

# 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 are 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.

The Star 130 and 155 Super ED Doublet Apochromatic offer excellent color corrections through the visual wavelengths. These

are great a great choice for those with a limited budget who want the superb, crisp, contrasty images of an apochromatic refractor.

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 and 206mm diameters, were developed with fast focal ratios of f7.5 and f8 respectively, for amateurs who long to achieve superb, wide field astrophotos. The EDF refractors feature giant 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.

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 stopper 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.

We offer a unique, unobstructed, highly corrected optical system 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 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 on a double-pass autocollimator. Each lens is tested, polished and retested repeatedly throughout the production process. We continue until the desired performance is achieved. 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 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. 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 with no backlash and our focusers are smooth with no wobble.

## MOUNT ASSEMBLY

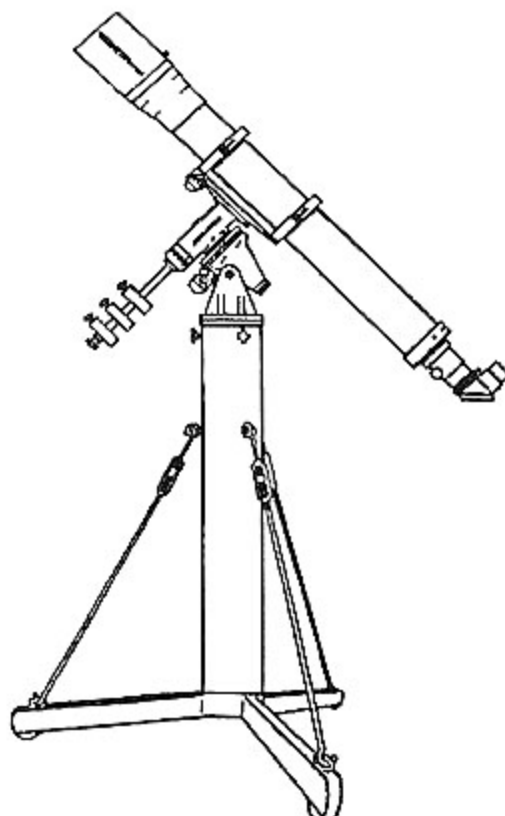
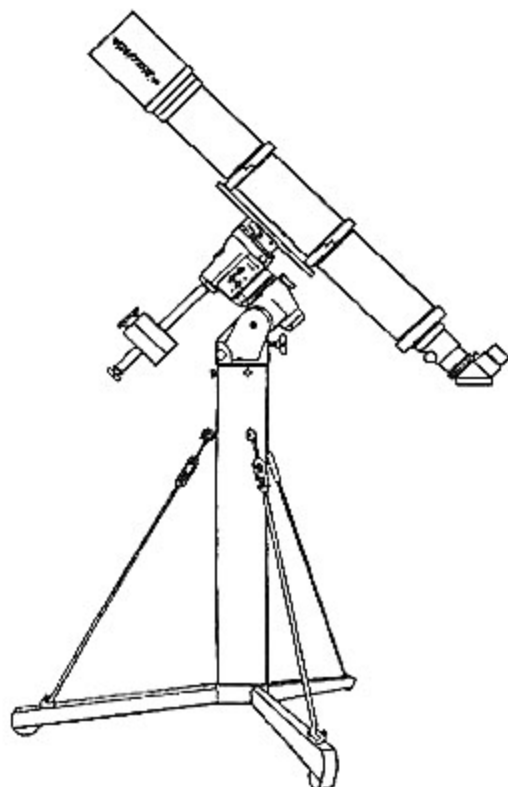
Our mount assembly department is staffed by a highly competent amateur telescope maker, now turned professional. Since he is an advanced user and observer, he understands how a precision mounting should feel and be adjusted. He brings this experience to the construction of each mounting. The components 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

# Star130 and Star155 5.1" f8 and 6.1" f9 Super ED APOCHROMATS

Many experienced amateurs feel that the long-focus doublet achromat does a superb job of showing the moon and planets with high contrast. Such achromats must be exceedingly long, 120 or longer, to reduce the visual color error to acceptable levels. With the Super ED (means Extra low Dispersion) lens design that we have developed, excellent color correction can be achieved in focal ratios as fast as f8. Compare the chromatic aberration (color error) of our Super ED doublet with Doublet Achromats and Fluorite Doublet Apochromats (see accompanying spot plots). The performance of the Super ED doublet objective is quite similar to that of the much more expensive Fluorite doublets, in fact, the color correction is so good that only an expert optician can tell them apart. Although normal ED glass has been available to the lens maker for a number of years, Super ED glass with a dispersion,  $V_d > 90$  has only recently been made in sufficient quantity for telescope refractor objectives. Super ED doublet lenses can be corrected for spherical aberration over a wider wavelength range than normal ED lenses. We invest a little more for premium materials to ensure that you achieve the absolute best definition and contrast that can be obtained with a doublet objective.

The optical design of the Super ED objective consists of a flint leading doublet with the ED glass in the rear of the objective. The design 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 sharply focused Airy disc 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 objective settles down quickly, rarely taking more than 30 minutes to reach thermal equilibrium. Like our EDT triplet objectives, the performance of the Super ED doublet objectives has been tested in sub-zero temperatures, and we have found them to perform perfectly under those conditions.

### MECHANICAL CONSTRUCTION

All aspects of the tube assembly and carrying case are identical for our line of Super ED Doublets and EDT Triplet refractors. 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 6x7cm 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. The focuser extension threads directly into the drawtube to provide an additional 2.5" of focuser travel for straight-through observations.



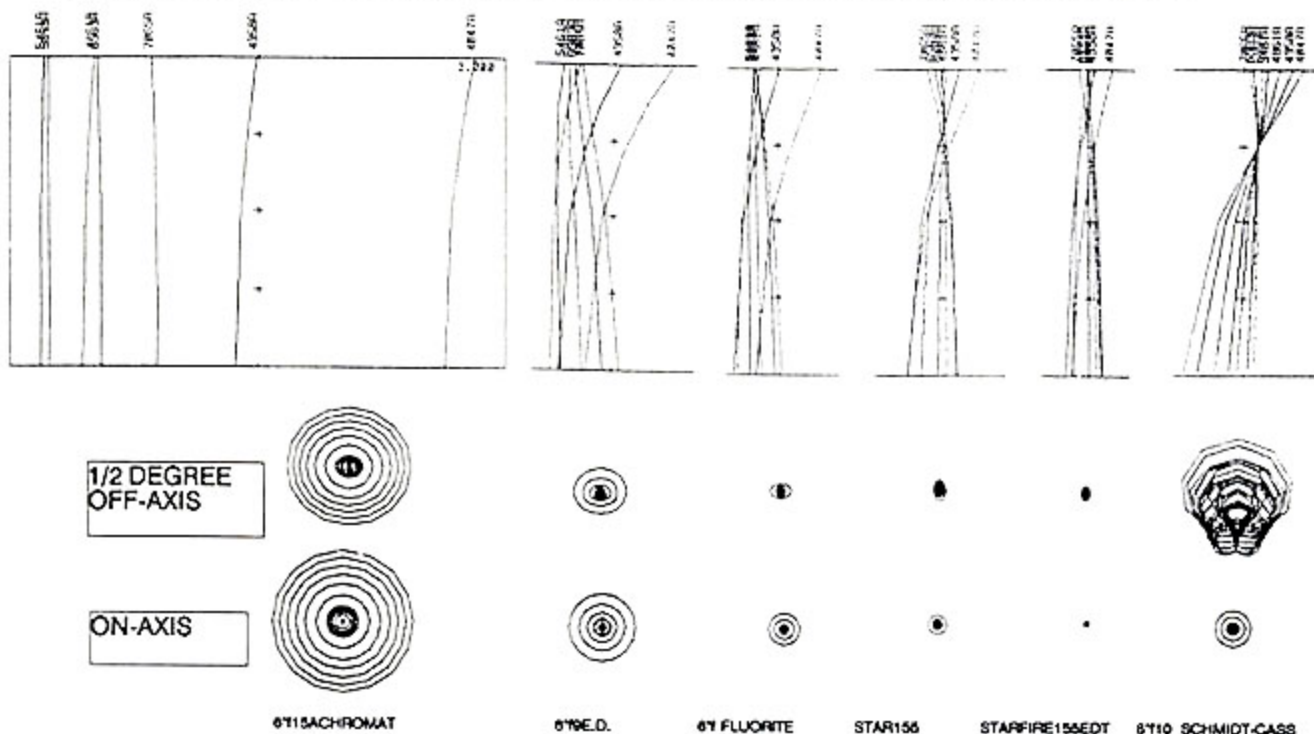
Star 130 Super ED Doublet, 400 mount, 48" pier and  
Star 155 Super ED Doublet, 600 E mount, 54" pier

