. You can use standard accessories with the 2" and 1.25" adapters. Recessed brass locking rings are installed at each thumbscrew location. As you tighten each thumbscrew, the brass locking ring clamps onto the part that has been inserted. Consequently, your focuser drawtube and 2" and 1.25" accessories are held securely in place. This is particularly important considering the heavy and expensive accessories that you may use. As an added advantage, the brass will not mar the surface of your accessories.



130mm StarFire EDT, 400 German Equatorial with encoders, Hardwood Tripod, 60mm Guidescope and other accessories

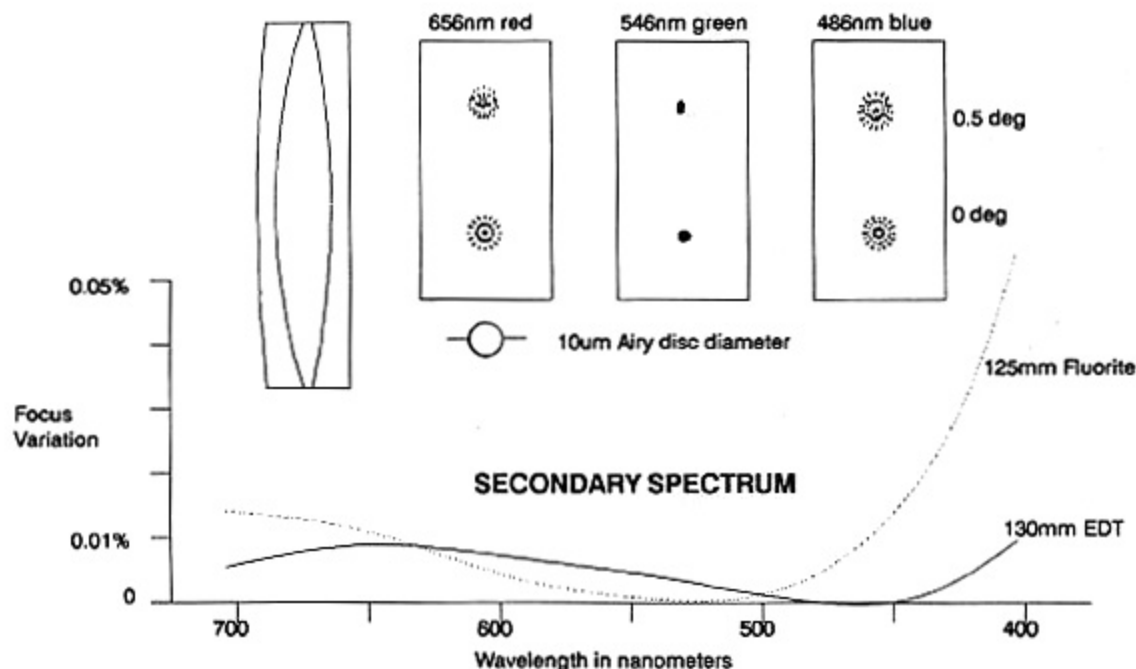
#### PERFORMANCE

The 130mm StarFire EDT was designed to be a compact, highly portable refractor that will set up in minutes, settle down quickly and provide hours of enjoyment. It has 67% more light grasp than a 4" aperture, yet it is not much larger than many of the 4" refractors on the market today. Like the classical 5" f15 refractor, this instrument is fully capable of superb planetary performance yet is only half as long. Amateurs have reported seeing the elusive Encke division on Saturn with our 5" StarFire. With a 35mm widefield eyepiece, we have observed the Double Cluster in Perseus. The stars were so sharp, they seemed to have no dimensions; pinpricks would have been too crude a description for their appearance. Take advantage of the many hours of daylight to observe fascinating detail on the surface of the sun.

The 130EDT optical design is ideal for astrophotography with small- and medium-format cameras. The widefield coverage in the 6x7 photographic format will record gorgeous images of a wide variety of objects such as the Andromeda Galaxy and the Lagoon and Trifid Nebulas. The negatives contain so much finely resolved detail that you can enlarge a small portion to feature one particular aspect of the object, i.e. the Gulf of Mexico portion of the North American Nebula. One of the finest solar eclipse photographs of the corona was taken with the 130 EDT StarFire refractor in July 1991. This photo and other deep sky photos that were taken with our 5" f8 StarFire have appeared on the cover of numerous astronomical publications around the world.

The 130mm StarFire EDT is a refractor with unsurpassed image quality, yet it is so handy and versatile that you will use it often.

## 130mm f8 StarFire EDT SPOT DIAGRAMS FOR VISUAL WAVELENGTHS, 0.5 DEG FIELD



### SPECIFICATIONS

Color correction:	Less than 0.01% focus variation from 706nm to 405nm
Clear aperture:	130mm (5.12")
Focal length:	1040mm (41")
Resolution:	0.87 arc seconds
Coatings:	Multi-layer, overall transmission greater than 97% in peak visual wavelengths
Magnification range:	18x to 500x
Tube assembly:	White, 5.5" aluminum tube, baffled, flat black interior, engraved push-pull lens cell
Focuser type:	2.7" ID Astro-Physics rack & pinion focuser, 4.5" travel; 2" and 1.25" adapters; 2.5" extension

Telescope length:	914mm (36") w/ dewcap fully retracted
Weight with dewcap:	16 lbs. (7.3 kg)
Carrying-case type:	Wood case with grey vinyl covering and foam-lined interior
Case outside dimensions:	40.5" x 9" x 9" (103cm x 23cm x 23cm)
Weight of case:	15.5 lbs. (7.8 kg)
35mm prime-focus field:	1.3 x 1.9 degrees @ f8
35mm telecompressor field:	1.8 x 2.5 degrees @ f6
35mm field with 2x Barlow:	0.7 x 0.9 degrees @ f16
6 x 7cm prime focus field:	3.3 x 3.9 degrees @ f8

Specifications subject to change without notice.

### FEATURES OF THE OPTICS

- Very high corrections of spherical and chromatic aberrations
- Visual and photographic focus is identical, eliminating the need for light-absorbing filters
- Clear, colorfree glass types result in brighter, more contrasty images
- Stunning lunar/planetary and deep sky-views
- Ideal for 35mm and medium-format deep-sky astrophotography
- High-resolution optics are a good match for fine-grained Technical Pan emulsions

### FEATURES OF THE TUBE ASSEMBLY

- Felt-lined dewcap slides over cell for storage
- Fully baffled tube and focuser assures highest contrast
- Giant 2.7" focuser allows coverage of 6 x 7 cm formats
- 2" and 1.25" adapters with brass locking ring, 2.5" extension
- Beautifully machined parts and expertly finished in hard polyurethane paint or black anodized
- Aluminum lens cover to protect against dust
- Sturdy foam-padded carrying case

### SUGGESTIONS

- Portable mount for visual and photographic studies  
400 German Equatorial Mount with Dual Axis Drive
- Portable mount for extensive astrophotography  
600 E German Equatorial Mounts with Dual Axis Drive

### Diagonals and Binocular Viewers

Prism diagonals have aberrations that degrade image quality. Since this is especially noticeable in scopes with fast focal ratios, we recommend the 2" Precision Mirror Diagonal. If you use a binocular viewer, (which has prisms), place a Barlow between the focuser and binocular viewer.

### Eyepieces

Plossis, Orthoscopics and Widefield eyepieces show sharp images only in the center of the field. These are fine as long as you realize this limitation. If you object to astigmatic images at the edge of the field, we recommend TeleVue Nagler and Panoptic eyepieces. These oculars have the best flat field images and will bring out the most in your 130 StarFire EDT. Use our 2x (2") Barlow to double your magnification.

	magnification	actual field of view	exit pupil
55mm Plossl	18x	2.8 deg	7.2mm
35mm Panoptic	30x	2.3 deg	4.3mm
22mm Panoptic	47x	1.5 deg	2.8mm
13mm Nagler	80x	1.0 deg	1.6mm
9mm Nagler	115x	0.7 deg	1.1mm
7mm Nagler	148x	0.6 deg	0.9mm
4.8mm Nagler	217x	0.4 deg	0.6mm

Please refer to the brochure for descriptions of these items and additional accessories.

## ASTRO-PHYSICS

### 180 mm f9 STARFIRE EDT REFRACTOR (7.1" aperture)

The 180mm f9 StarFire EDT is a high performance instrument with a Super ED triplet objective that is highly corrected for false color (chromatic aberration). The chromatic aberration is less than 0.01% from 706 nm to 405 nm compared to a 2-element Fluorite apochromat with 0.05% and a Doublet Achromat with 0.46% over the same spectral range. In an age when Fluorite is being hyped as the best lens material for fast refractors, it is significant that Astro-Physics has developed a non-Fluorite objective with 5 times better chromatic aberration at a fraction of the cost of Fluorite. Super ED glass (ED stands for extra low dispersion,  $V_d > 90$ ) is a real glass, not a crystal like Fluorite. ED is a much harder, less fragile material with a lower expansion coefficient than Fluorite. Unlike Fluorite, ED glass is not affected by atmospheric contaminants and acids. It is for these reasons that the world's major camera makers are incorporating ED glass into their best lenses.

The extremely high color correction of the Super EDT design allows the construction of a relatively short-focus objective that is superior to long-focus achromats in contrast and definition of subtle planetary detail. The EDT lens is also perfectly matched to the characteristics of the fine-grained Technical Pan emulsions which have their peak sensitivity at 405nm. With our matching accessories, you can create impressive astrophotos on 35mm and 6 x 7cm film formats.

The optical design of the 180mm EDT objective consists of a positive element of ED glass surrounded by two matching hard crown meniscus lenses. The two outer elements are chosen so that the combination is free of coma, spherical aberration and other higher-order aberrations. All surfaces are spherical, which results in a very smooth overall figure. Under steady viewing conditions, you will see a hard white Airy disc at focus surrounded by the first diffraction ring. Inside and outside of focus you will see an evenly illuminated, expanded disc with concentric Fresnel rings, the outermost ring brighter and wider than the rest. The two air-glass surfaces have multi-layer anti-reflection coatings that result in overall light transmission greater than 97% in peak visual wavelengths.

#### MECHANICAL CONSTRUCTION

We have incorporated several significant improvements to the tube assembly to make it easier to transport and set up in the field. The dewcap slides over the lens cell for more compact storage. An aluminum dust cover protects the optical surface when not in use, and a foam-fitted carrying case will help retain the beauty of your tube assembly for years. The tube is fully baffled and painted with light-absorbing flat black, and it features our adjustable push-pull cell.

Our superb Astro-Physics focuser is a very finely crafted unit with several unique features. The components are machined on our own CNC to extremely high tolerances assuring that there is no wiggle between the drawtube and housing. More than a dozen knife-edge baffles are machined into the wall of the drawtube and painted flat black in order to maximize contrast by essentially eliminating any internal reflections. The inside diameter (I.D.) of the drawtube is 2.7" which allows the avid astrophotographer to use a medium-format camera to capture images in a 6 x 7cm format with minimal vignetting. You can use standard accessories with the 2" and 1.25" adapters. Recessed brass locking rings are installed at each thumbscrew location. As you tighten each thumbscrew, the brass locking ring clamps onto the part that has been inserted. Consequently, your focuser drawtube and 2" and 1.25" accessories are held securely in place. This is particularly important considering the heavy and expensive accessories that you may use. As an added advantage, the brass will not mar the surface of your accessories.



180mm StarFire EDT, 1200 German Equatorial, 48" Pier and accessories

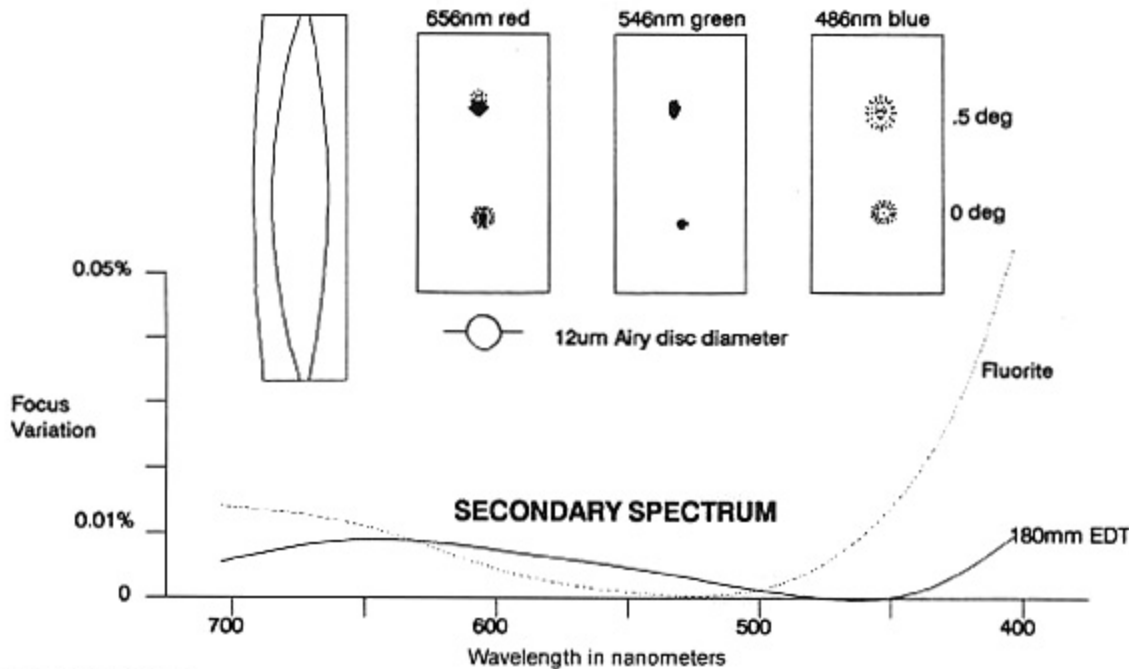
#### PERFORMANCE

The 180mm StarFire EDT was developed with our model 800 German Equatorial Mount to be the largest refractor system that is reasonably portable. It has 36% more light grasp than a 6" refractor and twice the light grasp of a 5" refractor. The planetary performance of the 180 StarFire is breathtaking, to say the least. At opposition, Mars reveals so much detail that it is difficult to draw everything that is visible. Deep-sky views are bright and contrasty. The high-definition optics reveal mottling and detail in nebulae where ordinary telescopes show only fuzzy outlines.

Stunning photographs of M33 reveal spiral arms as sprinklings of fine powdered sugar. H-alpha photographs of the sun's surface taken at full aperture rival anything we have seen from the professional observatories.

The views through your 180 StarFire EDT will draw crowds at star parties. Plan on standing in line to observe through your own scope! You will be very pleased with the mechanical construction of this beautiful refractor, and the way it performs optically will delight you.

## 180mm F9 STARFIRE EDT SPOT DIAGRAMS FOR VISUAL WAVELENGTHS, .5 DEG FIELD



### SPECIFICATIONS

Color correction:	Less than 0.01% focus variation from 706nm to 405nm.
Clear aperture:	180mm (7.1")
Focal length:	1620mm (64")
Resolution:	0.64 arc seconds
Coatings:	Multi-layer, overall transmission greater than 97% in peak visual wavelengths
Magnification range:	30x to 700x
Tube assembly:	White, 8.0" aluminum tube, baffled; flat black interior; engraved retaining ring; push-pull lens cell
Focuser type:	2.7" I.D. Astro-Physics rack & pinion focuser, 4.5" travel; 2" and 1.25" adapters; 2.5" extension
Telescope length:	1524mm (60") with dewcap fully retracted

Weight with dewcap:	35 lbs. (15.9 kg)
Carrying case type:	Wood case with grey vinyl covering and foam-lined interior

Case outside dimensions: 64" x 12" x 12" (173cm x 30cm x 30cm)

Weight of empty case: 32 lbs (14.5 kg)

35mm prime-focus field:	0.9 x 1.2 degrees @ f9
35mm telecompressor field:	1.1 x 1.6 degrees @ f6.7
35mm field with 2x Barlow:	0.4 x 0.6 degrees @ f18
6 x 7cm prime-focus field:	2.1 x 2.5 degrees @ f9

Specifications subject to change without notice.

### FEATURES OF THE OPTICS

- Very high corrections of spherical and chromatic aberrations
- Visual and photographic focus is identical, eliminating the need for light-absorbing filters
- Clear, colorfree glass types result in brighter, more contrasty images
- Stunning lunar/planetary and deep-sky views
- Ideal for 35mm and medium-format deep-sky astrophotography
- High-resolution optics are a great match for fine-grained Technical Pan emulsions.

### FEATURES OF THE TUBE ASSEMBLY

- Felt-lined dewcap slides over cell for storage
- Fully baffled tube and focuser assures highest contrast
- Giant 2.7" focuser allows coverage of 6 x 7cm formats
- 2" and 1.25" adapters with brass locking ring, 2.5" extension
- Beautifully machined parts, expertly finished in hard polyurethane paint or black anodized
- Aluminum lens cover to protect against dust
- Sturdy foam-padded carrying case

### SUGGESTIONS

#### Mounting:

- 800 German Equatorial Mount with Dual Axis Drive
- 900 German Equatorial Mount with Dual Axis Drive
- 1200 German Equatorial Mount with Dual Axis Drive
- 54" Portable Pier to match above mounts

#### Eyepieces:

Plossls, Orthoscopes, and Widefield eyepieces show sharp images only in the center of the field. These are fine as long as you realize this limitation. If you object to astigmatic images at the edge of the field, we recommend TeleVue Nagler and Panoptic eyepieces. These oculars have the best flat field images and will bring out the most in your 180 StarFire EDT. Use our 2" (2x) Barlow to double your magnification.

	magnification	actual field of view	exit pupil
55mm Plossl	29x	1.7 deg	6.2mm
35mm Panoptic	46x	1.5 deg	3.9mm
22mm Panoptic	74x	0.9 deg	2.4mm
13mm Nagler	125x	0.7 deg	1.4mm
9mm Nagler	180x	0.5 deg	1.0mm
7mm Nagler	231x	0.4 deg	0.8mm
4.8mm Nagler	338x	0.3 deg	0.5mm

Please refer to the brochure for descriptions of these items and additional accessories.



