Astro - Physics

7470 Forest Hills Rd.
Loves Park, IL 61111
Phone (815) 282-1513

January 19, ~~1989~~ 1990

Dear Mike Hambrick:

Thank you for your interest in Astro-Physics refractors. I apologize if there has been a delay since your request for a catalog. We have added several new products to our line in the last few months, including the 6"StarFire EDF, Star12 ED refractor and DX mount. The 6"EDF is so new that it is not even on our price list! In the next two months we will revise the brochure again to feature additional photos. In the meantime, we are including a color snapshot of the 5" StarFire on our 600 Mount, 6" StarFire on our 800 Mount, and the Star12ED on the DX Mount. I hope that you find the brochure informative.

We are very excited that photographs taken with our 5" StarFire have been prominently featured in recent issues of Astronomy and Sky and Telescope magazines. Look for these:

1. The front cover of the May issue of Astronomy featured the Lagoon and Trifid nebulae.
2. The front cover of the August issue of Sky and Telescope shows the Eagle Nebula (IC2177). The article on enhanced-color photography by Tony Hallas also features several additional deep sky photos.
3. September issue of Sky and Telescope included a full page color photo of Andromeda in one of the feature articles.

Unfortunately, the magazine reproductions of photographs (both in the above photos and our ads) do not show the wealth of detail that is on the originals. Since we want to share the best reproductions with you, we had a black and white photo of the Lagoon and Trifid printed and included it with this brochure. Even if you don't plan to take astrophotos, you can appreciate the pinpoint star images that demonstrate the resolution of our lenses.

Astro-Physics is a small, personalized optical shop for the discriminating advanced amateur. If you have developed an eye for clean, high-contrast, high-resolution optics, then you may wish to consider an Astro-Physics refractor. We have expanded our staff and facilties which has resulted in improved delivery times.

At the present time, this is our estimated delivery schedule for new orders:

4"f8 StarFire	February 1990
5"f8 StarFire	Summer 1990
6"f9 StarFire	April/May 1990
6"f12 Super Planetary	late 1990
6" EDF	late 1990
7"f9 StarFire	September 1990
Star12ED	May 1990
800 Equatorial Mount	February 1990
600 Equatorial Mount	February 1990

Again, thank you for reviewing our literature. If you have any questions, please feel free to write or give us a call. We look forward to hearing from you soon.

Sincerely,

Marjorie Christen,
Business Manager

A s t r o - P h y s i c s

ASTRO-PHYSICS has been developing telescopes and accessories for the advanced amateur since 1975. We now offer an extensive line of precision telescopes, 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.

APOCHROMATIC LENS DESIGN

Our objectives are APOCHROMATIC, which means that the images are essentially free of false color, both visually and photographically. We use three matched optical glasses to combine the colors of the visual spectrum into intense, sharp, concentrated images. The optics are based on the award-winning Christen Triplet design, featuring very low residual aberration in a short focal length design. Mr. Roland Christen is the founder and owner of Astro-Physics. Please refer to the attached sheet "Color Correction Curves of Astro-Physics Refractors" for a further discussion and comparison of optical designs.

The combination of the apochromatic lens design and careful, precise optical production techniques results in a clean optical system with superior contrast and light grasp. When seeing permits, powers up to 100X per inch of aperture are possible for lunar/planetary or double star work. The wide-field performance of this optical design is outstanding. Images on color film are crisp and sharp with no annoying blue halos around bright stars. Wide-field 2 inch oculars can be used for low power visual exploration of the sky. Deep sky objects stand out in stark contrast against velvet black skies.

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.

OPTICAL PRODUCTION

We manufacture all of our telescopes in our modern optical facility in Illinois, 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 batch of lenses, Roland computer optimizes the design based on the melt characteristics of the glass. We adjust our 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 as an individual. This process is very time consuming, but there is virtually no other way to achieve the level of resolution, definition and contrast that advanced amateurs demand.