### PERFORMANCE

The Super ED Doublet refractors are handcrafted with the same care as our ED Triplets. The spherical correction is superb over the red-to-violet visual wavelengths, allowing the observer to bring all the important colors to a critical focus. Planetary details are resolved crisply with good definition and contrast. Lunar craters appear white on black at high power, without the annoying blue haze normally seen in achromatic doublets. Under steady seeing conditions, powers of 100x per inch are quite practical without image breakdown. Even here, the chromatic aberration effects are quite small. Double stars are split cleanly to the theoretical limit of 0.74 arc second. Star clusters appear extremely sharp at all powers, nebulae and galaxies are surprisingly bold and crisp with fine detail features easily missed in mass-production telescopes. Our refractors are ideal for high-resolution photography of the sun's surface in hydrogen alpha and white light. We will be happy to assist you in designing a first-class solar-observing system.

Our STAR130 and STAR155 Super ED refractors are built to the quality levels of world-class instruments yet are truly affordable to every serious amateur. They are both quite portable and set up easily in minutes on our rugged German Equatorial. You will appreciate the attention to detail that sets these instruments apart from every other refractor on the market. They are supremely satisfying to use and to own.

## COMPARISON OF COLOR CORRECTION OF AMATEUR TELESCOPE OPTICS



The above graphs and spot diagrams compare the color correction of six different optical designs. The graph shows the residual color error for 7 wavelengths from 7065A to 4047A at an approximate scale of 0.18 cm/cm for the achromat and 0.1 cm/cm for the rest of the optics. The spot diagrams were computer ray traced for three colors, 6563A, 5461A and 4358A. The on-axis spot diagrams show what you would see when examining the image of a bright blue star at high power (~400x). It is assumed that all optics are equally well figured to better than 1/10 wave in the yellow-green peak. The residual color errors shown above are strictly the result of the inherent limitations of the optical designs. The upper spots show the image at the edges of a 1-degree field, indicating the amount of field curvature and coma present in the objectives.

The 6115 achromat is an optimized airspaced Fraunhofer design using standard crown and flint glasses. 115 was chosen as a comparison because it is considered a standard. The ED objective is a flint leading design using a KF or KzF flint in combination with E.D. glass. The Fluorite uses the published design of the Japanese Fluorite doublets. The Astro-Physics STAR ED and STARFIRE EDT lenses use a super ED (or SD) glass with a matching hard crown to eliminate the secondary spectrum. Only a small tertiary spectrum remains. The basic color curve is the same for both of these lenses; the main difference is in the spherical corrections at the ends of the spectrum.

### SPECIFICATIONS: STAR130 ED

Secondary Spectrum:	Less than 0.01% 706nm to 405nm
Clear aperture:	130mm (5.1")
Focal length:	1040mm (41")
Resolution:	0.88 arc seconds
Coatings:	Multi-layer on leading crown element
Magnification range:	18x to 500x
Tube assembly:	White, 5.5" aluminum tube; baffled, flat-black interior; engraved retaining ring, push-pull cell
Weight with dewcap:	14 lbs. (6.4 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 empty 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

- Superb corrections of spherical and chromatic aberrations
- Extremely well corrected for visual and photographic work
- Clear, colorfree glass types result in brighter, more contrasty images
- Stunning lunar/planetary and deep-sky views
- Excellent for 35mm and medium-format deep-sky astrophotography

### SPECIFICATIONS: STAR155 ED

Secondary Spectrum:	Less than 0.01% 706nm to 405nm
Clear aperture:	155mm (6.1")
Focal length:	1395mm (55")
Resolution:	0.74 arc second
Coatings:	Multi-layer on leading crown element
Magnification range:	25x to 600x
Tube assembly:	White, 6.5" aluminum tube; baffled, flat black interior; engraved retaining ring, push-pull cell
Weight with dewcap:	21 lbs. (9.5 kg)
Carrying case type:	Wood case with grey vinyl covering and foam-lined interior
Case outside dimensions:	56.5" x 9.8" x 10" (144cm x 25cm x 26cm)
Weight of empty case:	22 lbs. (10kg)
35mm prime-focus field:	1.0 x 1.4 degrees @ f9
35mm telecompressor field:	1.3 x 1.9 degrees @ f6.7
35mm field with 2x Barlow:	0.5 x 0.7 degrees @ f18
6 x 7cm prime-focus field:	2.5 x 2.9 degrees @ f9

Specifications subject to change without notice.

### 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

## 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, with 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, 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 rivals views in much larger instruments.

The Traveler is a fabulous astrograph. With a Pentax 6x7cm 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