## 130 F6 STARFIRE EDF APO REFRACTOR

**At last - an easy to use amateur telescope that can produce exquisite astrophotos with almost no effort and show excellent planetary images as well.**

- Short tube length and light weight for easy portability
- Advanced optical design produces superb color correction
- Fast optics for deep-sky observing and astrophotography
- Field flattener available for 6x7cm photography

### FEATURES OF THE OPTICS

- Very high corrections of spherical and chromatic aberrations
- Visual and photographic focus is identical, eliminating the need for light-absorbing filters
- Clear, colorfree glass types result in brighter, more contrasty images
- Stunning lunar/planetary and deep-sky views
- Ideal for 35mm and medium-format deep-sky astrophotography
- High-resolution optics are a good match for fine-grained Technical Pan emulsions.

### FEATURES OF THE TUBE ASSEMBLY

- Felt-lined dewcap slides over cell for storage
- Fully baffled tube and focuser assures highest contrast
- Giant 2.7" focuser allows coverage of 6 x 7cm formats
- 2" and 1.25" adapters with brass locking ring, 2.5" extension
- Beautifully machined parts and expertly finished in hard polyurethane paint or black anodized
- Aluminum lens cover to protect against dust
- Sturdy foam-padded carrying case

### SPECIFICATIONS

Color correction:	Less than 0.01% focus variation from 405nm to 706nm (r to h wavelengths).
Clear aperture:	130mm (5.12")
Focal length:	780mm (30.7")
Resolution:	0.87 arc seconds
Coatings:	Multi-layer, overall transmission greater than 97% in peak visual wavelengths
Magnification range:	22x to 500x
Tube assembly:	White, 5.5" aluminum tube, baffled, flat black interior, engraved push-pull lens cell
Focuser type:	2.7" I.D. Astro-Physics rack & pinion focuser, 4.5" travel; 2" and 1.25" adapters; 2.5" extension
Telescope length:	724mm (28.5") w/ dewcap fully retracted
Weight with dewcap:	15 lbs. (6.8kg)
Carrying-case type:	Wood case with grey vinyl covering and foam-lined interior
Case outside dimensions:	31"x9"x9" (79cmx23cmx23cm)
Weight of case:	14 lbs. (6.4kg)
35mm prime-focus field:	1.7 x 2.4 degrees @ f6
35mm telecompressor field:	2.3 x 3.3 degrees @ f4.5
35mm field with 2x Barlow:	0.9 x 1.2 degrees @ f12
6x 7cm prime focus field:	4.4 x 5.1 degrees @ f6

Specifications subject to change without notice.



130mm StarFire EDF, 400 German Equatorial with Encoders, Hardwood Tripod and other accessories

## KENDRICK DEW REMOVER SYSTEM

Many of our customers have requested a solution for dew removal and prevention. We can personally attest to the effectiveness of this product since it saved the day at the 1993 Astrofest convention! While we were enjoying the views through our instruments (the seeing was very good), heavy dew was soaking everything - a perfect evening to try out this new product.

A Kendrick Dew Remover that was put in place early in the evening kept a nearby Astro-Physics 5" refractor free from dew the entire night. After one of our own instruments dewed over rather early, we decided to try the Kendrick Dew Remover ourselves. We had a chance to see what this product can do under extreme conditions. After we installed the Dew Remover, we waited a half hour or so for the objective to warm just above the dewpoint then removed the excess moisture from the lens with a tissue. It remained free of dew until 2:30 A.M. when we finally decided we were too tired to observe any longer. Most everyone else on the field had dewed over long before that time - including all of our other scopes.

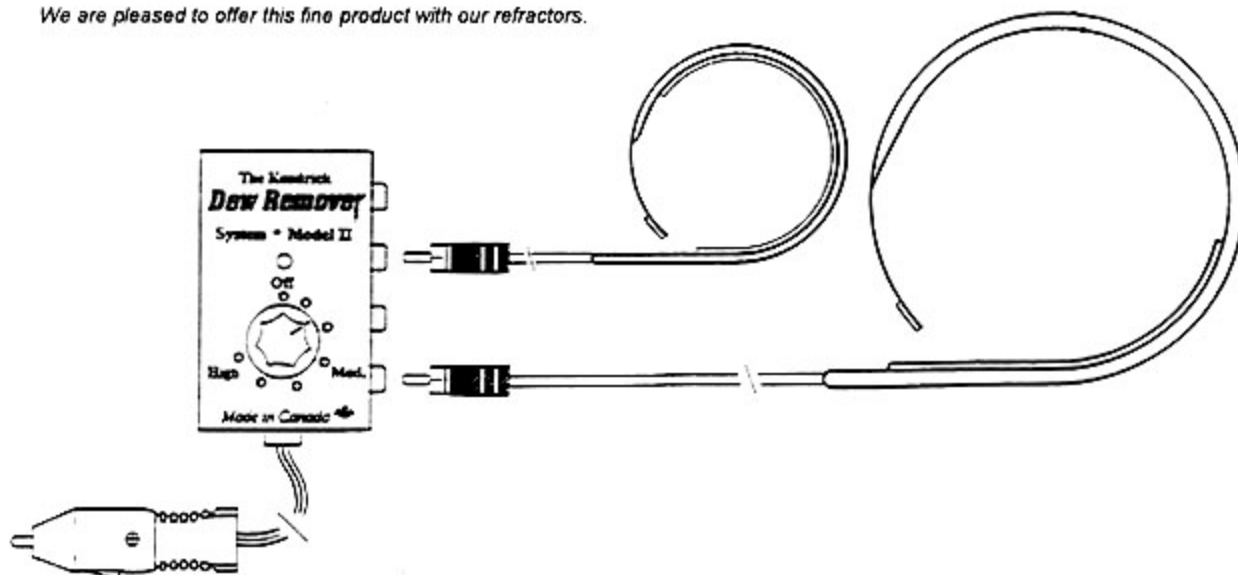
The Kendrick Dew Remover System consists of several components which are purchased separately according to your needs:

**DC Controller** - This unit is comprised of a duty cycle switch that is fused and reverse polarity protected. A control knob allows you to vary the power to your heaters from 40% to 100% of their capacity. Four input plugs allow you to use several different heaters simultaneously. With the addition of an RCA splitter plug, up to 5 heaters can be attached. The controller can be powered from 12v DC.

The controller is very compact (3.5" x 2.25") and attractive. It is constructed of aluminum and includes an LED which remains lit as long as your battery is providing adequate power. As an added benefit, the LED illuminates the control knob. The power cord is 6' long and has a cigarette lighter plug. A self-adhesive velcro backing on the controller allows you to mount it on the tube assembly, mount or tripod at your discretion.

Number	Description	amp hour ratings at highest setting	weight
KDRCON	12v DC Controller		150g 5.3oz
KDR004	4" Heater for our 105 Traveler EDT and previous 4" aperture	1.0	68g 2.5oz
KDR005	5" Heater for 127-130mm apertures (5"-5.1")	1.4	76g 2.7oz
KDR5/6	5.5"/6.5" Heater for our 152-155mm apertures (6"-6.1")	1.3	85g 3.0oz
KDR7/8	7"/8" Heater for our 178-206mm apertures (7"-8.1")	1.65	95g 3.4oz
KDRSME	Heater for 0.965" and 1.25" Eyepieces	0.17	40g 1.4oz
KDRLGE	Heater for 1.25" and 2" Eyepieces	0.33	45g 1.6oz
KDR002	Heater for 8x50 Finder, 60mm Guidescope or extra-large 2" eyepieces	0.33	45g 1.6oz
KDR003	3" Heater for 80mm Guidescopes	0.66	60g 2.1oz

We are pleased to offer this fine product with our refractors.



**Heaters** - A variety of heaters are available for your main objective, eyepiece, guidescope, finder and/or Telrad. The heating element is encased in fabric with velcro attachments. They have sponge insulation on one side to prevent heat being lost into the atmosphere. The heat is directed into the optics instead and because of this, less energy is needed to keep your optics free of moisture. All heaters come with 4' leads. In addition to the models listed below, heaters are available for secondaries and larger instruments up to 14" SCT. We can obtain these heaters on request.

The Kendrick Dew Remover System has several unique advantages:

- variable power output from low to high which results in less drain on your battery
- all of your optics can be protected with a single controller and power source

**Power Requirements:**

The amp hour ratings illustrate what each heater will draw if the controller is set at high - the maximum power usage. If the controller is set at its lowest setting the heaters will continue to draw the same amount of current, but only 40% of the time. The unit actually shuts power off to the heaters many times each minute when it is set anywhere below the highest setting. We recommend that you use the Dew Remover from the beginning of your observing session with the controller on its lowest setting (or near it) under most observing conditions. It is better to prevent the formation of dew than to remove it later. Think of this product as a dew *preventer* rather than a dew remover.

**12v DC** - The manufacturer recommends that you use deep cycle batteries with this system. Each customer will need to consider his or her power requirements when deciding which battery to choose. Smaller battery packs can be used (probably not less than 12 amp hour), however you will need to take special care that you begin the evening with a fully charged battery. We recommend that you use separate batteries for the motor drive of your mount and your dew remover.

If you want to use household current, Kendrick offers 120V and 240V converters that puts out 23V DC at 5 amps.

## ASTRO-PHYSICS

# 155mm f7 STARFIRE EDF APOCHROMATIC REFRACTOR ULTRA-PORTABLE WITH 2.7" FOCUSER

Although we originally designed the 155mm f7 StarFire EDF (6.1" aperture) featuring our gigantic focuser and field flattener with the avid astrophotographer in mind, we have come to appreciate the versatility of this instrument. At the urging of our customers, we now offer the same excellent 155mm f7 lens in a lighter weight tube assembly with our 2.7" focuser.

We continue to be amazed at the compact size of this instrument. At last, a 6.1" refractor with an overall length of 40" (with dewcap retracted). This is less than half the length of an f15 and approximately a foot shorter than an f9! In fact, it is about the same length as our 130mm f8, but with an inch more of aperture! You can transport it in a smaller car, store it in less space, invest in a smaller mount and shorter pier/tripod. This instrument is the fulfillment of the astronomer's dream for a truly portable 6.1" refractor.

### PERFORMANCE

The EDF is superb as a visual instrument. It is easily capable of high-power observations of the moon and planets. Secondary spectrum is totally absent at any power which allows you to discriminate the subtle color variations on the surface of the planets. Deep-sky views are equally impressive due to the very high transmission of the three glass types. Performance will rival larger obstructed systems because the contrast is excellent. Individual stars of globular clusters are sharply etched against velvet black skies. A beautiful sight!

This refractor can, of course, be used photographically with a 35mm camera at prime focus with only a simple camera adapter or at a fast f5.2 with the optional flat-field telecompressor. A single element field flattener is available for the Pentax 6 x 7 medium format camera, however the field is vignetted in the corners due to the restrictions of the 2.7" focuser (full coverage requires the 4" focuser/4" field flattener combination). The 2.7" focuser is interchangeable with the 4" model should you choose at some time in the future to upgrade to the full EDF package.

### ASTRONOMY TEST REPORT

In the test report entitled "Astro-Physics Refractors Big & Small", in the September 1993 issue of *Astronomy*, Alan Dyer described the performance of the 155mm f7 EDF during his winter observing sessions. Please note that the article referred to this instrument as an EDT.

"Optical performance of the 155EDT was impressive. It produced nary a trace of false color even on Venus. Equally impressive, this scope provided superb images as soon as it was set outside. Even in sub-freezing temperatures, image quality, though not perfect at first, was surprisingly sharp from the start. In cold weather, after a modest settle-down time of 30 minutes, in-focus star images were

textbook Airy disks with a well-defined first diffraction ring and a trace of a second outer ring. There was no sign of spherical aberration, lens figure changes, heat plumes, or distorted Airy disks due to tube turbulence."

We couldn't have said it better ourselves.



155mm StarFire EDF with 2.7" focuser, 600E German Equatorial, Hardwood tripod and accessories

### SPECIFICATIONS:

Color correction :	Less than 0.01% focus variation from 405nm to 706nm (r to h wavelengths)
Clear aperture :	155mm (6.1")
Focal length :	1085mm (43") efl
Resolution :	0.74 arc second
Coatings :	Multi-layer, overall transmission greater than 97% in peak visual wavelengths
Magnification range :	20x to 600x
Tube assembly :	White, 6.5" aluminum tube, baffled, flat black interior, engraved push-pull lens cell
Focuser type :	2.7" I.D. Astro-Physics rack & pinion focuser, 4.5" travel, 2.7", 2" and 1.25" adapters, 2.5" extension
Telescope length :	1041mm (41") with dewcap fully retracted
Tube weight :	23 lb
Carrying Case :	Foam-fitted, vinyl-covered plywood case
35mm Photographic field at prime focus :	1.3 x 1.8 degrees @ f7
35mm Photographic field with Telecompressor :	1.7 x 2.4 degrees @ f5.2
35mm Photographic field with 2x Barlow :	0.6 x .9 degrees @ f14
6 x 7 cm Photographic field at prime focus :	3.2 x 3.7 degrees @ f7 (vignetted)

## ASTRO-PHYSICS

# 155mm f7 STARFIRE EDF APOCHROMATIC REFRACTOR ASTROGRAPH WITH 4" FOCUSER AND 4" FIELD FLATTENER

This 155mm f7 StarFire EDF (6.1" aperture) was designed to be the ultimate astrograph while providing uncompromising visual performance. Outstanding photographs published in Sky & Telescope, Astronomy and various international astronomy magazines can only hint at the detail of the original prints and negatives. The 30" x 40" prints of the Lagoon/Trifid and Horsehead Nebulas that are on display in our showroom show incredible pinpoint star images from one side of the print to the other with no sign of image degradation. Truly amazing! Photographic spot diameters measure 15-20 microns over a 5 degree field (4" circle). The fast f7 focal ratio captures elusive and faint deep-sky objects easily with incredible detail. This lens has outperformed mirror type astrographs twice its size, as we had predicted.

The EDF is superb as a visual instrument as well. It is easily capable of high-power observations of the moon and planets. Secondary spectrum is nearly absent at any power. Deep-sky views are equally impressive due to the very high transmission of the three glass types.

In the astrographic configuration, the lens is a 5-element design in 2 groups (3 elements in front, 2 in rear). The heart of the front triplet apochromatic lens is an ED glass and 2 crowns. This combination totally eliminates all secondary spectrum, coma and spherical aberration. The rear lens is a 2-element field flattener that eliminates astigmatism and field curvature. In the visual configuration, the rear 2-element lens is removed and replaced with a standard visual adapter. This adapter allows all our usual accessories to be attached, as well as all standard 2" and 1.25" oculars.

The tube assembly comes fully baffled for a 5 degree 4" field. The giant 4" focuser is silky smooth and can be locked for long time-exposure astrophotography. Although it is possible to attach your own custom-made film holder, we have determined that the most practical camera back is the Pentax 6 x 7cm medium format camera. Field coverage is 3 x 3.5 degrees. After 4 years of field research, we've chosen this camera because it holds the film critically flat without the use of special vacuum attachments. This is not the case with other, less expensive film backs. The Pentax allows the user to critically focus directly on the ground glass with a high-power magnifier, assuring the highest possible resolution.



155mm StarFire EDF with 4" Focuser, 900 German Equatorial, with encoders, prototype short pier and astrocamera, 80mm Guidescope and other accessories

Another feature is the extra large opening and minimum back distance to the film plane which minimizes the inevitable vignetting of the light in the extreme corners of the format. All the important color and black/white films are available in the 120 format, which is not the case with large formats. It is for these reasons that we have standardized on the Pentax 6 x 7 and offer all the attachments necessary to use with the 155mm EDF.

The Astro-Physics giant 4" focuser is truly versatile. The 4" ID of the drawtube will allow maximum coverage of the Pentax 6 x 7 cm negative for medium format photography. The inside of the drawtube has a series of knife-edge baffles for maximum contrast. When you wish to use your 35mm camera with the Astro-Physics telecompressor for even faster exposures (f5.2), you can attach the 2.7" reducer and you are ready to go. The 2" and 1.25" adapters will allow you to use all of our standard accessories to maximize your visual and photographic applications.