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 members to their final destination - the ground. This is done in a way that minimizes weight and size while maximizing rigidity. Examples of this are the tension rods on the piers and thrust bearings on the polar and declination axes that transfer a tremendous amount of load in relation to their size. To this stability, we have added a drive that is accurate and sophisticated enough for the most demanding application. We started with a custom manufactured fine pitch worm gear and added a high resolution stepper motor with a modern push button controller that makes tracking the stars a snap, even for beginners.

ACCESSORIES

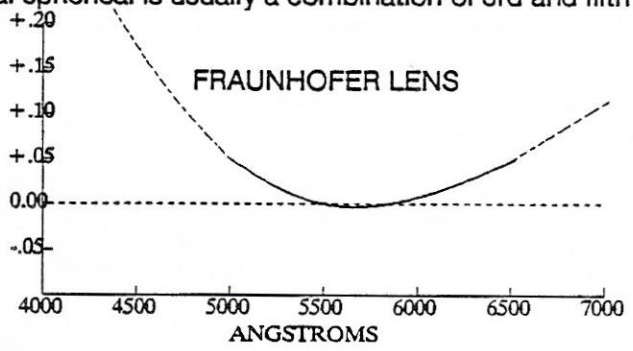
To these basic telescope components, we have added a whole list of accessories that make our telescopes versatile. From camera adapters to telecompressors, we have carefully designed them for their functionality and compatibility. They are all tested and proven in the field under actual observing conditions.

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, our optical and mechanical qualities with scopes of similar and even greater size.

ASTRO-PHYSICS
7470 Forest Hills Road
Loves Park, IL 61111
815-282-1513

COLOR CORRECTION CURVES OF ASTRO-PHYSICS LENSES

These charts compare the color correction of the Astro-Physics lenses with achromats and fluorites. The amount of color seen visually increases directly with lens diameter and decreases with longer focal ratios. Generally for lenses longer than f8 in the 4 to 8 inch aperture range, the color error is not troublesome if it's less than .05% of the focal length. While color correction is the largest aberration, some lens designs have inherent higher order aberrations such as sphero-chromatism and zonal spherical aberration. These aberrations can also affect the sharpness and contrast of a lens. Lenses with sphero-chromatism are undercorrected for spherical aberration in the red waves, and show overcorrection in the blue and violet waves. Zonal spherical is usually a combination of 3rd and fifth order aberrations. These high order aberrations may show up as zones and turned edge, and in some cases they can be brought under control only with much difficulty, even by a skilled optician .



The following charts show the color error over the principal wavelength range, and highlights the useful visual spectral range of each lens.

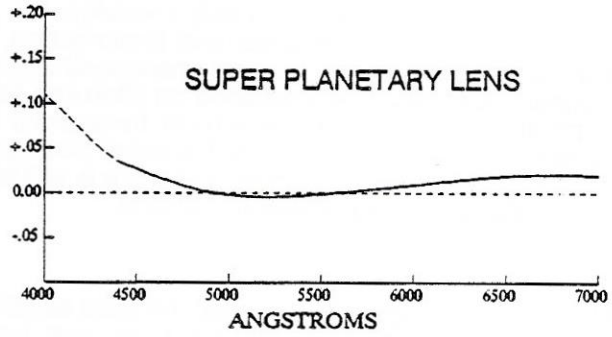
FRAUNHOFER DOUBLET ACHROMAT

The standard doublet achromat has undergone little change since its invention. Secondary color error is about the same regardless of the combination of crowns and flints used. Higher order aberrations are usually very well corrected in the longer focal ratios. In small apertures and long focal ratios, the achromat shows little color, and is capable of good definition and contrast.