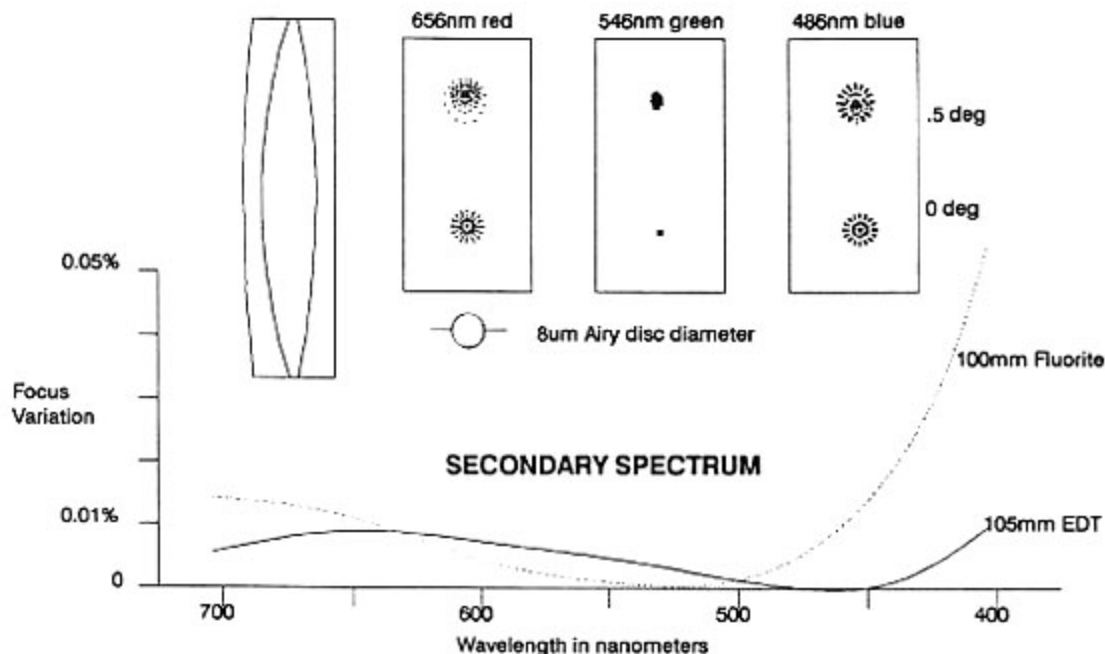
105mm Traveler EDT, 400 Mount, Wood Tripod

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.

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 6x7cm 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 with 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" I.D. Astro-Physics rack and pinion focuser, 4.5" travel; 2" and 1.25" adapters; 2.5" extension
Telescope length:	48 cm (19") with dewcap fully retracted
Weight with dewcap:	9 lbs. (4 kg)
Carrying-case type:	Custom padded bag from Tenba
Case outside dimensions:	21" x 10.8" x 7" (53cm x 27 cm x 18 cm)
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 7 cm 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 or without 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 that 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, 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 105 Traveler EDT. Use our 2" (2x) Barlow to double your magnification.

	magnification	actual field of view	exit pupil
55mm Plossl	11x	4.6 deg	9.6mm
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
4.8m Nagler	131x	0.6 deg	0.8mm

A 55mm 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 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 with 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 in 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 6x7cm 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 6x7cm 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, 600 E German Equatorial, 48" Pier

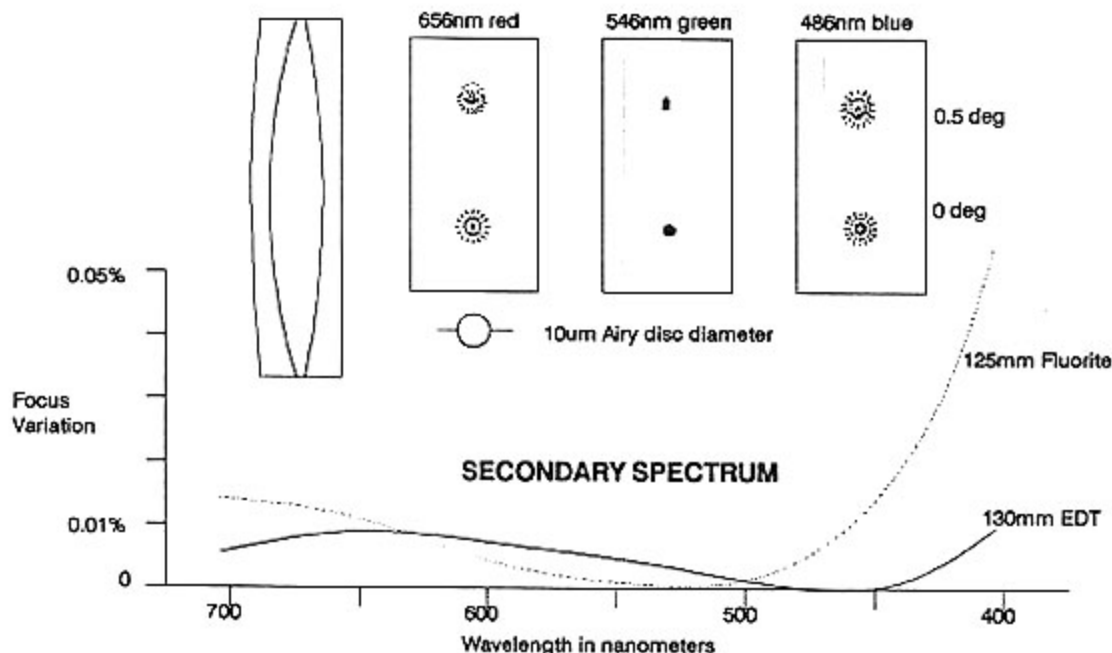
#### PERFORMANCE

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 130 EDT 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 covers 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:	1016mm (40")
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") with 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 or without 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

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 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

### 155 mm f9 STARFIRE EDT REFRACTOR (6.1" aperture)

The 155mm 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 706nm to 405nm compared with 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. E.D. 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 in 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 that 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 155mm EDT objective consists of a positive element of ED glass surrounded by two matching hard crown elements. 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 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 6x7cm 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.