### SPECIFICATIONS

Color correction :	Less than 0.01% focus variation from 405nm to 706nm (r to h wavelengths)
Clear aperture :	155mm (6.1")
Focal length :	1085mm (43") efl
Resolution :	0.74 arc second
Coatings :	Multi-layer, overall transmission greater than 97% in peak visual wavelengths
Magnification range :	20x to 600x
Tube assembly :	White, 6.5" aluminum tube, baffled, flat black interior, engraved push-pull lens cell
Focuser type :	4.0" I.D. Astro-Physics rack & pinion focuser, 4.5" travel, 2.7", 2" and 1.25" adapters, 2.5" extension
Telescope length :	1041mm (41") with dewcap fully retracted
Tube weight :	27 lbs.
Field Flattener :	4" diameter 2-element with multi-coatings
Carrying Case :	Foam-fitted, vinyl-covered plywood case
35mm Photographic field at prime focus :	1.3 x 1.8 degrees @ f7
35mm Photographic field with Telecompressor :	1.7 x 2.4 degrees @ f5.2
35mm Photographic field with 2x Barlow :	0.6 x 0.9 degrees @ f14
6 x 7 cm Photographic field at prime focus :	3.2 x 3.7 degrees @ f7
Maximum Photographic Field :	5 degrees, 4 inch circle

# 400 GERMAN EQUATORIAL MOUNT

TIGHT, COMPACT, STRONG

SMOOTH, SOLID PERFORMANCE

The two most important considerations in mount design and construction are maximum strength/rigidity for a given size and accuracy of the drive system. Without this basic foundation, all other features of a mount are just superfluous frills. The Astro-Physics 400 Equatorial was engineered to be a compact, firm platform for your high resolution instrument. Whether your interests are purely visual or include astrophotography, a steady image in the eyepiece or camera viewfinder is extremely important.

The 400 is constructed of the highest quality components to provide you with years of observing pleasure. All parts are precisely machined on our computerized CNC using solid or thick-wall aluminum and stainless steel. Machining tolerances are very high to achieve a tight, solid fit of all components. There are no thin-wall, weak, porous die castings as in most other mounts of comparable size. We avoid the use of any carbon steel shafts or plated steel fasteners because they will deteriorate with time. This mount will not rust or bind up and will retain its appearance and function throughout the years.

Both axes respond to fingertip pressure with unparalleled smoothness. Built-in clutches can be disengaged for ultra-smooth sweeping or locked for astrophotography. The worm gears, motors and drive components are enclosed to protect them from dirt and dust. With the 105 Traveler, the 400 mount damps out in one second when mounted on the lightweight aluminum tripod.

Your 400 mount can grow with your skills and interests in astronomy. If manual slow-motion controls meet your visual astronomy needs at this time, you can begin with the basic mount, without motor drives, then add the dual-axis motor drive (motors in both axes) with the hand controller. If at all possible, we recommend that you purchase the dual-axis motor drive so that the mount will follow the rotation of the earth. If you do not have any motors, you will be operating the slow motion controls continually to keep celestial objects in the center of the eyepiece. It is very difficult to concentrate on fine detail (surface markings of Mars, lunar rills, core stars of a globular cluster) if you must repeatedly adjust the mount. After all, fine resolution of these astronomical beauties is the reason that you purchased a high quality instrument!

When coupled with the options described separately, the 400 German Equatorial mount will be your portable observatory. This handy mount can be lifted easily into your backyard, packed conveniently into your car or carried aboard an airliner for travel to another hemisphere.

## FEATURES

- Precision-machined aluminum with radiused edges
- Gears and motors are fully enclosed
- Gear in declination axis allows full 360 degree continuous rotation: scope can move through zenith for photography
- 2.5" (6.4cm) hollow right ascension and declination shafts maximize strength at minimum weight
- Large UHMW thrust bearings form ultra-stable thrust surfaces for tremendous rigidity in a small package
- Right-ascension shaft threaded for optional polar scope allows quick, accurate polar alignment in the field
- Removable stainless-steel counterweight shaft for compact storage
- Engraved setting circles with Porter Slip Ring Design; polar axis ring is driven; it follows the stars without needing to be reset each time you look at a new object
- Fine altitude and azimuth adjustments for quickly and accurately zeroing in on the pole in the field
- Manual slow-motion knobs in both axes
- Black anodized finish will retain its lustrous beauty for years

## SPECIFICATIONS

Worm wheel:	3", 192 teeth fine pitched bronze wheel
Worm gear:	stainless steel
Tracking accuracy:	+ -5 arc second periodic error
Latitude range:	0 to 66 degrees
Azimuth adjustment:	approximately 25 degrees
Setting circles:	Porter Slip Ring Design
Right ascension:	10-minute increments, pointer engraved both Northern/Southern
Declination:	1-degree increments, pointer
Capacity:	Will accommodate refractors up to 5" reflectors to 6", Cassegrains to 8"
Weight of equatorial head:	20 lbs (9.1 kg)

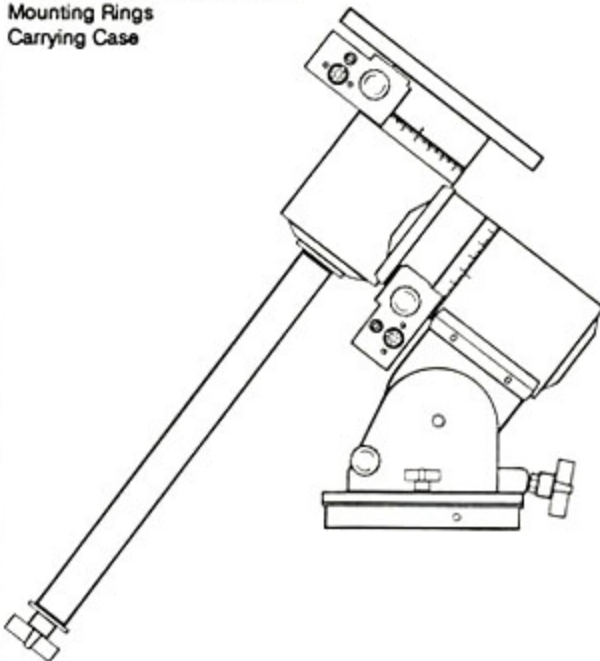
## DUAL AXIS MOTOR DRIVE SYSTEM - OPTIONAL

- High-resolution stepper motors in both axes
  - Lightweight, palm-sized controller
  - Quartz control
  - R.A. and declination reversing switches for correct object orientation and movement in eyepiece.
  - Power output to plug in guiding reticle or other accessory
  - Adjustable brightness control for guiding reticle
  - Plug-in for SBIG ST-4 or ST-6 Star Tracker
- Drive rates: Sidereal, solar, lunar  
Guiding/slewing rates: 2x/8x/16x  
Hemisphere: Switch for Northern/Southern  
Power Consumption: 0.2 amps at normal rates  
Power requirements: 12 VDC  
Suggested power sources: Portable battery pack, auto battery, power inverter for 110 volts

## OTHER AVAILABLE OPTIONS

Please see the accompanying information sheets for descriptions:

Sturdy, Adjustable Hardwood Tripod with shelf and carrying case  
Lightweight Davis & Sanford Aluminum Adjustable Tripod  
SBIG ST-4 or ST-6 CCD Star Tracker/Imaging System  
Portable Pier - 6" dia., heights 48", 54" or 62"  
6 Amp-hr, 12 Volt Rechargeable Battery Pack  
Stainless Steel Counterweights- 6 lbs., 9 lbs.  
Encoders for Digital Setting Circles  
Polar Axis Scope with Illuminator  
Mounting Rings  
Carrying Case



## 600 E GERMAN EQUATORIAL MOUNT WITH DUAL AXIS DRIVE

Astro-Physics 600 E German Equatorial Mount offers many fine features to provide superb performance in a compact, portable package. It was engineered to provide a firm, steady platform for your high-resolution instrument. Both axes respond to fingertip pressure with no hint of backlash. Built-in clutches can be disengaged for ultra-smooth sweeping or locked for astro-photography.

The 600 E is constructed of the highest-quality components to provide you with years of observing pleasure. All parts are machined of aluminum and stainless steel. We avoid the use of any carbon-steel shafts or plated-steel fasteners because they will deteriorate with time. This mount will not rust or bind up and will retain its appearance and function throughout the years.

Rigid aluminum castings enclose the worm gears and the right-ascension and declination motors. Drive components are protected from dirt and dust; extraneous wires and gearing are eliminated; and the overall appearance is enhanced.

Fine pitch, precision gears are the heart of the drive system. These gears are cut with Class AA hobs on a highly accurate gear-cutting machine. High-resolution stepper motors deliver 150 inch-oz. torque with a fraction of the power required by normal synchronous motor-drive corrector systems. Designed for the utmost in convenience, this drive system operates from a portable battery pack or the cigarette lighter of your automobile.

Included in the hand control is a choice of drive rates for lunar, solar, sidereal and variable (handy for comets) tracking. A reversing switch for declination allows the 4-button controller to be properly oriented on both sides of the meridian. The fine-guiding rate is designed for accurate tracking of guidestars at very high powers. The slew rate can be used for leisurely cruising on the lunar surface or for rapidly centering objects in the field of view.

Over the years, our mounts and drive systems have functioned reliably in the coldest environments of Canada, Norway and remote Alaska. The circuitry of our controller has been proven since the mid-1970s and is comprised of the highest-quality military spec components. We have seen many of our competitors' controllers constructed with flimsy, hygroscopic (water absorbing) circuit boards, components rated for indoor use and poor solder connections. Astro-Physics controllers will stand up to the humidity and temperature extremes common to many observing locations.

When coupled with the options described separately, the 600 E will be your portable observatory for home or dark-sky site. Within minutes, you will be assembled and polar-aligned, ready to enjoy the wonders of the night sky.

### SPECIFICATIONS OF EQUATORIAL HEAD

Worm wheel:	4" fine pitched bronze wheel
Worm gear:	stainless steel
Tracking accuracy:	+/- 5 arc second periodic error
Latitude range:	15 to 57 degrees
Azimuth adjustment:	approximately 17 degrees
Setting circles:	Porter Slip Ring Design
Right ascension:	10-minute increments, 2-minute vernier
Declination:	1-degree increments, pointer
Capacity:	Will accommodate refractors up to 6" f9, reflectors to 8", Cassegrains to 10"
Weight of equatorial head:	27 lbs. (12.3 kg)

### SPECIFICATIONS OF MOTOR DRIVE SYSTEM

Dimensions of controller:	6" x 2.5" x 1"
Drive rates:	Sidereal, solar, lunar
Guiding/ slewing rates:	2x/ 8x/ 16x
Hemisphere:	Switch for Northern/ Southern
Power consumption:	0.25 amps at normal rates
Power requirements:	12 VDC
Suggested power sources:	Portable battery pack, auto battery, power inverter for 110 volts

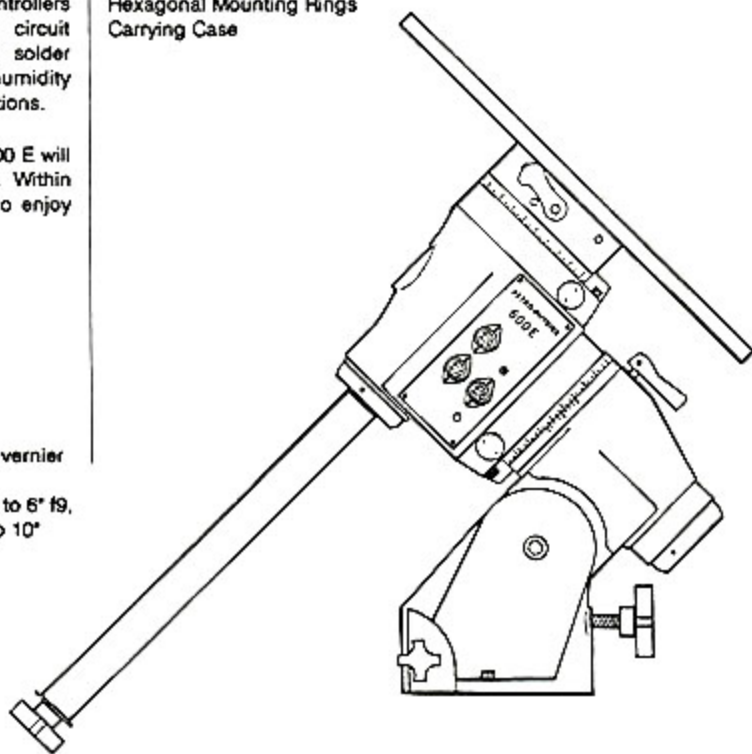
### FEATURES

- Virgin aluminum sand castings, precision hollow cast and machined for light weight and rigidity
- Gears and motors are fully enclosed
- Dual Axis Pulse Motor Drive with 12-Volt Controller
- Gear in declination axis allows full 360-degree continuous rotation: scope can move through zenith for photography
- Large UHMW thrust bearings form ultra-stable thrust surfaces for tremendous rigidity in a small package
- Hollow right-ascension and declination shafts maximize strength at minimum weight
- Right-ascension shaft threaded for optional polar scope for quick, accurate polar alignment in the field
- Removable stainless steel counterweight shaft for compact storage
- Engraved setting circles with Porter Slip Ring Design; polar-axis ring is driven; it follows the stars without having to be reset each time you look at a new object
- Fine altitude and azimuth adjustments for quickly and accurately zeroing in on the pole in the field
- High-resolution stepper motors in both axes
- Lightweight, palm-sized controller
- Quartz control
- R.A. and declination reversing switches for correct object orientation and movement in eyepiece
- Power output to plug in guiding reticle or other accessory
- Adjustable brightness control for guiding reticle
- Plug in for Santa Barbara Instrument Group ST-4 and ST-6

### AVAILABLE OPTIONS

Please see the accompanying information sheets for descriptions

Sturdy, adjustable hardwood tripod with shelf and carrying case  
Portable Pier - 6" diameter with heights 48", 54" or 64"  
SBIG ST-4 or ST-6 CCD Star Tracker/Imaging Systems  
6 Amp-hr, 12-Volt Rechargeable Battery Pack  
Stainless Steel Counterweights- 6 lbs., 9 lbs.  
Modification for latitudes 0-15 degrees  
Encoders for Digital Setting Circles  
Polar-Axis Scope with Illuminator  
Hexagonal Mounting Rings  
Carrying Case



# 800 GERMAN EQUATORIAL MOUNT WITH DUAL AXIS DRIVE

The importance of mechanical stability in a mounting cannot be overstated. You may own a fine, high resolution instrument, but unless your mount is rock-solid, you will rarely achieve the results that you want in the eyepiece or on film. The image will be subject to frequent movement, so you will not be able to perceive the subtlety of detail that would be possible if your image were steady. For astrophotography, movement in the image will result in a streak or blur on your negative.

Astro-Physics mountings are engineered to be steady even in gusting winds. Both axes respond to fingertip pressure with no hint of backlash. Built-in clutches can be disengaged for ultra-smooth sweeping or locked for astrophotography. The thrust bearing design allows for compactness, yet this mount will carry large telescopes with ease. Gear accuracy is also exceedingly important. Our gears were specifically designed for precision tracking. The fine pitch gears on our drives are cut with Class AA hobs on a highly accurate gear-cutting machine. With easy polar-alignment capabilities, it is possible to take excellent astrophotos with minimal or no guiding on most telescopes.

Included in the hand control is a choice of drive rates for lunar, solar, sidereal and variable (handy for comets) tracking. A reversing switch for declination allows the 4-button controller to be properly oriented on both sides of the meridian. The fine-guiding rate is designed for accurate tracking of guidestars at very high powers. The slew rate can be used for leisurely cruising on the lunar surface or for rapidly centering objects in the field of view.

Over the years, our mounts and drive systems have functioned reliably in the coldest environments of Canada, Norway and remote Alaska. The circuitry of our controller has been proven since the mid-1970s and is comprised of the highest-quality military spec components. We have seen many of our competitors' controllers constructed with flimsy, hygroscopic (water absorbing) circuit boards, components rated for indoor use, and poor solder connections. Astro-Physics controllers will stand up to the humidity and temperature extremes common to many observing locations.

When coupled with the options described separately, the 800 will be your portable observatory for home or dark-sky site. Within minutes, you will be assembled and polar-aligned, ready to enjoy the wonders of the night sky.