The reduction or elimination of secondary color requires an abnormal dispersion glass as one element in the optical system. The first practical apochromat was designed and built by Dennis Taylor over a century ago. His combination of Boron Flint glass and two normal glasses resulted in an f18 airspaced lens that had "sensibly perfect" color correction. These first triplets could only be made in long focal ratios because the glass was not very abnormal, and the elements required steep curves on the inner faces. Astro-Physics apochromat objectives all use a modern Boron Flint glass as the abnormal dispersion element. The two outer elements are chosen so that the overall combination is free of coma, spherical aberration and certain higher order aberrations. This allows us to put only spherical surfaces on all the elements and results in a very smooth overall figure.

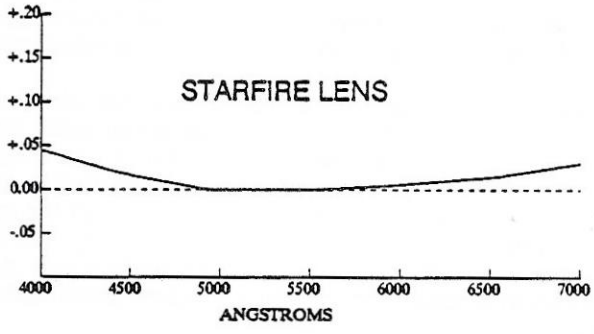
SUPER PLANETARY TRIPLET APOCHROMAT

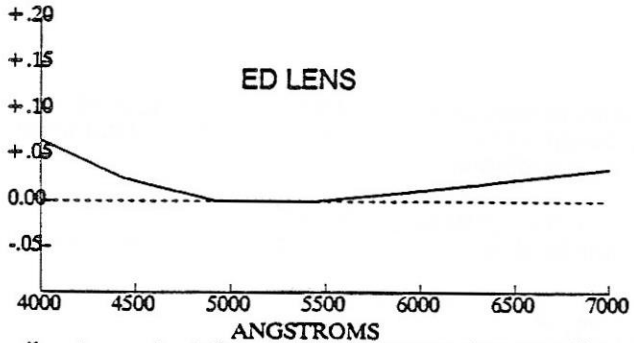
This design meets the highest requirement for definition and contrast in a planetary lens. In a 6" F12 version, secondary color essentially vanishes in the visual spectrum, and the higher order zonal aberrations are insignificant from C to F (6563 to 4861 A). The design is a classic apochromat with three zero crossings where three colors come to the same focus. The lens is also free of coma, and can cover its own diameter when used with a suitable field flattener.



STARFIRE TRIPLET APOCHROMAT

By using an abnormal dispersion crown glass, the violet color can be substantially reduced. Star images show intense white Airy discs. The Moon and Planets show no false colors at any power. The design can be made as fast as F8 - F9 which makes them ideal for astro-photography. The Starfire design makes it possible to construct very high performance portable refractors.





ED DOUBLET APOCHROMAT

The first calcium fluorite apochromat lens was designed by Ernst Abbe a century ago. Since then this apochromat system has been rediscovered numerous times. Mike Simmons came up with the first well designed doublet using Calcium Fluoride as the crown element. This material is too expensive for practical lenses, but the new Fluoro-Phosphate (ED) glasses are less costly and offer the same performance. ED lenses are usually designed with the flint leading to protect the very soft crown element. Recent developments in ED glass technology have led to improved durability and resistance to weathering. These glasses are much superior to calcium fluoride crystal and allow the construction of high performance doublet apochromats.

CHRISTEN STARFIRE TRIPLET APOCHROMAT REFRACTORS

The Christen STARFIRE is a fantastic new refractor that delivers the uncompromising performance of the classic long-focus instrument in a very compact and portable package. This telescope was designed on a challenge to deliver the absolute highest possible image quality for lunar/planetary observing while still remaining a truly portable instrument. The result is not only a fine planetary telescope, but also a superb deep sky instrument with unlimited photographic possibilities.

The heart of this system is a new triplet lens design that virtually eliminates secondary color and higher order aberrations over the immense spectral range of 400nm to 700nm (from the edge of the U.V. to the infrared region). The lens design incorporates two special dispersion flints that are matched to the hard crown front element. The image quality, contrast and color correction is so good that it is hard to believe one is looking through a short focus refractor. At high power, the Airy discs are clean white dots with only the minutest amount of violet visible on stars such as Vega and Sirius. The moon and planets appear totally color-free at all powers.