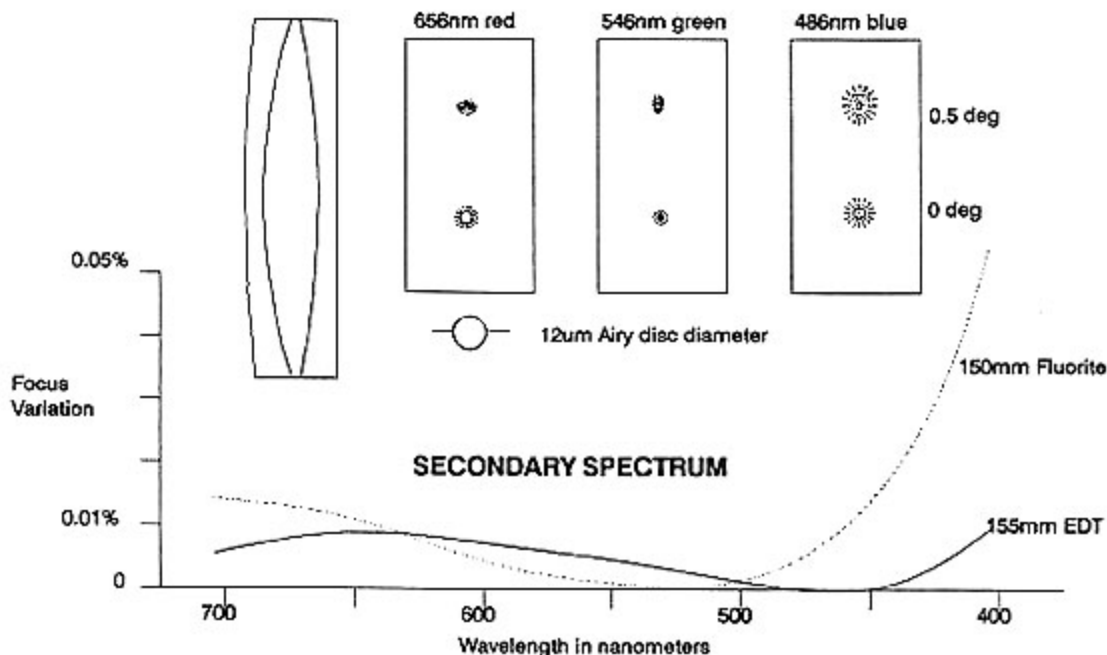
155mm StarFire EDT, 800 mount, 48" Pier

#### PERFORMANCE

The 155mm StarFire EDT was designed on a challenge to deliver the absolute highest possible image quality for lunar/planetary observing while still retaining a truly portable instrument. The result is not only a fine planetary telescope but also a superb deep-sky instrument with unlimited photographic possibilities. It has 38% more light grasp than a 130mm (5.1") aperture and 110% more than a 105mm (4.1") aperture. Planetary contrast is crisp and sharp, showing exquisite detail and natural coloration of surface features. On nights of good seeing, it will be a challenge to draw all of the lunar or planetary detail that you observe. Double stars at the theoretical limit of 0.74 arc second are split cleanly. Star clusters appear as diamond dust sharply defined against black velvet. Incredible solar granulation, sunspots with feathery faculae and the fine filaments of prominences are revealed in our H-alpha Solar System. The 155mm StarFire EDT is a truly versatile instrument that will allow the advanced amateur to explore many aspects of astronomy and to renew a wonder in the vastness and beauty of the universe.

You will be very pleased with the mechanical construction of this beautiful refractor, and the way it performs optically will delight you.

# 155mm f9 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: 155mm (6.1")  
 Focal length: 1395mm (55")  
 Resolution: 0.74 arc seconds  
 Coatings: Multi-layer, overall transmissions greater than 97% in peak visual wavelengths  
 Magnification range: 25x to 600x  
 Tube assembly: White, 6.5" aluminum tube, baffled; flat-black interior; engraved retaining ring; push-pull lens cell  
 Focuser type: 2.7" I.D. Astro-Physics rack and pinion focuser, 4.5" travel; 2" and 1.25" adapters; 2.5" extension

Telescope length: 1270mm (50")  
 Weight with dewcap: 23 lbs (10.5 kg)  
 Carrying-case type: Wood case with grey vinyl covering and foam lined interior  
 Case outside dimensions: 56.5" x 9.8" x 10" (144cm x 25cm x 26cm)  
 Weight of empty case: 22 lbs. (10 kg)  
 35mm prime-focus field: 1.0 x 1.4 degrees @ f9  
 35mm telecompressor field: 1.3 x 1.9 degrees @ f6.7  
 35mm field with 2x Barlow: 0.5 x 0.7 degrees @ f18  
 6 x 7cm prime-focus field: 2.5 x 2.9 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

Portable mount for visual and photographic studies:  
 600 E German Equatorial Mount with Dual Axis Drive

Portable mount for extensive astrophotography:  
 800 German Equatorial Mount with Dual Axis Drive

## 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 155 StarFire EDT. Use our 2" (2x) Barlow to double your magnification.

	magnification	actual field of view	exit pupil
55mm Plossl	25x	2.0 deg	6.2mm
35mm Panoptic	37x	1.8 deg	3.9mm
22mm Panoptic	63x	1.1 deg	2.4mm
13mm Nagler	107x	0.8 deg	1.4mm
9mm Nagler	155x	0.5 deg	1.0mm
7mm Nagler	200x	0.4 deg	0.8mm
4.8mm Nagler	291x	0.3 deg	0.5mm

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

## ASTRO-PHYSICS

### 180mm 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 706nm to 405nm compared with 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 in 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 6x7cm 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 wobble 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 6x7cm 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, 800 German Equatorial, 54" Pier

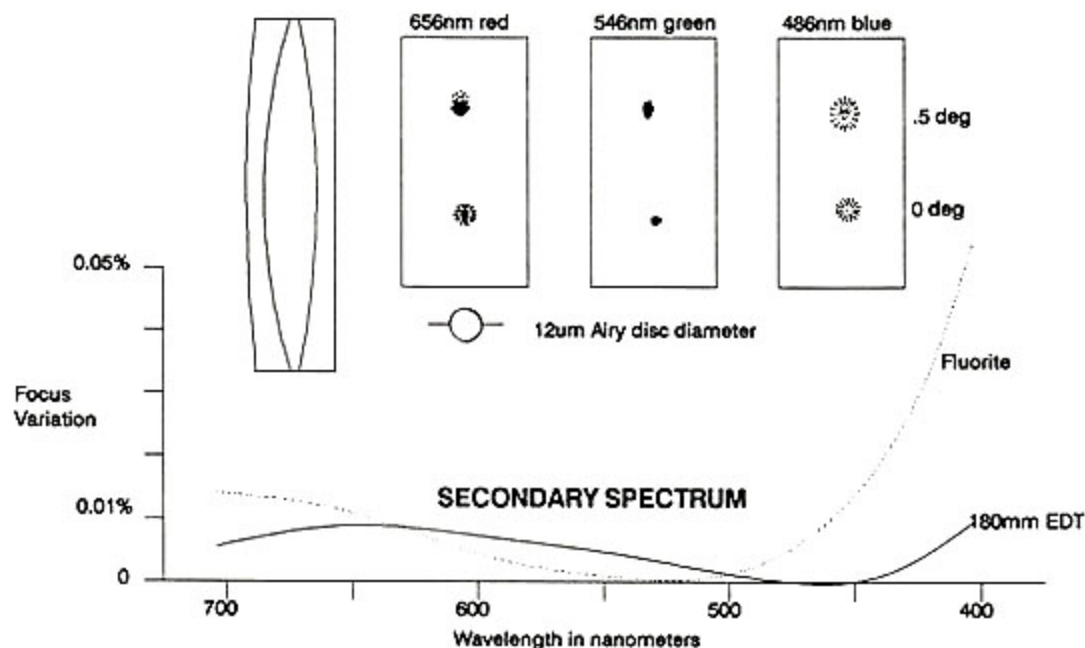
#### PERFORMANCE

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 and 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: 68" 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
- 1200 German Equatorial Mount with Dual Axis Drive
- optional computer slewing control
- 54" Portable Pier to match above mounts

#### 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 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

## ASTRO-PHYSICS

### 206mm EDF STARFIRE ASTROPHOTOGRAPHIC TELESCOPE

Our 206mm (8.1" aperture) EDF Refractor features a 3 element front objective with a 2 element rear field lens to image a highly corrected 3.5 degrees of sky over a 4" diameter field. With a focal length of 1620mm (64") the system operates at a speed of f7.9. This focal length coupled with the large field coverage is ideal for high resolution photography of deep sky nebulae, globulars, and clusters of galaxies.

The EDF optical design uses an advanced Super ED glass, chosen for its extremely good color correction well into the far violet regions where modern high resolution emulsions have their highest sensitivity. Resolution, contrast and color definition is superb, allowing extreme enlargements to be made from medium-format negatives. Multi-coatings are used throughout to increase overall efficiency well above 90%. Although mirror systems have been built with faster theoretical f ratios, their large central obstructions and reflective coating inefficiencies reduce their actual photographic speeds drastically. Actual side by side tests performed by top amateur astrophotographers using our refracting systems and comparable reflectors has shown that the refractors put more light down on the negative than the reflectors.