## SPECIFICATIONS OF EQUATORIAL HEAD

Worm wheel:	6" fine pitched wheel
Worm gear:	stainless steel
Latitude range:	0 to 57 degrees with polar scope in place
Azimuth adjustment:	approximately 14 degrees
Setting circles:	Porter Slip Ring design
Right ascension:	10-minute increments, 2-minute vernier
Declination:	5-degree increments, 1-degree vernier
Capacity:	Will accommodate refractors up to 7", reflectors to 10", Cassegrains to 12"
Weight of equatorial head:	45 lbs (20.5 kg)

## SPECIFICATIONS OF MOTOR DRIVE SYSTEM

Dimensions of controller:	4" x 3" x 1.5"
Drive rates:	Sidereal, solar, lunar, variable
Guiding/ Slewing rates:	2x/ 8x
Hemisphere:	Northern is standard Southern circles on request
Power consumption:	0.25 amps at normal rates
Power requirements:	12 VDC
Suggested power sources:	Portable battery pack, auto battery, power inverter for 110 volts

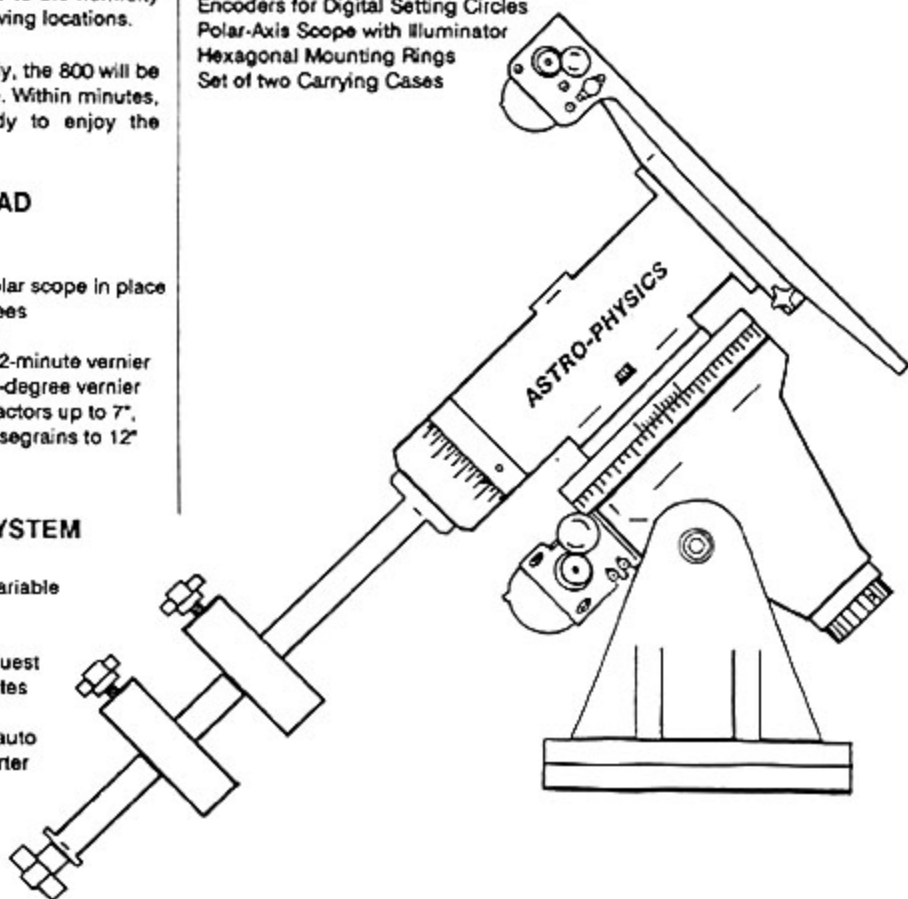
## FEATURES

- Virgin aluminum sand castings, precision hollow cast and machined for light weight yet provides rigid performance
- Precision 6" Gear with  $\pm 5$  second periodic error
- Dual Axis Pulse Motor Drive with 12-Volt Controller
- Manual slow-motion knob in both axes
- Tangent arm in declination
- Massive tapered Timken roller bearings form ultra-stable thrust surfaces for tremendous rigidity in a small package
- Hollow 1.5" stainless-steel right-ascension and declination shafts maximize strength at minimum weight
- Right-ascension shaft threaded for optional polar scope for quick, accurate alignment in the field
- Removable 1.125" stainless-steel counterweight shaft for compact storage
- Polar and declination axes come apart quickly for light weight easy handling
- Fine altitude and azimuth adjustments for quickly and accurately zeroing in on the pole in the field
- Engraved setting circles with Porter Slip Ring Design; polar-axis ring is driven; it follows the stars without having to be reset each time you look at a new object
- Converts to an alt-azimuth mount for comet hunting and terrestrial viewing. Imagine, two mounts in one!
- When most scopes are mounted on our 8" diameter pier, they damp out in 1-2 seconds

## AVAILABLE OPTIONS

Please see accompanying information sheets for description

- Modification of hand controller for SBIG ST-4 and ST-6 Star Tracker
- Right-Ascension Drive Cord for Southern Hemisphere
- Portable Pier - 8" diameter with heights 48", 54", 62"
- SBIG ST-4 and ST-6 Star Tracker/ Imaging Systems
- 12 Amp-hr, 12-Volt Rechargeable Battery Pack
- Stainless Steel Counterweights - 6 lbs., 9 lbs.
- Encoders for Digital Setting Circles
- Polar-Axis Scope with Illuminator
- Hexagonal Mounting Rings
- Set of two Carrying Cases



# 1200 GERMAN EQUATORIAL MOUNT WITH DUAL AXIS DRIVE AND BUILT-IN DIGITAL ENCODERS

## SPECIFICATIONS OF EQUATORIAL HEAD

R.A. worm wheel: 10.3", 225 tooth aluminum  
Declination worm wheel: 7.0", 225 tooth aluminum  
Worm gear: stainless steel  
Tracking accuracy: + -5 arc second periodic error  
Latitude range: 19 to 68 degrees with polar scope  
Lower latitude wedge available.

Azimuth adjustment:  
Setting circles: Porter Slip Ring Design  
Right ascension: 4-minute increments, pointer  
Declination: 1-degree increments, pointer  
Capacity: approximately 90 lbs.  
Weight of equatorial head: 72 lbs (30.9 kg), disassembles into two manageable pieces, declination axis with saddle plate is 34 lbs, right ascension axis is 38 lbs.

## SPECIFICATIONS OF MOTOR DRIVE SYSTEM

High resolution encoders: 4000 step encoders, each axis  
Drive rates: Sidereal, solar, lunar, variable  
Plug in for SBIG ST-4 or ST-6  
Guiding/ slewing rates: 2x, 8x, 16x  
Hemisphere: Northern/ Southern Switch  
Power consumption: 0.25 amps at normal rates  
Power requirements: 12 VDC  
Suggested power sources: Portable battery pack, auto battery, power inverter for 110 volts

## FEATURES:

- All machined mounting made from aluminum barstock
- Precision 10.2" gear in Right-Ascension, 7" gear in Declination
- Dual Axis Pulse Motor Drive with 12 Volt Controller
- Hollow R.A. axis with detachable polar scope for quick, accurate alignment in the field
- Removeable 2" counterweight shaft can hold up to five 18 lb. counterweights.
- Polar and Declination axes come apart quickly for light-weight easy handling and ease of transport.
- Fine altitude and azimuth adjustments for quickly and accurately zeroing in on the pole in the field
- Setting circles with Porter Slip Ring Design; polar axis ring is driven; it follows the stars without needing to be reset each time you look at a new object.
- Both axes have built-in high resolution encoders for use with popular digital setting circles.
- Ready to go with Santa Barbara Instrument Group ST-4 or ST-6 Star Tracker/Imaging Systems
- Base fits into 10" diameter pier with 1/8" wall thickness.

## OPTIONAL COMPUTER DRIVE SYSTEM

We can install special high performance stepper motors which will allow high speed slewing up to 1200x sidereal rate when used with our new computer drive. This drive allows automatic pointing to any part of the sky to over 400 objects in its permanent memory. Up to 64 objects may be entered for an evenings' observing session to which the computer will slew in sequence with one button activation.

## OTHER AVAILABLE OPTIONS

Please see accompanying information sheets for description

SBIG ST-4 or ST-6 Star Tracker/ Imaging System  
Portable Pier - 10" diameter, 1/8" wall thickness  
Jim's Mobile Industries Digital Setting Circles  
6 Amp-hr, 12 Volt Rechargeable Battery Pack  
Lumicon Sky Vector Digital Setting Circles  
Stainless Steel Counterweights - 18 lbs.,  
Lightweight Aluminum Tripod - 21 lbs.!!  
Mounting Rings  
Carrying Cases



## ACCESSORIES FOR 400, 600 E AND 800 MOUNTS

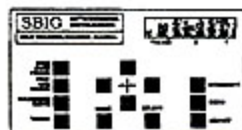
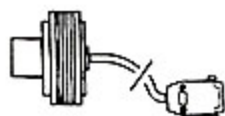
### SBIG ST-4 CCD STAR TRACKER/IMAGING

If you plan to take long exposure astrophotos, we recommend the ST-4 from Santa Barbara Instrument Group (SBIG). It is a dual purpose CCD based instrument that functions as either a star tracker or imaging camera. The star tracker function is most exciting to us. The CCD detector is mounted on the focuser of your guide telescope or primary telescope (if using an off-axis guider). After you select the guide star that you wish to use, the ST-4 centers the image on a pixel and holds that star in position by constantly monitoring it and sending correction signals to the telescope drive immediately. Your right ascension or declination motors will then be activated automatically to make the appropriate corrections. All of this happens in split seconds, with greater accuracy than is possible with manual guiding.

Astro-Physics German Equatorial mounts are ideally suited for the ST-4. Since the gear accuracy is excellent ( $\pm 5$  arc second periodic error), only minor corrections are needed, mostly to compensate for slight inaccuracies in polar alignment.

ST-4 CCD Head

Instrument Panel



### MODIFICATION OF HAND CONTROLLER FOR SBIG ST-4 STAR TRACKER

Astro-Physics offers a modification for our 800 German Equatorial mount to integrate the function of the ST-4 with our hand controller. If you have ordered or plan to order this mount, you may wish to consider the ST-4 modification which we can incorporate when building your hand controller. If you already own an older 600, 600 E or 800 mount, we can retrofit your hand controller with this modification. New 400 and 600 E mounts include this feature.

Tony Hallas and many other customers have used the ST-4 extensively and are thrilled with its performance. Just think, after you set up your astrographic system and begin your exposure, you can take a break from the cold or mosquitoes or enjoy visual astronomy with another scope.

### SBIG ST-6 IMAGING CAMERA

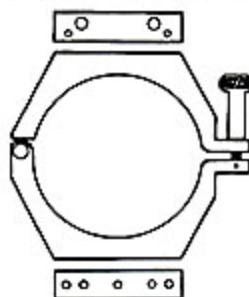
If your primary interest is CCD imaging, you may wish to consider the ST-6 model. The ST-6 is a second generation cooled CCD camera with approximately 9 times the detector area of the model ST-4. It uses a CCD with a resolution of 375 by 242 pixels. The pixel size is 23 by 27 microns and the total array is 8.6 by 6.5 millimeters. The ST-6 guides itself while imaging and is "sky background" limited- capable of up to one hour integrations under favorable sky conditions. The ST-6 is used in conjunction with an IBM PC compatible computer which allows the images to be easily displayed and manipulated. This remarkable instrument has been widely acclaimed by experienced CCD users around the world.

### PORTABLE RECHARGEABLE 12 V BATTERY PACK

The 6 amp portable battery pack is the ideal power source to have when you are observing in the field. Just plug the connector into the base of your mount to power your drives and electronic accessories. This unit is completely maintenance free, safe and can be operated in any position. The battery pack is easily recharged by the self-contained charger which inserts into the battery pack and plugs into a 110 wall outlet. Since it has no memory, it will recharge fully every time without a loss of capacity (unlike ni-cad batteries).

### MOUNTING RINGS

Astro-Physics mounting rings attach to the cradle plate of the mount and hold your tube assembly firmly in place. The unique ring design allows you to support your guidescope, camera or other accessories requiring a flat mounting surface. These rings feature a hinged assembly with thumbscrew closure. They are felt-lined to prevent marring of your tube. The base of the mounting rings are drilled and tapped for 1/4-20 screws. The hole patterns fit the following mounts: Astro-Physics 400, 600E, and 800; Carton alt-azimuth; Vixen DX and Super Polaris; and the TeleVue Systems mount. The top of the rings are drilled for our piggyback camera bracket and guidescope rings. Please order the size that corresponds to the outside dimension of your tube assembly: 5.0", 5.5", 6.0", 6.5", 7.0", 8.0"



holes for guidescope rings and piggyback camera bracket

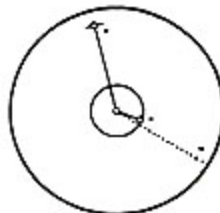
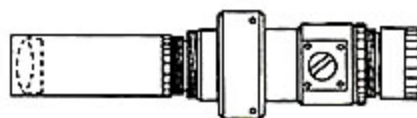
1/4-20 holes drilled for several popular mounts

### POLAR AXIS SCOPE WITH ILLUMINATOR

The polar axis scope will allow you to quickly align your mount on the pole stars to ensure greater tracking accuracy throughout your observing session. The unit threads into the base of the polar axis of the 400, 600 E and 800 equatorial heads. The illuminator can be attached to the polar axis scope enabling you to see the reticle clearly. On-off control and adjustable intensity. Operates with batteries.

#### Specifications:

Magnification	5 x
Achromatic objective	20mm
Eyeiece	K22mm (Diopter adjustable)
Field of view	8 degrees
Rated Voltage	3VDC
Power consumption	16mA
Light	red LED
Battery	Button type: two Varta V76 PX or equivalent



Reticle of polar axis scope

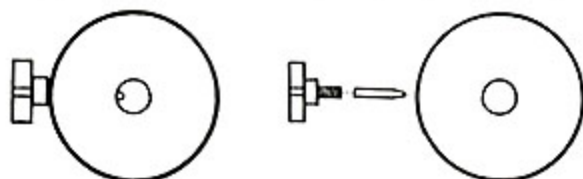
The secret to quick polar alignment is an easy to use reticle that shows the positions of several stars in the region of the region of polaris. Line up these stars in just minutes and you are ready to go.

## STAINLESS STEEL COUNTERWEIGHTS

Our counterweights are precision machined from 303 stainless steel. A bronze sleeve is press fit into the center hole to prevent marring of your counterweight shaft as you adjust the position of your counterweights. The weights slip easily onto the counterweight shaft and are secured in position with a large hand knob/brass pin assembly. The brass pin will not mar your shaft.

Keep in mind that you can adjust the position of the weights to counterbalance varying loads, however, the addition of a guidescope, camera and other heavy accessories may necessitate an additional counterweight. If you plan to mount your catadioptric, Newtonian or any other scope, figure that you will need a counterweight total approximately 80% of your tube assembly weight. We recommend the following combinations of weights for our refractors:

- 105 Traveler EDT Tube Assembly - one 9 lb. weight
- 130 ED Doublet Tube Assembly - two 6 lb. weight
- 130 StarFire EDT Tube Assembly - two 6 lb. weights
- 155 StarFire EDT Tube Assembly - two 9 lb. weights
- 155 ED Doublet Tube Assembly - two 9 lb. weights
- 180 StarFire EDT Tube Assembly - three 9 lb. weights
- 155 StarFire EDF Tube Assembly - two 9 lb., one 6 lb. weights

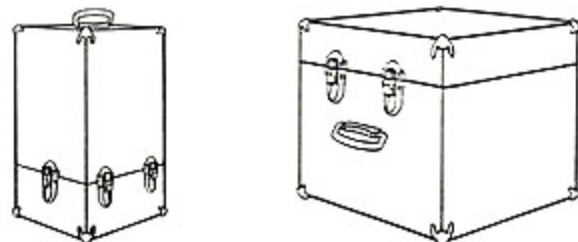


## 800 MOUNT CARRYING CASES

These carrying cases will allow you to transport your mounting in a protective and attractive manner. If you habitually organize your mount components in these cases, you will be sure to have all of your parts and tools when you arrive at your observing site. Please note that these cases were not designed for airline transport.

The polar axis, declination axis, cradle plate, hex rings and counterweight shaft all disassemble quickly for packing. The 800 mount is packed in a set of two vinyl covered cases. One case holds the polar axis assembly and the second case holds the declination axis with the cradle plate, mounting rings, hand control, power cords, polar axis scope and two counterweights and a few tools.

	dimensions L x W x H	weight of case w/o mount
800 Polar Axis Case	13" x 11" x 15"	14 lbs
800 Declination Axis Case	18" x 18" x 11"	16 lbs



## 400 AND 600E MOUNT CARRYING CASES

The cases for these two mounts are constructed of molded ABS polycarbonate shell for strength and rigidity. These cases are suitable for airline baggage transport and can be locked using an external padlock (not provided). A pluckout foam interior allows you to customize your case.

	dimensions L x W x H	weight of case w/o mount
400 Mount Case	21.7" x 14.6" x 9"	10.7 lbs
600 E Mount Case	22.7" x 19.8" x 9"	13.4 lbs

## PORTABLE PIER

This pier mounting features a unique tension design that combines rugged construction with light weight while eliminating flexure and annoying vibrations. Legs and tension rods attach without hardware, allowing field assembly in seconds. Stainless steel tension rods do not interfere when the telescope is pointed at the zenith. Turnbuckles allow you to tighten the rods and are the secret to the firm base of support that this pier provides. The center posts are constructed of aluminum tubing, the base construction is aluminum and steel and the legs are steel.

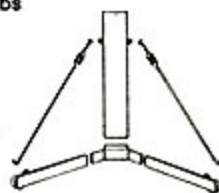
### Pier for 600 E Mount

height of pier	48"	54"	62"
diameter of post	6"	6"	6"
length of legs	24.5"	24.5"	24.5"
weight of pier post	7 lbs	8 lbs	9 lbs
weight of pier base	6 lbs	6 lbs	6 lbs
weight of each leg	5 lbs	5 lbs	5 lbs
weight of 3 struts	4 lbs	5 lbs	5 lbs
total weight assembled	32 lbs	33 lbs	34 lbs



### Pier for 800 Mount

height of pier	48"	54"	62"
diameter of post	8"	8"	8"
length of legs	25"	25"	25"
weight of pier post	15 lbs	17 lbs	19 lbs
weight of pier base	11 lbs	11 lbs	1 lbs
weight of each leg	6.5 lbs	6.5 lbs	6.5 lbs
weight of 3 struts	4 lbs	5 lbs	5 lbs
total weight assembled	49.5 lbs	51.5 lbs	53.5 lbs



## DAVIS AND SANFORD TRIPOD

The adjustable Davis and Sanford (Tiffin) tripods is offered for light weight, compact transport. The legs retract and fold into a relatively small unit. It is recommended as the primary tripod for the 400 mount and 105 Traveler (or similar sized instruments). While it is not our first choice for the 400 mount and our 130mm refractors, it's a very portable option for people who plan to transport their equipment as airline baggage for observing in exotic locations (or on a business trip). This is the tripod that we transported by air to Baja, Mexico for the solar eclipse in 1991.



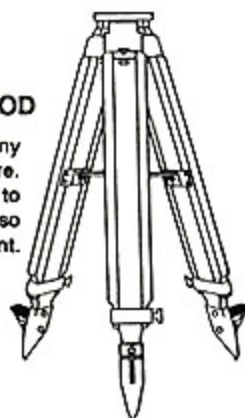
The tripod is constructed of black anodized aluminum and black painted aluminum castings.

Possible height:	29"-51"
Recommended height:	29"-45"
Weight:	11 lbs.
Maximum diameter:	6.5"
Minimum length:	34"

## ADJUSTABLE HARDWOOD TRIPOD

This superb hardwood tripod surpasses any portable tripod that we have seen anywhere. The unique method of attaching the legs to the tripod top was carefully engineered so that there is no side to side movement. Tripod comes with fabric carrying case.

Recommended height:	42"-55"
Weight:	18 lbs.
Maximum diameter:	6"
Minimum length:	45"



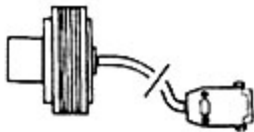
## ACCESSORIES FOR 1200 MOUNT

### SBIG ST-4 CCD STAR TRACKER/IMAGING

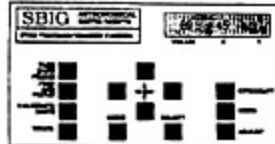
If you plan to take long exposure astrophotos, we recommend the ST-4 from Santa Barbara Instrument Group (SBIG). It is a dual purpose CCD based instrument that functions as either a star tracker or imaging camera. The star tracker function is most exciting to us. The CCD detector is mounted on the focuser of your guide telescope or primary telescope (if using an off-axis guider). After you select the guide star that you wish to use, the ST-4 centers the image on a pixel and holds that star in position by constantly monitoring it and sending correction signals to the telescope drive immediately. Your right ascension or declination motors will then be activated automatically to make the appropriate corrections. All of this happens in split seconds, with greater accuracy than is possible with manual guiding.

Astro-Physics German Equatorial mounts are ideally suited for the ST-4. Since the gear accuracy is excellent, only minor corrections are needed, mostly to compensate for slight inaccuracies in polar alignment.

ST-4 CCD Head



Instrument Panel



### SBIG ST-6 CCD IMAGING CAMERA

If your primary interest is CCD imaging, you may wish to consider the ST-6 model. The ST-6 is a second generation cooled CCD camera with approximately 9 times the detector area of the model ST-4. It uses a CCD with a resolution of 375 x 242 pixels. The pixel size is 23 x 27 microns and the total array is 8.6 x 6.5 millimeters. The ST-6 guides itself while imaging and is "sky background" limited- capable of up to one hour of integrations under favorable sky conditions. The ST-6 is used in conjunction with an IBM PC compatible computer which allows the images to be easily displayed and manipulated. This remarkable instrument has been widely acclaimed by experienced CCD users around the world.

### MOUNTING RINGS

Astro-Physics mounting rings attach to the cradle plate of the mount and hold your tube assembly firmly in place. The unique ring design allows you to support your guidescope, camera or other accessories requiring a flat mounting surface. These rings feature a hinged assembly with thumbscrew closure. They are felt-lined to prevent marring of your tube. The base of the mounting rings are drilled and tapped for 1/4-20 screws. The hole patterns fit the following mounts: Astro-Physics 400, 600E, and 800 and 1200 mounts; Carton alt-azimuth; Vixen DX and Super Polaris; and the TeleVue Systems mount. The top of the rings are drilled for our piggyback camera bracket and guidescope rings. Please order the size that corresponds to the outside dimension of your tube assembly: 5.0", 5.5", 6.0", 6.5", 7.0", 8.0"



holes for guidescope rings and piggyback camera bracket

1/4-20 holes drilled for several popular mounts

### PORTABLE RECHARGEABLE 12 V BATTERY PACK

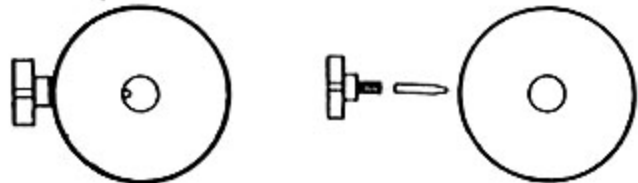
The 12 amp portable battery pack is the ideal power source to have when you are observing in the field. Just plug the connector into the base of your mount to power your drives and electronic accessories. This unit is completely maintenance free, safe and can be operated in any position. The battery pack is easily recharged by the self-contained charger which inserts into the battery pack and plugs into a 110 wall outlet. Since it has no memory, it will recharge fully every time without a loss of capacity (unlike ni-cad batteries).

### STAINLESS STEEL COUNTERWEIGHTS

Our counterweights are precision machined from 303 stainless steel. A bronze sleeve is press fit into the center hole to prevent marring of your counterweight shaft as you adjust the position of your counterweights. The 6" diameter weights slip easily onto the counterweight shaft and are secured in position with a large hand knob/brass pin assembly. The brass pin will not mar your shaft.

Keep in mind that you can adjust the position of the weights to counterbalance varying loads, however, the addition of a guidescope, camera and other heavy accessories may necessitate an additional counterweight. If you plan to mount your catadioptric, Newtonian or any other scope, figure that you will need a counterweight total equal to approximately 80% of your tube assembly weight. We recommend the following combinations of weights for our refractors:

- 180 StarFire EDT Tube Assembly - two 18 lb. weights
- 206 StarFire EDF Tube Assembly - three 18 lb. weights



### PORTABLE PIER

This pier features a unique tension design that combines rugged construction with light weight while eliminating flexure and annoying vibrations. Legs and tension rods attach without hardware, allowing field assembly in seconds. Stainless steel tension rods do not interfere when the telescope is pointed at the zenith. Turnbuckles allow you to tighten the rods and are the secret to the firm base of support that this pier provides. The 10" diameter center post is constructed of 1/8" aluminum tubing, the base construction is aluminum and steel and the legs are steel.

height of pier	48"	54"
diameter of post	10"	10"
length of legs	25"	25"
weight of pier post	14 lbs	17 lbs
weight of pier base	18.5 lbs	18.5 lbs
weight of each leg	6.25 lbs	6.25 lbs
weight of 3 struts	4.5 lbs	4.5 lbs
total weight assembled	55.75 lbs	58.75 lbs

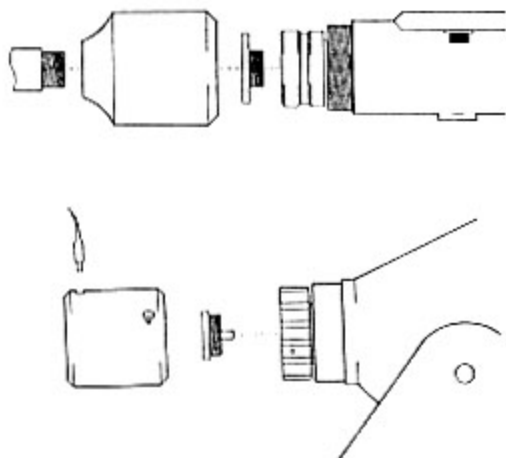


# DIGITAL SETTING CIRCLES

## HIGH RESOLUTION MOUNTED ENCODERS

Our mounted encoders will allow you to use digital setting circles with your Astro-Physics mounts. The high-resolution encoders are enclosed in machined aluminum housings that were designed to look like an integral part of your mount, rather than an after-market add-on. The encoders read the movements of the shaft directly. One encoder is mounted securely to the declination axis just above the counterweight shaft and the other to the polar axis housing. You can order your new mount with the encoders or upgrade your present 400, 600E and 800 German Equatorial Mounts.

Illustration of 800 Mount encoder attachments



## JIM'S MOBILE INCORPORATED (JMI) DIGITAL SETTING CIRCLES

Available for 400, 600E, 800 and 1200 mounts.

If you live in a suburban environment where star hopping is very difficult, you will appreciate the ease of using digital setting circles. Spend more time observing and less time hunting for objects. These computer units can easily guide you to any of hundreds or even thousands of objects. You don't have to know where they are or even have a star chart handy.

Simply turn the computer on, sight two stars (one if you are polar aligned), and you are ready to explore the universe as never before. You don't need to polar-align, or level your telescope. You don't have to define your latitude, longitude or even the date or time!

Select any object in the internal database and with the press of a key, view detailed information such as Right Ascension and Declination, magnitude, size, common name, constellation, object type and Sky Atlas (TM) chart number reference. Then simply move your telescope in the direction indicated by the arrows until the angles decrease to zero. The telescope will now be pointed at the selected object!

The three dedicated computer units offered by JMI share many common features. Those which are listed here are present in each of the units. Refer to descriptions of each unit for additional features.

- Red LED display with selectable brightness for easy reading both under the stars and in full daylight
- 24 hour operation from single 9V alkaline battery (at dimmest setting)
- Real-time display of telescope's current Right Ascension and Declination (Epoch 2000.0)
- Event timer - useful for timing astrophotographs to the second
- Operate between -10 degrees C (14 degrees F) and + 50 degrees C (122 degrees F)
- Can track slew rates of up to 60 degrees per second or more. ( Note that these are passive units; they don't move the telescope).
- Low battery and encoder error detection.

Choose the model with the features that you prefer.

### NGC-microMAX

After a simple two star alignment, the NGC-microMAX computer will display your telescope's current right ascension and declination for use in locating objects at known locations (this information can be obtained from star charts, books and periodicals). Additionally, the positions of all 110 Messier objects (these are some of the brightest deep-sky objects) are permanently stored in the computer's memory to enable them to be located quickly by beginner or expert alike.

Modes: R.A. & DEC, Catalog, Guide, Star Fix, Align

### NGC-miniMAX

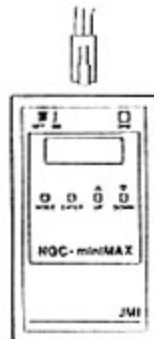
This is a dedicated computer with an internal database of 3,900 objects including most NGC/IC objects to about 13th magnitude and planets. It actually knows where your telescope is pointed at all times and can guide you to any object in its database. You can even add your own objects. The NGC-miniMAX is the only unit of its type on the market to offer multi-lingual capabilities! English \* French \* German \* Italian \* Spanish.

Modes: R.A. & DEC, Catalog, Guide, Timer, Star Fix, Align, Polar Align

### NGC-MAX

JMI's top-of-the-line in dedicated computer. This unit has an incredible 12,100 object database including all NGC and IC objects to 16th magnitude, 360 other non-stellar objects, 928 stars, planets and 28 user identified objects. The RS-232C serial interface can be used with The\_Sky software. Includes an Identify Mode which identifies unfamiliar objects and finds objects near the current position.

Modes: R.A. & DEC, Catalog, Guide, Timer, Star Fix, Align, Polar Align, Identify



# ASTRO-PHYSICS ACCESSORIES

## ASTRO-PHYSICS 2.7" FOCUSER

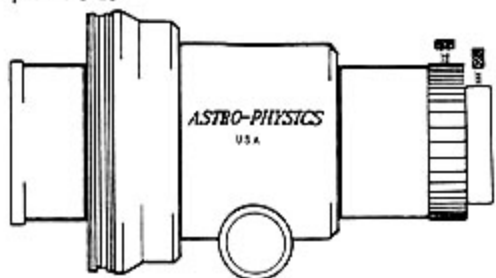
For the amateur who wants a smooth, yet solid focuser, we manufacture our own model of high quality components. Our focuser features a drawtube of 2.7" inside diameter which allows the avid astrophotographer to use a medium format camera to capture images in a 2.25" x 2.25" format with minimal vignetting. A series of knife-edge baffles are machined directly into the drawtube to assure the highest possible contrast by minimizing reflections. The helical rack and pinion provides ultra-smooth motion for precision focusing. Our machined aluminum knobs were designed with comfortable, firm handling in mind. The adapter thumbscrews are substantial and easy to grasp.

Brass locking rings are an important feature of our focuser. We realize that many of our customers use a variety of heavy and expensive accessories including 2 lb. eyepieces, 35mm and medium format cameras, binocular viewers, etc. So, we designed our focuser with recessed brass locking rings at each thumbscrew location. As you tighten the thumbscrew, the brass locking ring clamps onto the part that has been inserted. Consequently, your focuser drawtube, 2" accessories and 1.25" accessories are held securely in place. As an added advantage, the brass will not mar the surface of your accessories.

This focuser is included with all of our StarFire refractors. The 2.7" focuser is also a first class choice for the do-it-yourselfer who takes pride in constructing his own tube assembly.

### FEATURES:

- All components are machined of high quality aluminum. Housing is black anodized.
- Brass locking rings to secure focuser drawtube, 2" and 1.25" accessories.
- 2" adapter is aluminum, black anodized, screws into focuser tube, brass locking ring, thumbscrew.
- 1.25" adapter is aluminum, black anodized, slips into 2" adapter or 2" diagonal, brass locking ring, thumbscrew, threaded for 48mm filters.
- Inside diameter of focuser draw tube is 2.7"
- Focusing travel with the 2" adapter is 4.4"
- Focusing travel with telecompressor is 5.0"
- Overall length of the focuser when fully racked in with 2" adapter is 4.8"
- Overall length of the focuser when fully racked in with 1.25" adapter is 5.25"



## FOCUSER EXTENSION

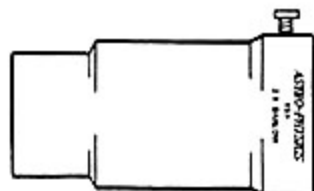
Our focuser extension tube threads securely into the focuser drawtube of the Astro-Physics 2.7" focuser and accepts the 2" adapter. A series of knife-edge baffles are machined into the wall. This extension will provide you with 2.5 additional inches of focuser travel necessary for straight through viewing. It is included with each focuser.



## 2" PHOTO-VISUAL BARLOW AMPLIFIER (2x)

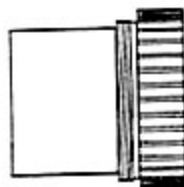
This custom-made accessory doubles the focal length of the objective for high-power photo-visual observation. The 2-element design uses special glasses to preserve the fine color correction of the main objective. The optical elements are hand-corrected and precision centered to insure that no aberrations are introduced into the system. The large optics will accept both 1.25 and 2 inch

oculars and will cover a 2 inch photographic field with pinpoint images to the edge. Four baffles are machined into the barrel to eliminate internal reflections. The barlow also features a brass locking ring as described for the 2.7" focuser.



## FLAT FIELD VISUAL-PHOTOGRAPHIC TELECOMPRESSOR (0.74x)

We have increased the versatility of our telecompressor by designing it for both visual and photographic applications. Slip in a 2" diagonal with your favorite eyepiece or your camera adapter with camera. The effective focal length will be 0.74x the focal length of the instrument. Deep-sky objects are recorded on film in a fraction of the time needed at prime focus. This well-corrected accessory lens preserves the high contrast and superb color correction of the main objective. A must for the serious astrophotographer. Threaded for 58mm filters. Please note that the camera adapter and t-ring is not included.

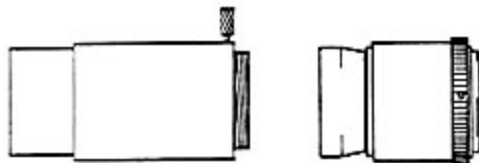


## CAMERA ADAPTER WITH T-RING FOR 35mm CAMERA

This camera adapter allows you to mount your 35mm camera to any focusing unit accepting 2" accessories for wide-field astrophotography. It is machined of aluminum and black anodized. The camera adapter is threaded for the popular 48mm filters. Please specify the type of camera you plan to use.

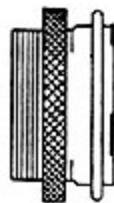
## CAMERA ADAPTER WITH EYEPIECE PROJECTION TELE-EXTENDER AND T-RING FOR 35mm CAMERA

You can use the camera adapter alone for prime focus astrophotography or insert your favorite eyepiece into the eyepiece projection tele-extender for achieve higher powers and closer views of your object. The assembly consists of a 2" prime focus camera adapter threaded for the popular 48mm filters, and a removable 1.25" eyepiece projection assembly with a brass locking ring to hold your eyepieces firmly in place.



## PENTAX 6 x 7 cm CAMERA ADAPTER WITH FIELD FLATTENER

This accessory allows you to couple the medium format Pentax camera to your StarFire telescope for truly superb wide field photographs. The built-in field flattener lens produces sharp star images over the entire format. Enlargements of 16"x20" are possible without fuzzy images or loss of detail.

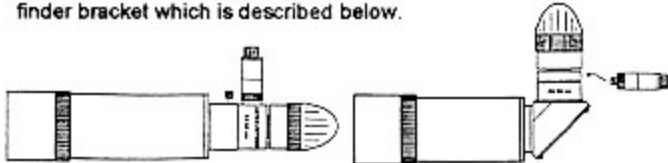


## ACCESSORIES

### 8x50 RIGHT-ANGLE OR STRAIGHT-THROUGH FINDERS WITH ILLUMINATED RETICLE

Our imported finders feature a unique eyepiece with crosshairs in the center of the field which can be illuminated with the matching self-contained, battery-powered LED. The 1.25" diagonal and eyepiece provide a wide 5.6° field of view to assist you in locating your favorite objects.

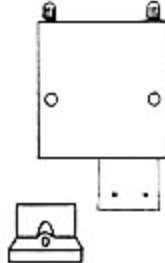
Both finders are black and include a dustcover for the lens and a built-in dewcap. The right-angle finder has a rubber eyecup and the straight-through model includes a dustcover for the eyepiece. The rheostat control on the illuminator allows you to control brightness of the reticle. You will really appreciate the handy quick release finder bracket which is described below.