The 206mm EDF refractor is an outstanding visual telescope as well. Widefield oculars allow sweeping low-power views of the Milky Way and large extended nebulae. At high power, the 8.1" aperture shows crisp, sharp and contrasty views of the Sun, Moon, planets and double stars. All optical surfaces are carefully polished and the finished lens is tested and figured to a null under autocollimation. 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, with the outermost ring brighter and wider than the rest.

#### MECHANICAL CONSTRUCTION

The 206mm EDF refractor is constructed as a compact portable telescope to minimize the size requirement for the mounting. 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 easier 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 to come. The tube is fully baffled, painted with light-absorbing flat black and features our adjustable push-pull cell.

The focuser on the EDF Refractor has a massive 4" inside diameter to allow full coverage of 6x7cm negatives. 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 camera adapter containing the field lens comes with a large adapter ring machined especially for the superb Pentax 6x7 camera (camera body is not included). A visual back is included that lets you use 2.7", 2" and 1.25" visual and photographic accessories. 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, 2" accessories 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.



206mm EDF StarFire, 1200 German Equatorial, Pier

#### PERFORMANCE

The 206mm EDF StarFire refractor was developed as an outstanding astrophotographic system that can also be used as a super portable high resolution Lunar/Planetary refractor. In order for this instrument to achieve its resolution potential on fine grained emulsions, we recommend a very large, stable mounting that can be controlled to a high degree of accuracy. You may wish to consider our 1200 German Equatorial Mounting for your transportable use or permanent installation.

This instrument was requested by some of the world's most advanced amateurs who recognize the inherent advantages of a highly corrected, super-sharp refractive optical system for widefield high-resolution photography. These individuals are pushing the limits of astrophotography with new equipment and emulsions to achieve results that used to be the exclusive domain of large professional observatories. We are proud to be part of the push to extend the boundaries of amateur astronomy.

## 155mm f7 STARFIRE EDF TRIPLET APOCHROMAT REFRACTOR (6.1" aperture)

This 6" f7 StarFire EDF 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" x40" prints of the Lagoon and Trifid Nebula 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 totally 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 is an ED glass and 2 crowns. This combination totally eliminates all secondary spectrum, coma and spherical aberration. The rear group is a 2 element field flattener system 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. 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 7cm and offer all the attachments necessary to use with the 6" EDF.

The Astro-Physics giant 4" focuser is truly versatile. The 4" I.D. of the drawtube will allow maximum coverage of the Pentax 6 x 7cm 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 0.004% focus variation from 406nm 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 and 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
Field Flattener	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

## 6" f12 STARFIRE TRIPLET APOCHROMATIC REFRACTOR

The StarFire design has proven so popular in the past few years that we decided to offer the 6" f12 StarFire for the most discriminating lunar/planetary observer. Color correction is essentially perfect, far exceeding that obtained in even the finest achromatic doublets. Planetary contrast is crisp and sharp showing exquisite detail and natural coloration on the surface. The planets themselves are well defined disks against a black sky. Low power performance of these long focal length lenses is equally impressive. Giant wide-field oculars will show star fields and deep sky objects with high contrast just like our faster lenses do. Astrophotography is possible at f8 with the triplet telecompressor. The barlow may be used for photo-visual work at f24, and even longer focal ratios are possible with the eyepiece projection adapter.

### SPECIFICATIONS:

Color correction :	Less than 0.05% focus variation from 706nm to 405nm (r to h wavelengths)
Clear aperture :	152mm (6")
Focal length :	1829mm (72", + -1.5") efl
Resolution:	0.74 arc seconds
Magnification range :	33x 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 and pinion focuser, 4.5" travel, 2" and 1.25" adapters, 2.5" extension
Carrying Case	Foam-fitted, vinyl-covered plywood case
Telescope length :	1727mm (68") with dewcap fully retracted
Tube weight :	21 lbs. (9.6 kg)
35mm Photographic field at prime focus :	0.8 x 1.1 degrees @ f12
35mm Photographic field with Telecompressor :	1.1 x 1.6 degrees @ f8
35mm Photographic field with 2x Barlow :	0.4 x 0.6 degrees @ f24

# 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

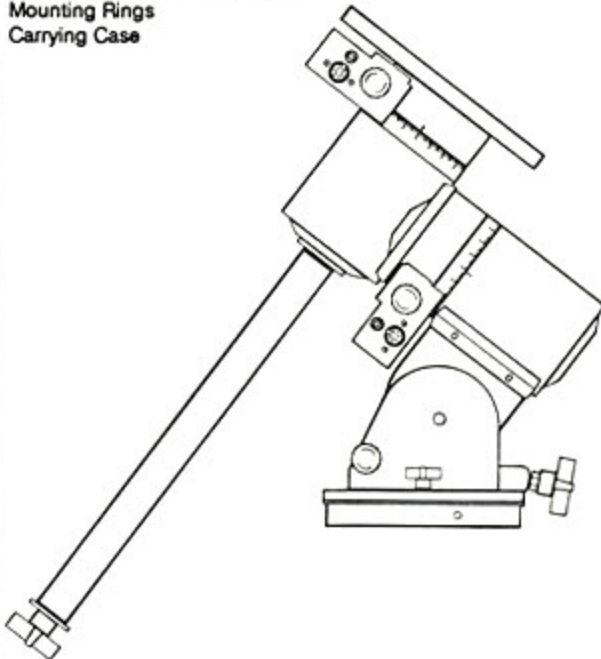
- High-resolution stepper motors in both axes
- Lightweight, palm-sized controller
- Quartz control
- R.A. and declination reversing switches for correct object orientation and movement in eyepiece.
- Power output to plug in guiding reticle or other accessory
- Adjustable brightness control for guiding 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