### QUICK RELEASE FINDER BRACKET

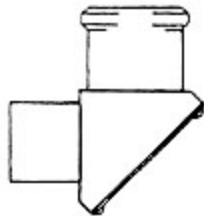
The quick release finder bracket was designed by Astro-Physics to make your life easier. Now, you can attach and detach your finder in seconds while retaining the alignment. The base of the bracket mounts onto the predrilled holes of your Astro-Physics refractor. The remainder of the assembly with the finderscope slips into the groove of the base bracket and tightens quickly with two thumbscrews. Now you are ready to go! There are no mounting screws to get lost in the grass or snow and your fingers won't freeze as you struggle with tools. To use with the Traveler accessory plate (ACPLTR), attach the bracket part to the 7" sliding bar (SB0800). This accessory is a must!

You may even want to consider purchasing extra bases that you can mount permanently on your other telescopes. This will allow you to use the same bracket and finder interchangeably.



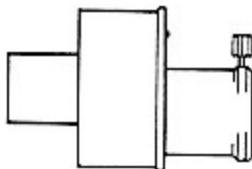
### 1.25" AMICI PRISM DIAGONAL

This right-angle diagonal contains a roof prism erecting system which allows normal orientation of the subject in your eyepiece. No more inverted or upside-down images! Terrestrial viewing is more enjoyable when using the Amici or porro prism diagonal with your favorite eyepiece. Amici prism diagonals are not recommended for astronomical use.



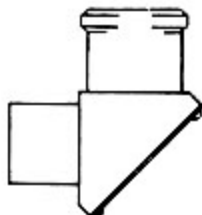
### 1.25" PORRO PRISM DIAGONAL

The porro prism diagonal provides straight-through viewing. Image orientation of the subject in your eyepiece is normal so it is easy to observe deer grazing in a distant meadow. Recommended for daytime nature use of your refractor when straight-through viewing is preferred. Porro prism diagonals are not recommended for astronomical use.



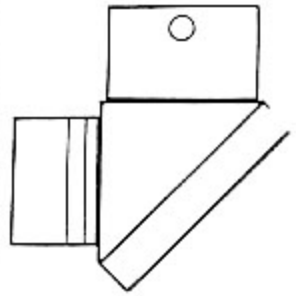
### 1.25" PRISM DIAGONAL

Right-angle diagonal prisms are fully coated and accept 1.25" eyepieces. Image orientation when used with a refractor is right side up with left/right reversal. Prism diagonals are not recommended for fast (f6) refractors.



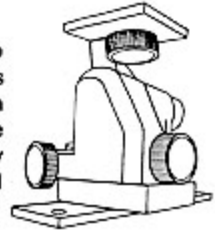
### 2" MIRROR DIAGONAL

If you own or plan to add the popular 2" widefield eyepieces to your collection, you will need a high quality 2" diagonal. This precision diagonal can also be used with 1.25" eyepieces when used with an adapter. Please note that while the adapter is NOT included with the purchase of the diagonal, you can either use the 1.25" adapter that is included with our 2.7" Astro-Physics focuser or purchase it as a separate item.



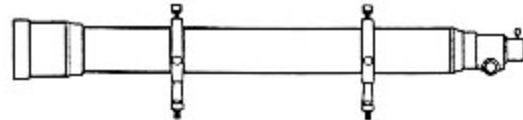
### PIGGYBACK CAMERA BRACKET

The unique micro-adjust knobs allow you to frame star fields easily in 2 axes. Attach this bracket to your favorite 35mm camera, then screw to the predrilled rings on the top of the hex rings. To use with the Traveler accessory plate (ACPLTR), remove the flat base and attach to the 7" sliding bar (SB0800).



### 80 x 900 mm GUIDESCOPE & 3.9" RINGS

For serious astrophotography, a full 80mm f11 (3" of aperture) provides bright star images to facilitate guiding. Our imported guidescope includes a fine achromatic lens coupled with a smooth 1.25" helical rack and pinion focuser with a full 5.5" of travel. A dewcap and dustcover are included. Two half-inch wide aluminum bands are attached to the optical tube in order to protect the finish from marring, the position is adjustable. Choose the 3.9" I.D. guidescope rings (sold separately) which mounts onto these aluminum bands. The three alignment thumbscrews are adjusted to position the scope. You will need to purchase a 1.25" diagonal if you do not wish to guide straight through. For manual guiding, we suggest a 12.5mm illuminated eyepiece and 2.5x Barlow. For autoguiding, use the ST-4.

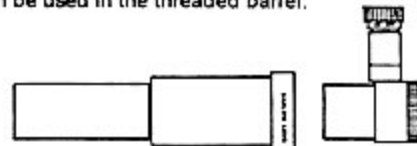


### 60 x 700mm GUIDESCOPE & 3.4" RINGS

This 60mm (2.4") f11.6 guidescope is ideally suited for the 105 f6 Traveler and 130 f6 StarFire EDF. It features a 1.25" helical rack & pinion focuser with locking screw and adjustable protective rings. You can use standard 1.25" guiding eyepieces or an ST-4 autoguider! A real plus for a guidescope this size. Choose the pair of 3.4" I.D. guidescope rings (sold separately) with three alignment thumbscrews. These rings attach to the 7" sliding bar (SB0800) for use with either the Traveler accessory plate (ACPLTR) or 8" Dovetail plate (DOVE08).

### 12.5mm ILLUMINATED EYEPIECE

This 1.25" illuminated orthoscopic eyepiece will allow you to keep your guidestar in the center of your eyepiece. When illuminated, the crosshairs of this reticle stand out in stark contrast against the black sky allowing you to keep your star in the center of the field with ease. The etched glass double cross hair reticle includes a diopter adjustment to allow focusing of the eyepiece onto the reticle pattern. This feature compensates for individual eye variation. The self-contained battery unit provides a compact power supply. Standard filters can be used in the threaded barrel.



### TELEVUE 2.5x BARLOW

Increase the power of your eyepiece with this 1.25" Barlow. A great addition to your guiding equipment.

# SOLAR FILTERS AND ACCESSORIES

Our sun is the most dynamic, everchanging astronomical object, offering new surprises each day, varying even from one hour to the next. Yet, oddly enough, most astronomers do not observe the sun at all. Astro-Physics now offers a line of the finest solar accessories available on the market today. We invite you to explore this fascinating aspect of astronomy.

UNFILTERED SUN CAN EASILY DAMAGE EYES AND INSTRUMENTS. FOR SOLAR OBSERVING, USE ONLY SAFE, SOLAR FILTERS IN FRONT OF THE MAIN TELESCOPE OBJECTIVE. DO NOT USE EYEPIECE SOLAR FILTERS ALONE BECAUSE THE CONCENTRATED HEAT AT THE EYEPIECE MAY CAUSE THE FILTER TO BREAK ALLOWING THE FULL MAGNIFIED INTENSITY OF THE SUN TO REACH YOUR EYES. ALWAYS SUPERVISE CHILDREN WHO ARE OBSERVING THE SUN.

## Observations of the Sun in white light

Amateur telescopes, when aimed directly at the sun, concentrate the brilliant light to such an extent that serious damage would occur to the retina with even a quick glance into the eyepiece. Unfortunately, most commercially available glass filters severely distort the wavefront entering the telescope, with a resultant loss of fine detail and contrast. There is a way to reduce the light energy for safe viewing while at the same time preserving the high contrast and resolution of your objective lens. We have developed a high quality glass solar filter with a chrome coating that can be used both visually (with an accessory eyepiece filter), or photographically for high resolution studies of the sun's surface. These filters are sufficiently accurate to reveal intricate sunspot features and fine solar granulation. Filters are coated with 3 layers of chrome that is calibrated to let a sufficient amount of light through for high speed photography. More light will pass than is normally used for visual observations. As a result, faster shutter speeds are possible, useful for capturing moments of good seeing. For safe, comfortable visual observations, one simply screws the companion neutral density filter into the eyepiece adapter. No heat buildup will occur in the eyepiece optics because the main solar energy has been essentially eliminated by the main filter.

## Observations of the Sun in Hydrogen light

To observe the sun in the red light of hydrogen, a special filter system must be used to isolate the H-alpha line. Hydrogen-alpha multi-layer interference filters reject all visible light except for a specified wavelength band in the red (hydrogen) portion of the spectrum. Various types of filters are differentiated by the number of angstroms or sub-angstroms that the filter allows to pass. The smaller the number of angstroms, the narrower the band width which is centered on the H-alpha line at 6562.8 angstroms. Depending on the width of the band, you can observe wispy, dramatic prominences in bold relief against the blackness of space; as well as surface features including dark filament swirls; magnetic storm lines; explosive solar flares; plage, spicules and fine chromospheric network in stark contrast to the sun's brilliant red surface.

**PROMINENCE FILTERS:** If your primary interest is photographing the prominences, it is best to use a fairly wide bandwidth filter to get maximum light energy. The advantage is that high shutter speeds are possible, effectively freezing the seeing. Surface structures on the sun are completely lost, and because the sun's light is so bright an occulting disc must be used to eliminate the resulting glare. The 10 A Prominence Viewer from Baader Planetarium has been specially designed to capture the prominences in all their breathtaking detail. With its wide bandpass, the prominences are bold, bright and dramatic.

**NARROW BAND FILTERS:** For detailed viewing of active regions on the solar disc as well as prominences off the disc, a narrow band filter is essential. Bandwidths greater than 0.8A are useless for showing surface detail, while bandwidths narrower than 0.5A will not show prominences well. We offer the superb line of Daystar filters and accessories because they are proven to be the best in the world for high resolution studies of the sun. The sub-angstrom H-alpha filters from Daystar offer incredible detail of active surface regions, with good views of the prominences. The narrower the band pass, the higher the contrast of surface regions. University, ATM and T-Scanner models are all available in bandpasses of 0.8A, 0.7A, 0.6A, and 0.5A. Please refer to the description below.

**ENERGY REJECTION FILTERS:** All H-alpha systems require an energy rejection filter to be placed over the front aperture to block the intense ultraviolet (U.V.) light from the sun which would otherwise bleach the main filter in a short time and render it useless.

The energy rejection filter must be of the same high optical quality as the main lens, otherwise you will not be able to resolve the fine detail in the prominences or on the sun's surface. Our filters are made from Schott RG610 red filter glass. They are polished and tested interferometrically to 1/4 wave peak-to-valley minimum, and are guaranteed to give the highest definition and contrast possible. The filters are mounted in a machined aluminum cell that fits over the front of the objective cell.

## ASTRO-PHYSICS PHOTOGRAPHIC GLASS WHITE LIGHT FILTER

Our full aperture white light glass filters are crafted by European opticians of fine-annealed 10mm plane-parallel glass, polished better than  $\lambda/4$  and chrome coated to density 3.3. The filter is mounted in a machined aluminum cell which fits over the lens cell. We also provide a grey 1.8 ND (Neutral Density) filter for 2" eyepieces which is used in conjunction with the primary photographic filter for visual observation. This eyepiece filter is coated with MgF2 on both sides.

The glass white light filter comes with protective aluminum dustcovers for both sides.

### ADVANTAGES:

- Sunspots show penumbral detail that resembles fine eyelashes.
- A motor driven mount and polar alignment are helpful, but not critical

### CONSIDERATION:

- Prominences and H-alpha surface detail cannot be seen

Available for: Astro-Physics refractors, specify model

## 1.5 Å HYDROGEN-ALPHA PROMINENCE VIEWER FROM BAADER PLANETARIUM

The H-alpha filter in this Prominence Viewer passes red light of 6562.8 Angstroms which is strongly emitted by the sun's chromosphere and prominences. The transmission characteristics of the filter are provided on the spectrophotometer tracing included with each unit.

It is wonderful to observe delicately shaped prominences appear, change shape, blow out into the corona, and disappear- all in slow motion.

### Components:

1. Prominence viewer body, consisting of a four/five section cylinder which houses:
  - Aspheric relay lens with teflon sockets for the occulting cones
  - Adjustable iris diaphragm to minimize scattered light in the system
  - Multi-coated projection lens array in conjunction with the H-alpha filter with a bandpass of 1.5Å
  - Two extension tubes (use one or two as needed)
2. Six (6) occulting cones of varying diameters that individually provide an artificial solar eclipse within the instrument. Since the relative size of the sun varies throughout the year, you will select the cone of the proper size. A pair of tweezers and gloves are included to manipulate the cones.
3. VIP Excenter- for visual and photographic use. Allows you to view or photograph prominences at the edge of the field or center them. A large spring-loaded tension ring with three adjustment screws allows sensitive tension adjustment depending on the connected observing system (i.e., diagonal/eyepiece or camera). Includes sliding focus t-adaptor (specify your camera) and 1.25" visual back. This system is essential for higher visual magnification and serious photographic work.
4. Adapter for 1.25" oculars
5. Calibration curve for your H-alpha filter with bandpass and maximum transmission.
6. Carrying case

In addition, you will need:

- visual: 1.25" star diagonal and eyepieces (we suggest 24mm TeleVue Widefield)
- photographic: camera adapter, and 35mm camera

OPTIONAL ACCESSORIES: Projection eyepiece PII and M43 extension tubes (two tubes)

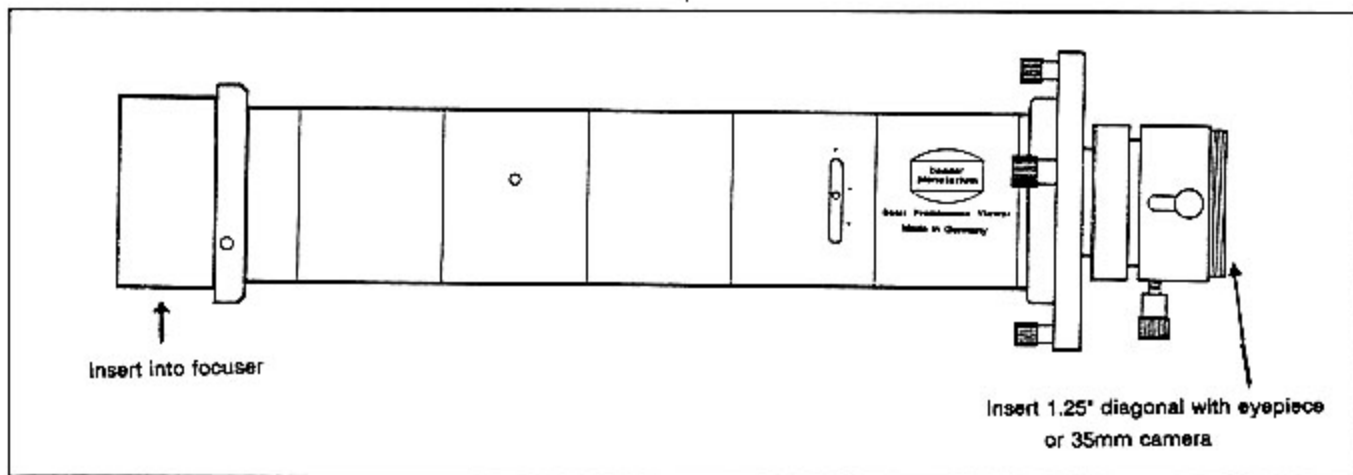
### ADVANTAGES:

- Observation with up to 130mm aperture
- The H-alpha bandpass filter is fully blocked from X-ray to deep infrared wavelengths
- This filter has over 30% transmission. Prominences appear bright, showing brilliant detail out to the finest "splashes."
- Fast photographic exposure times 1/250-1/500 of a second, effectively freezing the motion of the prominence and atmospheric seeing effects.
- Does not require heating of H-alpha filter and is ready to go as soon as you are set up
- Wider bandpass to emphasize prominences
- You will record doppler shifted components of prominences automatically.

### CONSIDERATIONS:

- Must be used with refractor, mirror systems scatter light which lowers contrast.
- Must use tilt mechanism (included) for colder temperatures
- Requires perfect polar alignment and sturdy mount with solar tracking rate. It is important that the disc of the sun remains covered by the occulting cone
- Not readily interchangeable with other refractors. The occulting cones are customized for the focal length of the instrument. If you plan to use the Prominence Viewer with more than one refractor, you will need occulting disks for each focal length.
- Cannot be used easily with long focus refractors exceeding 1500mm

Available for the following refractors: All Astro-Physics refractors, Celestron 80mm f= 910 Firstscope, Celestron 102mm refractor



## RED ENERGY REJECTION FILTER SCHOTT RG610

Filter thickness 10mm, polished to 1/4 wave peak-to-valley in transmission. Made specifically to reduce the intense U.V. light from the sun when using H-alpha filters, our red energy rejection filters are available in 100mm 130mm diameter filter sizes. The machined aluminum cells will fit over the front of the objective cell of our 105 Traveler, Star12ED and 130mm doublets and triplets. In addition, these filters are available for our larger telescopes for reduced aperture viewing with DayStar filters and Prominence Viewers.

The red energy rejection filter comes with protective aluminum dustcovers for both sides.



## DAYSTAR T-SCANNER

The T-Scanner is fabricated to the same standards of quality and safety as the world recognized DayStar ATM and UNIVERSITY model H-alpha systems. The T-Scanner requires no power input and is completely portable.

In operation, the T-Scanner takes advantage of the fact that all optical interference filters will shift towards the shorter wavelengths when tilted. Therefore, the filter is fabricated with the passband a few angstroms to the red side of the H-alpha line, i.e. 6565 Å. When the control knob is turned, the filter is tilted and the passband (fringe) scans across the solar image showing H-alpha features.

The filter's 30mm (1.18") clear aperture allows full disk H-alpha feature and prominence observations when used with telescopes having focal lengths of 118" and less. Telescopes with longer focal lengths and resulting larger solar image diameter only need to be guided to the solar active area of interest.

When ordering your T-Scanner, request the front cover with the female t-thread.