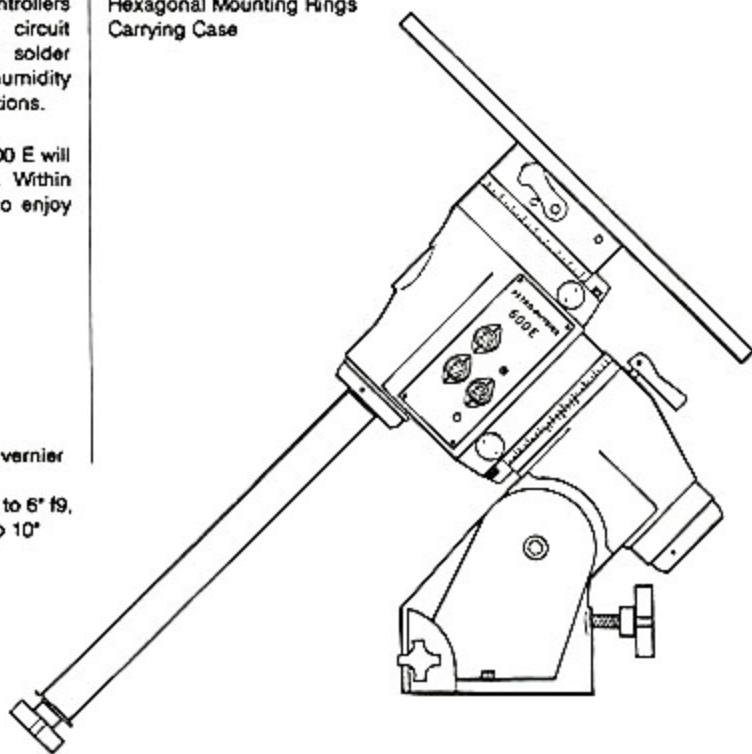
### FEATURES

- 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

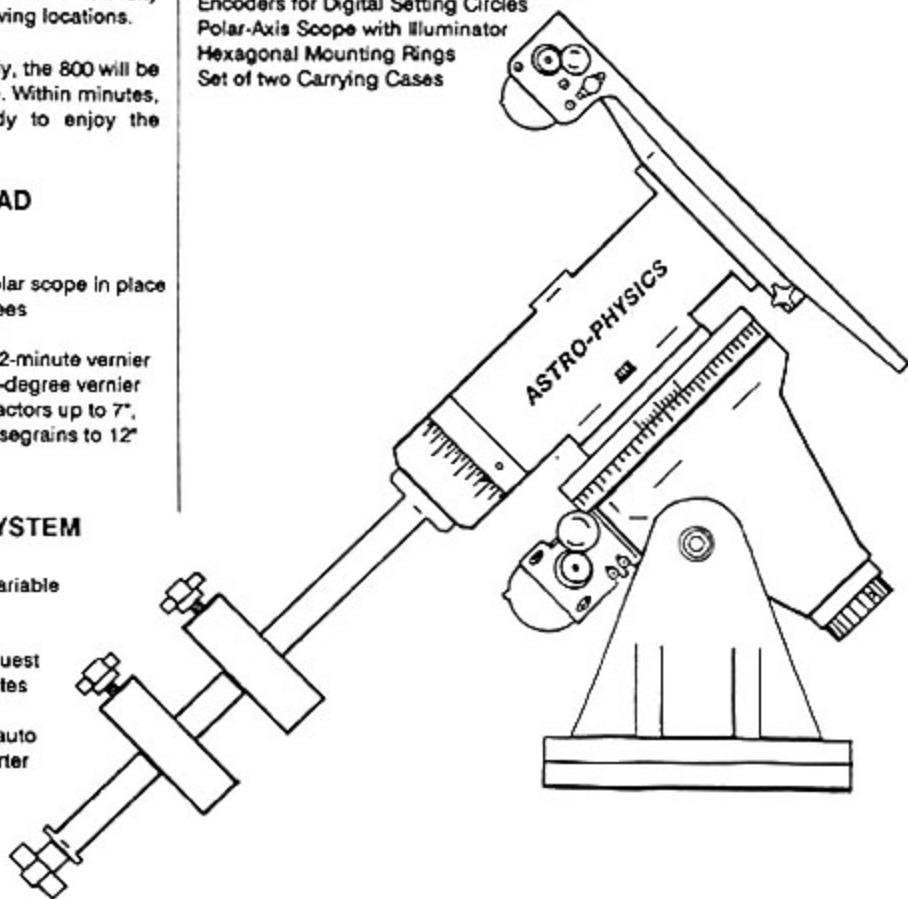
## FEATURES

- 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

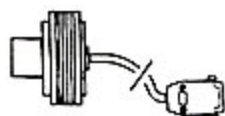
## ACCESSORIES FOR 400, 600 E AND 800 MOUNTS

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

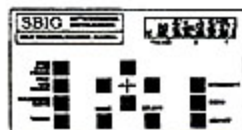
If you plan to take long exposure astrophotos, we recommend the ST-4 from Santa Barbara Instrument Group (SBIG). It is a dual purpose CCD based instrument that functions as either a star tracker or imaging camera. The star tracker function is most exciting to us. The CCD detector is mounted on the focuser 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 mosquitos or enjoy visual astronomy with another scope.

### SBIG ST-6 IMAGING CAMERA

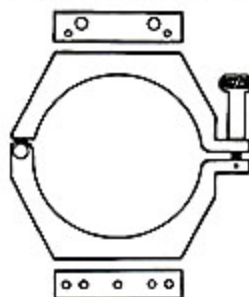
If your primary interest is CCD imaging, you may wish to consider the ST-6 model. The ST-6 is a second generation cooled CCD camera with approximately 9 times the detector area of the model ST-4. It uses a CCD with a resolution of 375 by 242 pixels. The pixel size is 23 by 27 microns and the total array 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

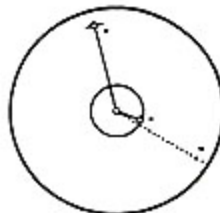
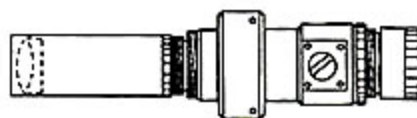
1/4-20 holes drilled for several popular mounts

### 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

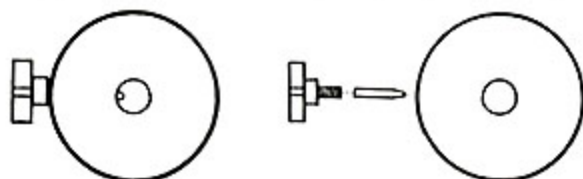
The secret to quick polar alignment is an easy to use reticle that shows the positions of several stars in the region of the region of polaris. Line up these stars in just minutes and you are ready to go.

## 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

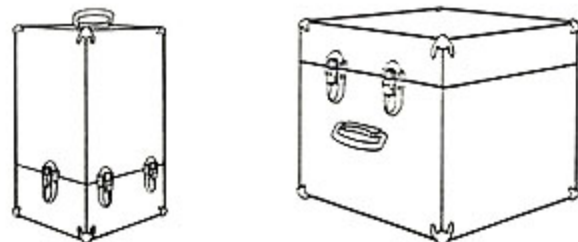


## 800 MOUNT CARRYING CASES

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.

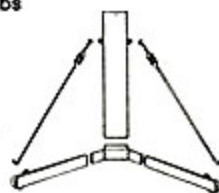
### Pier for 600 E Mount

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.



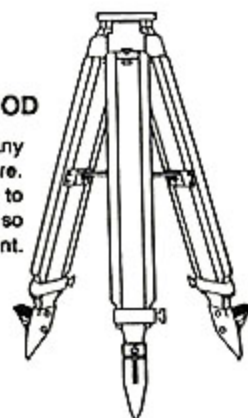
The tripod is constructed of black anodized aluminum and black painted aluminum castings.

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"



## 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.

### 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 100 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 1,950 objects. 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. An instruction sheet covering the basic operation of the unit is also provided in each language, in addition to the English manual. A brand new ROM chip allows the user to select which of five languages is used for the display.

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

### NGC-MAX

JMI's top-of-the-line in dedicated computers. This unit has an incredible 12,000 object database, is the only such unit on the market to offer an RS-232C serial interface (can be used with The\_Sky software), is the only unit they offer with an Identify Mode (identifies unfamiliar objects and finds objects near the current position), and can find all of the planets.

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

## ACCESSORIES FOR 1200 MOUNT

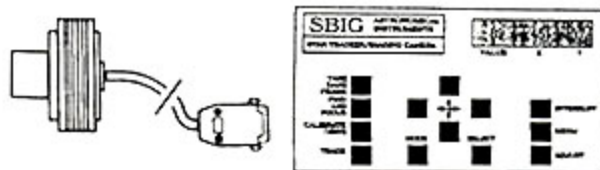
### SBIG ST-4 CCD STAR TRACKER/IMAGING

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 ( $\pm 5$  arc second periodic error), only minor corrections are needed, mostly to compensate for slight inaccuracies in polar alignment.

ST-4 CCD Head

Instrument Panel



### 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 by 242 pixels. The pixel size is 23 by 27 microns and the total array area 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.

### 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, 800 AND 1200 mounts; Carton alt-azimuth; Vixen DX and Super Polaris; and the TeleVue Systems mount. 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

### 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).

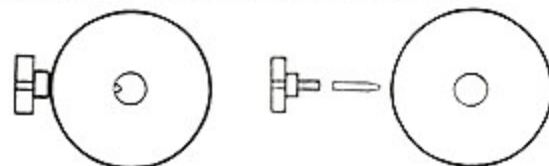
### STAINLESS STEEL COUNTERWEIGHTS

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 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"	62"
diameter of post	10"	10"	10"
length of legs	25"	25"	25"
weight of pier post	19 lbs.	22 lbs.	25 lbs.
weight of pier base	25 lbs	25 lbs.	25 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	68 lbs.	72 lbs.	75 lbs.



### LIGHTWEIGHT ALUMINUM TRIPOD

Our 21 lb. aluminum tripod is amazingly lightweight and sturdy, even with the 1200 mount and our 206mm StarFire EDF! The handy, removeable shelf includes a 15.5" diameter surface to hold your eyepieces and accessories out of the dew. Three legs fold inward for transport. Height is not adjustable.

Weight: 21 lbs. (9.5 kg)

Assembled height: 56.5" (22.2 cm)

Length of legs: 62" (157.5 cm)

# ASTRO-PHYSICS ACCESSORIES

## ASTRO-PHYSICS 2.7" FOCUSER

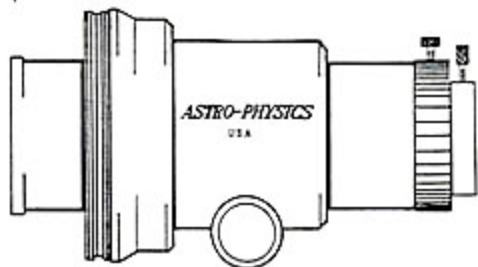
For the amateur who wants a smooth, yet solid focuser, we manufacture our own model of high quality components. Our focuser features a drawtube of 2.7" inside diameter which allows the avid astrophotographer to use a medium format camera to capture images in a 2.25" x 2.25" format with minimal vignetting. 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

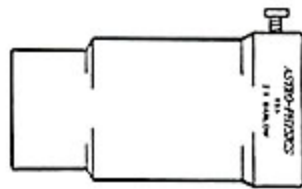
Our focuser extension tube threads securely into the focuser drawtube of the Astro-Physics 2.7" focuser and accepts the 2" adapter. A series of knife-edge baffles are machined into the wall. This extension will provide you with 2.5 additional inches of focuser travel necessary for straight through viewing.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

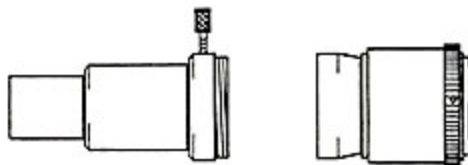
We have increased the versatility of our telecompressor by designing it for both visual and photographic applications. Slip in a 2" diagonal with your favorite eyepiece or your camera adapter with camera. The effective focal length will be 0.74x the focal length of the instrument. Deep-sky objects are 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

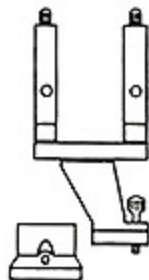
Our imported finders feature a unique eyepiece with crosshairs in the center of the field which can be illuminated with the matching self-contained, battery-powered LED. The 1.25" diagonal and eyepiece provide a wide field of view to assist you in locating your favorite objects.

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

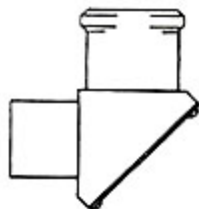
The quick release finder bracket was designed by Astro-Physics to make your life easier. Now, you can attach and detach your finder in seconds while retaining the alignment. The base of the bracket mounts onto the predrilled holes of your Astro-Physics refractor. The remainder of the assembly with the finderscope slips into the groove of the base bracket and tightens quickly with a thumbscrew. 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. The die cast mounting bracket includes fine adjustment screws with nylon tips to help protect the finish of the finder. This accessory is a must!



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

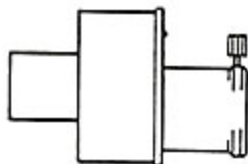
### 1.25" AMICI PRISM DIAGONAL

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 also more enjoyable when using the Amici or porro prism diagonal with your favorite eyepiece. Amici prism diagonals are not recommended for astronomical use.



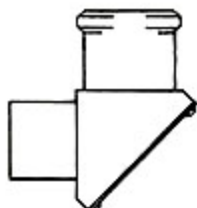
### 1.25" PORRO PRISM DIAGONAL

The porro prism diagonal provides straight-through viewing. Image orientation of the subject in your eyepiece is normal so it is easy to compare the star fields in your eyepiece with your star charts. Also recommended for daytime nature use of your refractor when straight-through viewing is preferred. Porro prism diagonals are not recommended for astronomical use.



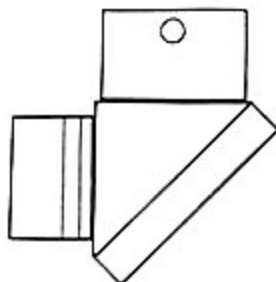
### 1.25" PRISM DIAGONAL

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.



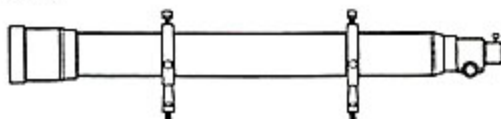
### PIGGYBACK CAMERA BRACKET

Attach this bracket to your favorite 35mm camera, then screw to the predrilled rings on the top of the hex rings. The unique micro-adjust knobs allow you to frame star fields easily in 2 axes.



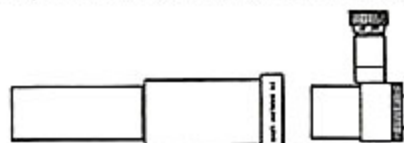
### 80 x 900 mm GUIDESCOPE

For serious astrophotography, a full 80mm (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. Two half-inch wide aluminum bands are attached to the optical tube in order to protect the finish from marring. The guidescope rings (4" I.D.) are mounted onto these aluminum bands and the three alignment thumbscrews are adjusted to position the scope. A dewcap and dustcover are included. You will need to purchase a 1.25" diagonal if you do not wish to view straight through. For manual guiding, we suggest a 12.5mm illuminated eyepiece and 3x barlow.



### 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.



### 3x 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 an Inconel 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 a layer of Inconel 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 Inconel 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.