The T-Scanner requires a nominal f/30 beam. This is accomplished with the Astro-Physics TELECENTRIC BARLOW SYSTEM as described below or with a DayStar red energy prefilter of an appropriate aperture to result in a nominal f30 beam. For instance, if the focal length is 1016mm (as in our 130mm f8 StarFire EDT), an f30 beam is achieved with a 1.3" aperture. (Actually DayStar provides 2" aperture masks for 4" refractors). The full aperture of the 130EDT can be used with our Telecentric Barlow System.

### ADVANTAGES:

- Shows prominences and surface features of the sun
- Economical, high quality subangstrom Ha filter from Daystar
- No heating unit, no electrical power is required for the filter
- Does not need time to warm up
- Can be used visually and photographically

### CONSIDERATIONS:

- Works best within a specific range of temperatures, this may limit viewing during cold months in northern climates
- Filter is fine-tuned by a tilting mechanism. If the filter is off band, parts of the image may appear out of the pass band

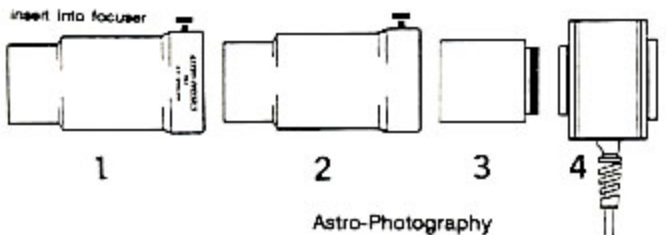
## DAYSTAR UNIVERSITY AND ATM H-ALPHA SUB-ANGSTROM FILTERS

Two DayStar H-alpha solar filter series are available. The ATM and UNIVERSITY; both feature 32mm clear aperture.

The ATM model filters are fabricated with instrument quality components and will meet the needs of most amateur solar astronomers. They are designed primarily for visual disk feature observations and prominence photography. Passband tuning is accomplished by a built-in heater which requires 110V AC power.

The UNIVERSITY model filters are fabricated with the finest filtering components and meet the rigid imaging and photographic requirements of professional institutions.

When ordering the UNIVERSITY and ATM filters, specify the female T-thread end plates for both sides. Astro-Physics offers a custom 2" adapter that will allow use of 2" accessories.



1. Astro-Physics 2" Barlow
2. Extension tube
3. Telecentric Unit
4. DayStar Filter
5. 2" Adapter for DayStar
6. Camera adapter with T-threading
7. 35mm Camera
8. 2" Diagonal

As with the T-SCANNER model, the UNIVERSITY and ATM filter requires a nominal f/30 beam. This is accomplished with the Astro-Physics SOLAR SYSTEM as described below or with a DayStar red energy prefilter of an appropriate aperture to result in a nominal f30 beam. For instance, if the focal length is 1016mm (as in our 130mm f8 StarFire EDT), an f30 beam is achieved with a 1.3" aperture. (Actually DayStar provides 2" aperture masks for 4" refractors). Full aperture operation up to 130mm can be accomplished with our Telecentric Barlow system.

Recommendations from DayStar Filter Corporation: If your primary interest is bright prominence, but you also want to know what's happening on the disk, the 0.8 angstrom filter will do the job nicely.

The 0.7 angstrom bandwidth filter is a good intermediate choice. The red prominences stand out briskly against the dark sky and the disk features have good contrast. This filter is the most popular for general work and as a teaching aid.

The 0.6 angstrom bandwidth filter provides excellent contrast and is great for detailed studies of active regions. The prominences are quite visible and easily photographed. A good choice for educators.

The 0.5 angstrom bandwidth filter provides SUPERB disk feature contrast and used with telescopes having one arc-second resolution or better will provide visual and photographic results comparable to professional observatory quality. Prominences are subdued.

NOTE: The bandwidths indicated are maximum.

### ADVANTAGES:

- Shows prominences and surface features of the sun
- Can be used visually and photographically
- Polar alignment is recommended but not critical.

### CONSIDERATIONS:

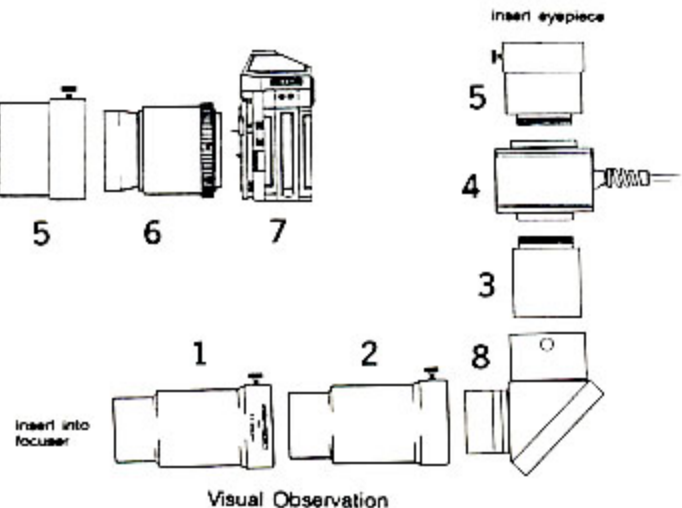
- Requires heating unit powered by AC power source
- Unit may take 1/2 hour to one hour to be on band (depending on temperature)
- More expensive than T-SCANNER

## TELECENTRIC BARLOW SYSTEM TO USE WITH DAYSTAR H-ALPHA FILTERS

Normally, the required f30 beam is accomplished by stopping down the aperture of the scope. The Telecentric Barlow System will provide the longer f ratio using the full aperture of your 4" or 5" refractor. Six inch and larger scopes will be limited to 5" (130mm) to allow the full disk of the sun to be seen.

### Components of Solar System:

1. 2" Barlow - The Astro-Physics barlow features four baffles machined into the barlow, flat black interior, and a brass locking ring. This versatile photo-visual accessory can also be used for daytime terrestrial viewing and nighttime astronomy.
2. Telecentric Unit - This optical component is used in conjunction with the 2x Barlow to increase the effective focal length and make the light rays nearly parallel for the Daystar Filter.
3. Extension tube with brass locking ring
4. Adapter for DayStar filter which enables use of 2" eyepieces. Available for: All Astro-Physics refractors



3-10-92

Dear Roland and Marjorie,

We feel we should share our experiences with you using your refractors.

Six years ago we bought our first refractor, a 5" f6 to do 35mm wide field photography. This was before ED glass and multi-coatings. It became apparent that a 35mm negative from this telescope could be enlarged to 20" x 24" prints and still look sharp. There were color problems with the brighter blue stars but the faint ones were mere pin pricks.

One evening Daphne and I did a duo photograph of the North American Nebula - she with the refractor and I with a 10" Newtonian. Both instruments were f/6. We exposed identical film for 45 minutes. When the film was processed, we were surprised to see that the film exposed in the refractor had more contrast and more density! A lot more light was getting through the refractor and with much less flare. It was obvious the refractor has certain superior characteristics as an astrograph.

Time has progressed and with it refractor technology. We became the first recipients of your 6" f/7.5 ED Triplet refractor set up to expose 6 x 7 cm negatives. Some characteristics were immediately obvious. Visually, it was like looking through a reflector, there was no color fringing, even at high powers! Unlike two-element ED designs that don't correct the far blue and ultra violet, the ED triplet had no halo around bright blue stars visually, and most important, photographically! Indeed, the single most significant improvement with the ED triplet was the far blue-ultraviolet correction because, as you know, film is the most sensitive to these colors! Stars now were so microscopic on the film that only a 30" x 40" enlargement revealed the true resolution of the lens.

There seem to be some rumors that the ED triplet does not stabilize and suffers from thermal problems. During the time we have had this lens and under some very cold nights on Mt. Pinos, we have never noticed any degradation of image. Furthermore, even while we are polar aligning and the scope is cooling down, our target star exhibits classic diffraction patterns at 275 power. As we would with any telescope, we allow it to cool down in order to maintain critical focus over 2.5 hour exposures.

The light transmission of the ED triplet is phenomenal. Looking through the elements is like looking through air. The advanced multi-coatings reduce light absorption to almost nothing. Since the third element only blocks 1% of the light, we feel the advantages of the triplet design are enormous, especially if you plan to do photography. Indeed, it is a prerequisite unless you enjoy using a minus violet filter to suppress the far blue and ultraviolet. We had ghosting problems with the use of filters so the ED triplet was like an answered prayer.

It's really unfortunate that Mt. Pinetubo messed up the atmosphere ... alot of our projects are now on hold until it clears up a little more.

We are very enthusiastic about the 6" ED triplet we own and can't wait to use it again. In its 2 years of use, we have made magazine covers and "Images" in *Sky & Telescope* and a lot of 16" x 20" prints that have been well received. Although substantial effort is done in the dark room, we could never even begin to make these photographs without the superb telescope you created for us. For this, we thank you and look forward to many years of interesting and progressive results.

Clear skies! (someday)

Tony Hall  
Daphne Mount

# DEAR ASTRO-FOLKS:

## "ASTRO-PHYSICS REFRACTORS BIG & SMALL"

Excerpts from product review in *Astronomy*, September 1993, pp. 62-67

Instruments featured: 105mm f6 Traveler EDT, 155mm f7 StarFire EDT, 400, 600E and 1200 German Equatorial Mounts

"Astro-Physics' new line of refractors promises high-resolution, color-free optics on solid mountings. Our testing found they amply delivered on that promise.

... Each of the three mounts I examined was an outstanding example of fine craftsmanship. Assembly was quick and convenient. Fit and finish were superb. The motions were smooth, the locks firm and solid. And the all-important steadiness of the mountings was as good as I've seen on any mountings of similar size and load-carrying capacity.

... The optical quality of the Traveler proved superb. Images of even the brightest objects - tough tests such as Venus and the limb of the moon - were completely color-free, a remarkable achievement in an f5.8 refractor and a tribute to how far lens technology has come in the past few years. There was no sign of spherical aberration or on-axis astigmatism. Star images looked textbook perfect in focus and on either side of focus. The fully multicoated optics also provided very bright images for the aperture.

... Optical performance of the 155EDT was impressive. It produced nary a trace of false color even on Venus. Equally impressive, this scope provided superb images as soon as it was set outside. Even in sub-freezing temperatures, image quality, though not perfect at first, was surprisingly sharp from the start. In cold weather, after a modest settle-down time of 30 minutes, in-focus star images were textbook Airy disks with a well-defined first diffraction ring and a trace of a second outer ring. There was no sign of spherical aberration, lens figure changes, heat plumes, or distorted Airy disks due to tube turbulence.

... The current selection of apochromatic refractors on the market is enough to make any lover of fine telescopes drool. The Astro-Physics units I tested proved to be first-class instruments made to exacting standards of performance. Fitted with optional guidescopes, refractors like these have been used to create some of the finest astrophotos ever taken.

The limited production numbers and high demand for Astro-Physics telescopes have produced waits of several months to a year for many models, but if you are looking for some of the finest instruments on the telescope market today, the wait may be worth it." Alan Dyer, *Astronomy*

### 105mm f6 TRAVELER EDT

"As observers lined up for a peek the reaction was -over and over again- 'But it's such a small scope .. that's amazing.' Everyone loved the smooth focuser and the stars snapping into crisp pinpoint focus.

The North America Nebula [35mm Panoptic 18x, O-III filter] caused a sensation. The whole thing along with most of the Pelican was so clearly seen that some of us thought we could detect the striations that show up in photos. It was by far my best view ever of this object. One veteran who has a [name deleted 8" and 14" SCT] said 'this is the first time I have ever really seen this object in 25 years of observing.'

Veil Nebula [ 35mm Panoptic 18x, O-III filter] was equally spectacular showing both sides (brightly) along with the faint wedge in between. Filamentary detail in the two main sections was easy to see even at this low power...

This is a marvelous telescope. Once more units are in the field you should be swamped with orders. There must be several thousand serious amateurs who would regard this as a perfect primary or secondary telescope." Name withheld on request

### 105mm f6 TRAVELER EDT

"From my suburban backyard, observed NGC6207 (magnitude 11.6 galaxy near M13) as well as NGC7331; beat out a 13" Dobsonian in observing M85, demonstrating that contrast can be more important than sheer light grasp; M42 a fabulous sight with glowy tendrils and sharply defined. Structure at 70x; NGC 457 and NGC 7789 resolved at 70x, the latter into an incredible sprinkling of tiny, faint pinpoint stars. From dark sites in Virginia, have seen NGC 7293 (the Helix nebula) and, inexplicably, NGC 931 - listed as a magnitude 13.9 galaxy that theoretically should not have been visible in such a small instrument."

Image quality far surpasses 8" SCT and 10"/13" (name deleted). Similar resolution and brightness as a good 6" f10 Newtonian (custom)." S.S., PA

### 105mm f6 TRAVELER EDT

The Traveler easily outperforms my [other 4" apo refractor], especially at high powers. The quality of construction is also much better, especially the light baffles and the large, rock solid focuser.

The Traveler 105 is a great scope, both optically and mechanically. I can highly recommend it to anyone who wants an excellent, portable refractor." E.S., Florida

### **105 TRAVELER EDT**

"Thank you for creating the beautiful Traveler telescope for me. The scope and 400 series mounting head with adjustable wood tripod arrived a short while ago. I would like to take this opportunity to express my feelings about this system...

The fit and finish of the scope, mounting head and tripod are exquisite. The machining is completely first rate! This type of quality seems to be getting harder to find every day. (Perhaps Astro-Physics is hiring all of the great engineers and machinists in this country.) In this area, I feel qualified to state my opinion as my profession is the sale of highly engineered and machined products. Based on all of the units I've seen, Astro-Physics is a line with which I am happy to be associated. You obviously take a great deal of pride and care in all aspects of telescope manufacture. ...

Under the stars the Traveler really shines... Several times I have seen six stars in the Trapezium. There are many examples of the awesome capabilities of this handy scope; terrific detail in Saturn, the moons of Jupiter, and wonderful gossamer quality to any number of nebula.

### **130mm f8 STARFIRE EDT**

"The new StarFire 130 EDT arrived a few days ago. It was a joy to unpack it and to set it up: it looks beautiful and bears testimony of exquisite craftsmanship throughout. Yesterday the sky cleared up and the telescope got 'first light.' I was out under the stars for many hours - looking, testing and also comparing the new instrument with other telescopes. Yet I soon realized that there was no reason to use any other instruments: the StarFire simply was superior. Deep sky views with 9mm and 7mm Nagler eyepieces was sharper, cleaner and more contrasty than I have ever seen. And best of all: With this instrument the problem of spurious colour in the refractors definitively is gone- incredible! Jupiter was quite a show at all magnifications I tried (50x up to 290x with no image breakdown). What amazed me not the least was how bright its disk looks, also at high magnifications, with the colors in the belt system readily visible. There was a wealth of detail, much more than I could have drawn, though the seeing was somewhat unsteady. In short: it was a totally satisfying night of observing. Thanks for a superb instrument... I consider the StarFire EDT design a milestone and a great gift to the community of amateur astronomers. Y.T., Denmark

### **130mm f8 STARFIRE EDT**

"I am enthusiastic of the 130mm StarFire EDT: the optics are superb, I can put on it every kind of eyepieces, even 3mm Plossl Clave and Barlow 2x to an equivalent focal length of 1,5mm without any distortion or secondary spectrum...I intend to buy from you another bigger, the 7" or 8"..." C.G., Italy

### **130mm f8 STARFIRE EDT**

"I always get a good crowd at observing sessions. I wouldn't trade it for anything else I've ever looked thru....

As you already know, I am a real nit-picker, and I don't hesitate to pick up the phone and bug Marge when I have a real or imagined problem. Your attitude toward service has been super, and your technical assistance has been great...

I would recommend any of your products without hesitating based on my experiences of the last 3 years..." S.E., WI

### **130mm f8 STARFIRE EDT**

"Solar photographs showing detail of almost 1 arc second in photo" G.G., IL

### **130mm f8 STARFIRE EDT**

"From 'First Light' through the 130EDT my quest for the PERFECT observing instrument was over. My time spent with my new REFRACTOR under the stars are no less than a literal religious experience. The spectacular vistas laid out before my eyes were unlike any other I have had the opportunity to experience before. To relate to you what I now see regularly with my 130EDT, with statements like 'Star Points literally with no dimensions', 'or super planetary images with unbelievable amounts of detail and sharpness' do not cover the full spectrum of satisfaction regarding what I actually see with the 130EDT. Familiar objects viewed through the refractor such as the Dumbbell, Ring, M81 & M 82, BlackEye, and the Whirlpool, M13, M3 to name a few, are simply incredible!!! The inky black sky boarding an absolutely crisp image of the core of M13, my Cassegrain could never reveal this much detail, not on any night and no matter how far up/north I went. Jupiter and Saturn fill the 9mm Nagler with detail I would not dare imagine possible. Many of my Astro/Buddies have said the same thing and have come away from the eyepiece with the same sort of opinions and thoughts. C.S. Canada

### **130mm f8 STARFIRE EDT**

"It blows everything else away in terms of sharpness and contrast, and compares favorably in light grasp with 8 inch SCT's... I am truly impressed with your quality and commitment to excellence, rare indeed in the economic climate of the country today. Surely your reputation will be remembered in the history of telescope makers ..."J.L., New Jersey

### **130mm f8 STARFIRE EDT**

"Thanks again! for making a excellent telescope available to "average" guys like me. Besides the excellent lens I like the focuser, I really like the focuser! The lens is beautiful and never ceases to amaze me even in my light polluted backyard.