### 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

## 10 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 10Å ± .2Å
  - 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)

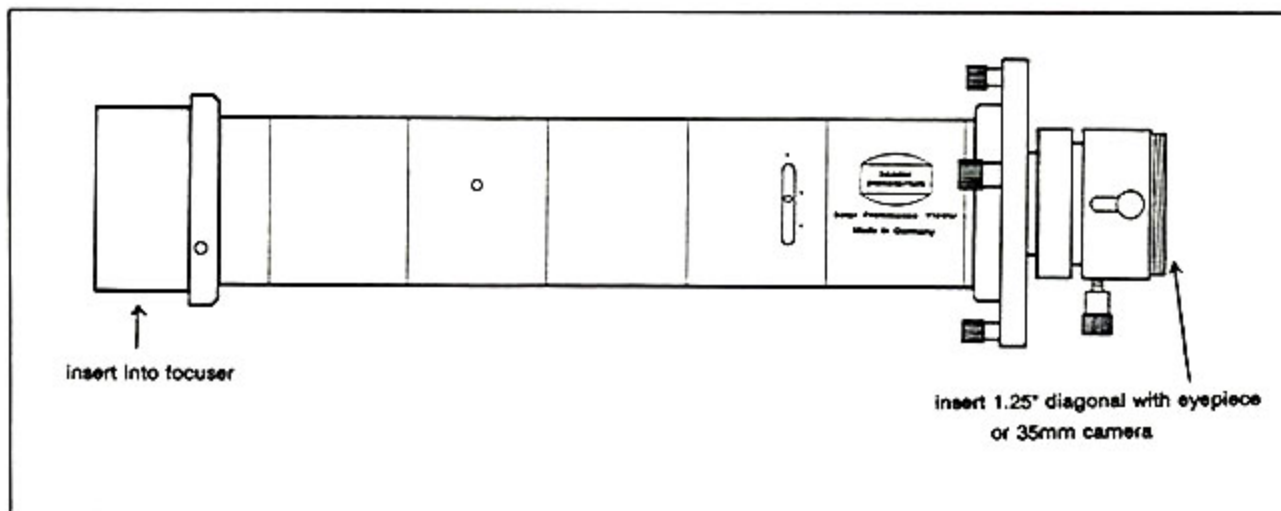
### ADVANTAGES:

- Observation with full aperture
- The H-alpha bandpass filter is fully blocked from X-ray to deep infrared wavelengths
- This filter has 40-50% transmission. Prominences appear bright, showing brilliant detail out to the finest "splashes."
- Photographic exposure times 1/500 to 1/1000 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
- You will record doppler shifted components of prominences automatically.

### CONSIDERATIONS:

- Requires perfect polar alignment and sturdy mount with solar tracking rate. It is important that the disk 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, other refractors on request



## 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 and 130mm diameter 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 all our larger telescopes for reduced aperture viewing with Daystar filters.

## 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.

T-Scanners are equipped with standard 1.25" adapters. Astro-Physics offers a custom adapter for 2" accessories.

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.

The UNIVERSITY AND ATM filters are equipped with standard 1.25" adapters for your 1.25" accessories. Astro-Physics offers a custom 2" adapter that will allow use of 2" accessories.

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 13mm 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 prominence 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 disc 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 and the 94mm and 130mm Brandon 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.

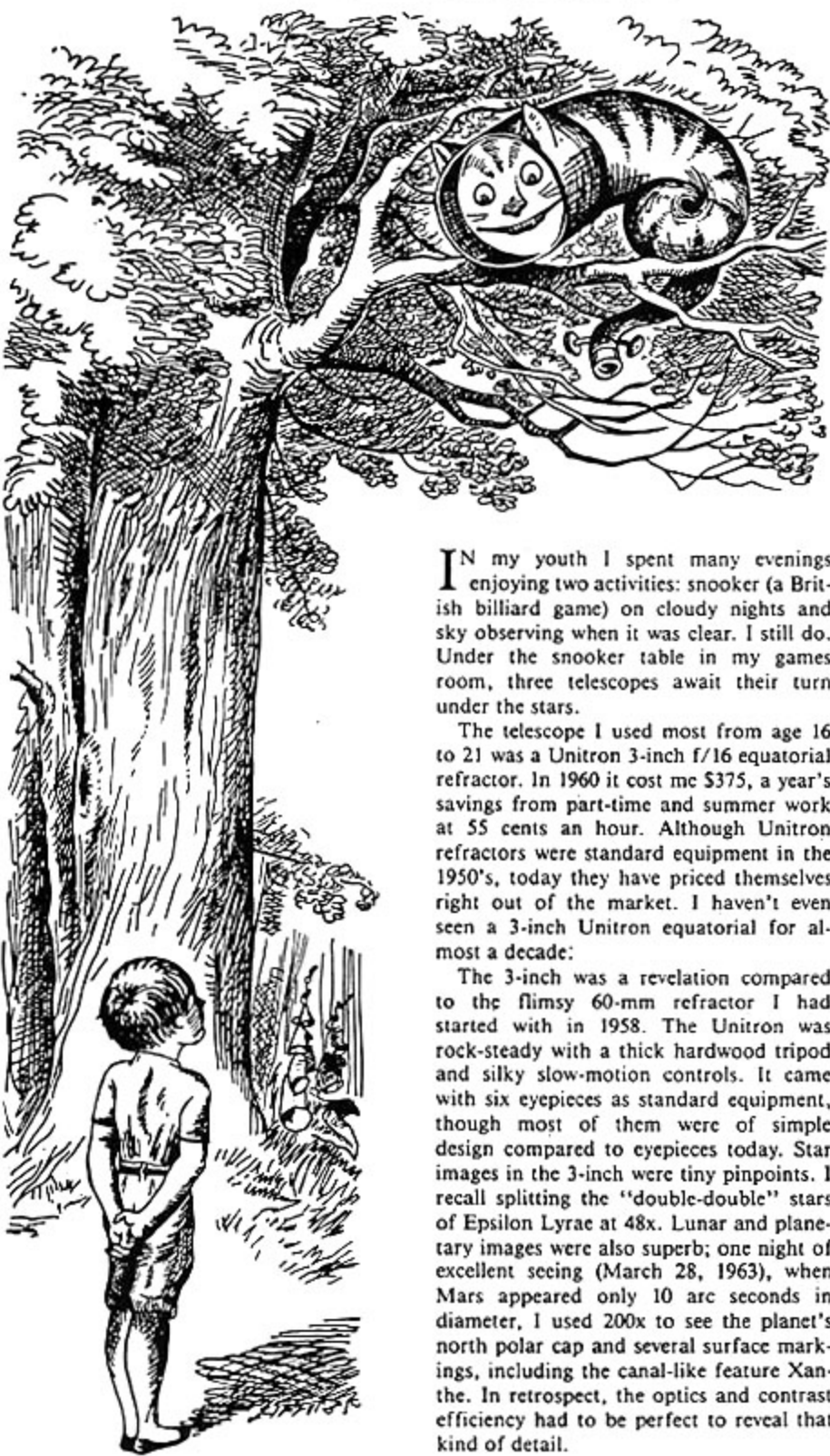
Clear skies! (someday)

Tony Hall  
Daphne Mount

# 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  $5/4$  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.*

---

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 Tithonus 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 8 Star Atlas (w/ V. Costanzo & G.F. Chaple, Edmund Scientific)
- Halley's Comet: Mysterious Visitor From Outer Space (Edmund Scientific)
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