Crispness and contrast is a fair trade off for large aperture and mushy stars. I finally know what that perfect star looks like. I enjoy the way the image 'snaps' into focus." P.B., Iowa

### **130mm f8 STARFIRE EDT**

"My first night out with the new scope can be summed up in just one word: "heaven." Stars finally, at whatever magnification, looked like stars: bright points of colorful light. Jupiter was bright and clear, with no apparent chromatic aberration. I found, and thoroughly enjoyed, the Owl Nebula on my first try, something I hadn't been able to do with any of my earlier purchases even after hours of searching.

So thank you for manufacturing such a wonderful instrument; I am a completely happy customer. Is the StarFire the 'perfect' telescope? Well, it doesn't weigh less than a pound, cost \$1.49, and show distant objects like the 200 inch Palomar, so no, it's not perfect. But is it as good as the present state of the art allows? I think so." T.L., Maine

### **130mm f8 STARFIRE EDT**

"The contrast afforded by your optics allows me to routinely observe planetary detail which before would only reveal itself in momentary glimpses. The ability to distinguish color is also exceptional. And there is no false coloring or image ghosting what-so-ever. Venus is a hard white crescent with NO purple halo that I can detect. Views of the moon are completely free of that yellow fringe common with lesser quality "apochromatic" designs. Even with the poor seeing from my backyard many faint objects show details I would normally expect only under much better skies. The quality of the mechanical workmanship is a joy to behold. Every aspect of the design assures a solid mounting, super smooth focusing, and no wobble between parts that don't mate perfectly. My great grandchildren will also be pleased when they inherit this telescope.

Thanks for making a fine product. It has helped to return the "amour" to my amateur pursuits." P.S., Washington

### **130mm f8 STARFIRE EDT**

This is my first telescope after many years without one. However, I did not wish to go through what so many amateurs do, i.e. buying and selling a string of scopes that they are never really happy with. I also desired a scope that would still be a fine instrument in 30 years, in other words, a long term prospect. I feel satisfied that the StarFire meets all my needs. J.B. Australia

### **130mm f8 STARFIRE EDT**

"Observing Moon is an interesting sight; all I saw was sharpness, clarity and contrast. Mostly white, gray, and black with no smearing or glare whatsoever. Saturn is an experience that every observer should see; at about 113 to 226 power; I saw Ring C as well as A and B, Cassini's division, and subtle colored shadings. With 40mm Wide Field TeleVue eyepiece, Pleiades and Double Cluster displayed as whole object, in sharp diamonds-like across the field of the view. In deep sky observing, Great Nebula in Orion really shines in greenish color, studded with four diamonds of Trapezium. With aid of nebula filter, I saw Blinking, Dumbell, Crab, Eskimo, Helix Pelican, North America, Ring, Rosette, Veil, and without filter, numerous nebulae, clusters, galaxies, and multiple stars were enjoyable to observed. P.L., Massachusetts

### **130mm f8 STARFIRE EDT**

My name is Contini Stefano and I'm your customer since 1990. I own an Astro-Physics 130 EDT refractor and some accessories to take astronomical observations and photos. I really don't know how to thank you for the excellent refractors that you build and the huge visual and photographic satisfactions that they give to me. I operate in these sector with another your customer, Mr. Zinelli Alberto, that own an EDF 6.1" f7. Mr. Zinelli and me have obtained really excellent photos with the EDT and EDF refractors. The 130 EDT and, particularly, the 155EDF are truly two excellent telescopes. Many of ours photos have been published on the great Italian astronomical reviews (l'Astronomia, Nuovo ORIONE, and Astronomia V.A.I.), and we intend to collect them in a photographic atlas to publish. I think that we will send you some copy of these photos soon, so to have your opinion. " C.S., Italy

### **180mm f9 STARFIRE EDT**

"I've observed Mars since January and am simply astounded at the images I am getting, views of Martian detail have a clarity and are surpassing any I've previously observed. (I very much like this scope). This winter the gas clouds of Orion were brighter with blacker sky than I'm used to - pure "delight." and JUPITER. It's quite a show. I didn't expect this much detail. It's hard to pass up a clear night anymore. R. O, Maryland

### **180mm f9 STARFIRE EDT**

" I am truly delighted with every aspect of the equipment you sent me - the workmanship is first class and the views are startling in their clarity." B.G., Australia

### **180mm f9 STARFIRE EDT**

"I love the 1200 mount and the 7.1" EDT is incredible. On first light, with seeing at a 7 out of 10, I could count, with a barlow and a 4.8mm Nagler, six ring divisions on Saturn and substantial detail on the surface and pole areas. I had my 20" Dob with (name deleted) optics out and was amazed at how close M42 looked in the 7.1" to the 20". I know that it's not supposed to be that way but the much higher

resolution really boosts the visibility of extended objects." D.S., Missouri (note: I am sure that he meant "contrast" rather than "resolution")

### 180mm f9 STARFIRE EDT

"Thank you for the 180mm Apochromatic refractor you have made for me, it performs very well, the images are almost perfects and we have enjoyed it in many observations... This is the instrument we have always dreamed and we enjoy to look at the sky with it. We are two friends with many instruments: binocular, Newtonians (12", 20" equatorial, and 30" alt-azimuth) but nobody gives so pure images on Moon, Planets, double-stars and Sun." G.C., Italy

### 180mm f9 STARFIRE EDT

"I'm writing to thank you for producing your outstanding telescope equipment. As you can see in the accompanying newspaper article, I was privileged to observe and sketch the dark feature imparted on Jupiter by fragment "A" to Comet Shoemaker-Levy 9 on 16 July 1994 at approximately 8 P.M. E.D.T., a couple of hours prior to the confirming HST images broadcast on TV.

Without the superb optics of my 7" StarFire I seriously doubt that I would have been able to discern this subtle feature near the Western limb of Jupiter at sunset. To say I was thrilled would be a gross understatement..." J.S., PA.

### 180mm f9 STARFIRE EDT

"I recently received my 180 EDT refractor. It is truly an impressive instrument to look at. The fit and finish is superb. Looking through it is equally as impressive. Diffraction rings are perfect and very high contrast views of Jupiter. I am sending some CCD images of Comet S/L-9 impact sites on Jupiter which I took with an SBIG ST-4 CCD camera. ... Thank you very much for a really fine instrument. I am really proud to see an instrument of this quality and at a reasonable cost made in the USA!" D.H., GA.

### 6" STARFIRE EDF f7.5

"Well... If you had made a bet with me about five years ago that I would be raving about the performance of a refractor I would have put heavy money up against such an eventuality!

I took the 6-inch f/7.5 EDF out this last new moon to check it out and to make the first photos with it (First Light!). The negatives remain to be developed but the visual performance was absolutely incredible !!!!!!!

The seeing was about 8.5/10... First thing we looked at for some hard optical testing was Vega. The inside-and -outside-of-focus diffraction patterns were identical and showed NO COLOR AT ALL on the EDF !!! ...Absolutely fantastic !!!

Thank you so much for this wonderful instrument !!! Congratulations on your optical prowess !!! B.W., California (noted astrophotographer and author)

### 155mm f7 STARFIRE EDF

"The EDF 155 f/7 is just arrived a few days ago and it looks beautiful and fantastic craftsmanship. I am very happy." A.Z., Italy

### 6" STARFIRE EDF F7.5

At Riverside 1992, some very critical Japanese observers and some equally critical American [name of prominent Japanese telescope company deleted] user-observers trained Jack C.'s 6"EDF on Vega and tried their damndest to find color and couldn't. The Japanese were highly impressed and the [deleted telescope company] owners finally mumbled that the A-P refractor was definitely better. My wife wondered why I wanted the 6.1" when I had an excellent 5", turned to me after looking at the Whirlpool galaxy through Jack's scope and said "Now, I understand" and supported me fully in fulfilling my dream of obtaining the 6.1"EDT. By the way, she is a very hard sell, but seeing is believing + she is definitely now a believer." R.A., California (Mr. A. owned a 5TB refractor with an Astro-Physics StarFire lens).

### 400 GERMAN EQUATORIAL MOUNT

I am writing to let you know how happy I am with my 400 mount. The quality is outstanding, the mechanical workmanship is excellent, and the electronics work great! ... I am currently saving up for one of your telescopes as well. Keep up the good work! D.F., Illinois

### 600 GERMAN EQUATORIAL MOUNT

"This scope has been and continues to be subject to probably some of the most rigorous usage of any scope and mount anywhere. I attempt religiously to observe the sky every clear night during our dark season here and that usually means deep cold, even down to -60 degrees F. Regardless of conditions, the scope and mount have always functioned in a flawless, silky smooth, ultra-stable manner. I have never come across any other man-made thing which works so reliably at these extreme subzero temperatures. I have kept the pier and mount where a telescope belongs (outside, under open sky) continuously since obtaining it four (4) years ago, and have transported it a great deal, as well." D.C. Alaska

# Amateur Astronomers

Conducted by Stephen James O'Meara

## ADVENTURES IN REFRACTORLAND



**I**n my youth I spent many evenings enjoying two activities: snooker (a British billiard game) on cloudy nights and sky observing when it was clear. I still do. Under the snooker table in my games room, three telescopes await their turn under the stars.

The telescope I used most from age 16 to 21 was a Unitron 3-inch  $f/16$  equatorial refractor. In 1960 it cost me \$375, a year's savings from part-time and summer work at 55 cents an hour. Although Unitron refractors were standard equipment in the 1950's, today they have priced themselves right out of the market. I haven't even seen a 3-inch Unitron equatorial for almost a decade:

The 3-inch was a revelation compared to the flimsy 60-mm refractor I had started with in 1958. The Unitron was rock-steady with a thick hardwood tripod and silky slow-motion controls. It came with six eyepieces as standard equipment, though most of them were of simple design compared to eyepieces today. Star images in the 3-inch were tiny pinpoints. I recall splitting the "double-double" stars of Epsilon Lyrae at 48x. Lunar and planetary images were also superb; one night of excellent seeing (March 28, 1963), when Mars appeared only 10 arc seconds in diameter, I used 200x to see the planet's north polar cap and several surface markings, including the canal-like feature Xanthe. In retrospect, the optics and contrast efficiency had to be perfect to reveal that kind of detail.

Furthermore, the exceptionally long  $f/16$  focal ratio reduced chromatic aberration almost to zero. Only on Venus did a tinge of purple emerge. Today such performance is sometimes called apochromatic. I remember being shocked when I finally got to peek through bigger refractors and saw the violet haloes around Jupiter, Saturn, and brighter stars.

But I was even more dismayed by the erratic performance of the Newtonians used by most of my colleagues. Their telescopes ranged from a 6-inch  $f/10$  that produced pinpoint stars and excellent planetary detail to pitiful telescopes that could never be properly focused. At the time I was unaware of the devastating effects of improper collimation, tube currents, and large-aperture seeing limitations that plague Newtonians. I attributed it all to poor optics.

Regardless, that experience led me to purchase a larger refractor — a 7-inch  $f/17$  built by Harold Brown of Toronto. I bought it from a local amateur for \$200 in 1966; the owner regarded it as a white elephant and was glad to remove it from his garage. It had been used on a pier in the open for years, protected by a boat cover. The mount was, in effect, a rusted piece of yard sculpture. I could only salvage the counterweight. Likewise, the focuser was trash.

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*Over the past 30 years,  
my observing started  
with refractors  
and has come full circle.*

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A few months later, however, it came to life in my roll-off-roof observatory in suburban Toronto. The "Big Eye," as everyone called it, was the largest refractor in amateur hands in Canada. But as we all learn sooner or later in the backyard astronomy game, big isn't necessarily better. Anything moderately bright through the 7-inch was adorned with a purple wreath. The homemade objective also suffered from astigmatism. To eliminate most of it I had to diaphragm the objective to  $5\frac{1}{4}$  inches, which made it a fine  $f/23$  system. In any case, two years later a large shopping center was built about a mile away, greatly reducing the observatory's effectiveness. In 1969 I sold everything.

From 1970 to 1983 I purchased and sold a variety of Newtonians, Schmidt-Cassegrains, and Maksutovs. Although I enjoyed them all, none gave razor-sharp images like the old Unitron. I wasn't

about to return to small aperture. But why couldn't the performance of the 3-inch be scaled up to larger instruments? That bothered me.

Theoretically, an unobstructed optical system is the optimum design, and among amateur instruments available commercially that means the refractor. Furthermore, small imperfections in a lens' figure introduce far less aberration into the image than mirror defects. But the refractor's nemesis is chromatic aberration, which skyrockets as aperture increases. A 6-inch f/10 refractor has more than 30 times as much as a 3-inch f/15. To produce the same color-free images as the 3-inch, the 6 must have its chromatic affliction reduced by 97 percent.

In the late 1970's I heard about Takahashi's new fluorite refractors with exceptional color correction. More recently, other manufacturers have offered similar instruments. Fluorite, when used as one of the full-aperture elements in a doublet objective, eliminates false color to below the visual threshold, even on Venus. Four-inch models marketed by Takahashi and Celestron are superb performers — expensive but worth it for the purist. However, the cost of 5-inch or larger versions remains astronomical.

By 1984 another option had appeared on the scene: apochromatic refractors by

Illinois-based Astro-Physics. These telescopes have triplet objectives that virtually overcome chromatic aberration. In 1985 I ordered a 5-inch f/12. After my first night with that telescope, I knew the quest was over. Here was a telescope that acted like a scaled-up version of my old 3-inch Unitron. After a few months of observations with it, I couldn't resist ordering a family of three shorter focal ratio Astro-Physics refractors: a 4-inch f/6.5, 5½-inch f/7, and a 7-inch f/9.

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*Apochromatic refractors  
offer a new level of  
observing experience  
for the purist with money.*

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The 4- and 5½-inch refractors perform as well as the 5-inch f/12, though the former has a bit more residual color and the latter a shade less due to more exotic glass. Their shorter tubes make them excellent field telescopes. The 4-inch is particularly versatile atop a Celestron Super Polaris mount. It fits in my Firebird and can be set up in about three

minutes to provide perfectly framed views of the Pleiades at 20x or sharp images of the planets at 150x.

The 7-inch took 20 months to arrive, but it was worth the wait. The Astro-Physics design so effectively suppresses chromatic aberration it's as if the refractor has been reinvented. The Starfire series is virtually color-free. There remains a touch of false color that can be seen in stringent tests. For example, in my 7-inch a bit of spurious blue appears around Vega and a vague touch of blue around Venus. I have not seen chromatic aberration on other planets or the Moon.

Despite its low altitude from Canada, Saturn looked particularly impressive last year through the 7-inch. Cassini's division was obvious all the way around. I may have glimpsed Encke's too. Saturn's disk displayed several pale belts in addition to the conspicuous North Equatorial Belt, which contained some threshold detail. In the spring of 1988, gibbous Mars, only 9 arc seconds in apparent diameter, revealed a huge south polar cap, Syrtis Major, and Libya in average seeing. By opposition time the detail was overwhelming — more than I could draw. I was delighted to see, for example, the forking of Tithonius Lacus, which might represent detection of 75-mile-wide features on the planet.

In deep-sky tests, three experienced ob-

servers judged the 7-inch to be about equal to a good 10-inch f/5.6 Newtonian in showing faint objects. It was considered superior in revealing fine details such as dust lanes in galaxies and individual stars in the cores of globular clusters. At 180x the great cluster in Hercules (M13) became a mass of tiny stellar points. Planetary performance was no contest. And at 40x the 1°.6 field was stunning, framing the galaxies M81, M82, and NGC 3077 in Ursa Major beautifully.

Of course the comparison was partly unfair in that the refractor cost several times as much as the Newtonian. But it does demonstrate the several-inch advantage gained by unobstructed high-contrast optics that transmit about 97 percent of the light entering the lens.

The Astro-Physics refractors cost between \$300 and \$500 per inch of aperture (tube assembly only), which is less than some manufacturers charge for traditional refractors. Fluorites start at about \$400 per inch; some models are well over \$1,000 per inch. Tele Vue's Genesis refractor has a fluorite corrector only, and its performance is, I'm told by those who have tested it, comparable to true fluorites and the Starfires.

Yet why pay \$3,000 for an equatorially mounted 5-inch apochromatic refractor when you can get a fully loaded 8-inch Schmidt-Cassegrain or a 17-inch Dobsonian for the same outlay? Why, indeed?

Since this is a blatantly biased personal account, all I can write is why I have been smitten by apochromatic refractors. To me, telescope viewing is primarily an aesthetic experience — a private journey in time and space. Stars look like tiny pinpoints to the unaided eye, and that's the way I want my telescope to show them. Planets should appear as sharp-edged globes that focus to perfect clarity when the seeing is good. A faint star and a faint galaxy should always look completely different. In wide-field viewing the images should be in focus over the entire field.

Those are my (extremely high) criteria for a pleasurable observing experience. I don't want to see fuzz, flares, and waviness caused by mediocre optics or incessant tube currents. I want images as close to the real thing as possible. Now that I am seeing them in my new refractorland, I'm spending more time than ever at the eyepiece. You may not agree with my priorities. I expect that most amateur astronomers won't. Apochromatics aren't as compact as Schmidt-Cassegrains, nor can they compete with the brute aperture of large Newtonians. But they come closest to my idea of a perfect telescope.

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The Backyard Astronomer's Guide (with Alan Dyer, Camden House)  
Nightwatch (Camden House)  
Exploring the Moon and the Solar System  
Sky Guide (with Sam Brown, Camden House)  
Mag 6 Star Atlas (w/ V. Costanzo & G.F. Chaple, Edmund Scientific)  
Halley's Comet: Mysterious Visitor From Outer Space (Edmund Scientific)  
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