One amateur remarked that in the 7", the lunar mountains looked pure white, like freshly fallen snow. A Japanese amateur was surprised at how easily his new 5" StarFire beat his 8" SCT in resolution on the planets and double stars

> "Antares was a glowing red fire - other nameless stars were like countless tiny white specks, intensely shining like diamond dust. The most obvious comparison was where the StarFire resolved six tiny dots of various sizes and shapes at 143 and 357x, the 8" SCT resolved only two - the rest were chained together like a fuzzy rope. Saturn, the Moon, then Jupiter: MAGNIFICENT!"

4"F8 STARFIRE TUBE ASSEMBLY

Objective	Magnesium fluoride coated 3 element apochromat, 32" +-1"efl.
Metric conversions	102mm diameter, 813mm +-25mm efl.
Light transmission	96.5% over the visible spectrum
35mm Photographic field at prime focus	1.68 x 2.47 degrees @ F8
35mm Photographic field with Triplet Telecompressor	2.53 x 3.71 degrees @ F5.3
35mm Photographic field with 2x Barlow	0.84 x 1.24 degrees @ F 16
6 x 7 cm Photographic field at prime focus	4.22 x 4.94 degrees @ F8
Secondary spectrum	Less than +-.025 % from r to h wavelengths
Light gathering power	204 times unaided eye
Focuser	Helical rack & pinion; 2" I.D.; 5" travel; 1.25" adapter; focus locking screw
Tube assembly	Aluminum, 5" diameter, 9 lb, white, baffled, 5" dewcap

5"f8 STARFIRE TUBE ASSEMBLY

Objective	Magnesium fluoride coated 3 element apochromat, 40" +-1" efl.
Metric conversions	127mm diameter, 1016mm +- 25mm efl.
Light transmission	96.5% over the visible spectrum
35mm Photographic field at prime focus	1.34 x 1.97 degrees @ F8
35mm Photographic field with Triplet Telecompressor	2.02 x 2.97 degrees @ F5.3
35mm Photographic field with 2x Barlow	0.67 x 0.99 degrees @ F16
6 x 7 cm Photographic field at prime focus	3.37 x 3.95 degrees @ F8
Secondary spectrum	Less than. +-.025 % from r to h wavelengths
Light gathering power	330 times unaided eye
Focuser	Astro-Physics helical rack & pinion; 2.7" I.D.; 2", 1.25" adapters;2.5" extension; 4.5" travel
Tube assembly	Aluminum, 5.5" diameter, 14 lb, white, baffled, 7" dewcap

6"F9 STARFIRE TUBE ASSEMBLY

Objective	Magnesium flouride 3 element apochromat, 54" +-1.5" efl.
Metric conversions	152mm diameter, 1372mm +- 37mm efl.
Light transmission	96.5% over the visible spectrum
35mm Photographic field at prime focus	1.00 x 1.46 degrees @ F9
35m Photographic field with Triplet Telecompressor	1.49 x 2.19 degrees @ F6
35mm Photographic field with 2x Barlow	0.50 x 0.73 degrees @ F18
6 x 7 cm Photographic field at prime focus	2.50 x 2.93 degrees @ F9
Secondary spectrum	Less than +-.025 % from r to h wavelengths
Light gathering power	460 times unaided eye
Focuser	Astro-Physics helical rack & pinion; 2.7" I.D.; 2" ,1.25" adapters;2.5" extension; 4.5" travel
Tube assembly	Aluminum, 6.5" diameter, 20 lb, white, baffled, 9" dewcap

7"F9 STARFIRE TUBE ASSEMBLY

Objective	Magnesium fluoride coated 3 element apochromat, 63" +-2"efl
Metric conversions	175mm diameter, 1600mm +- 50mm efl
Light transmission	96.5% over the visible spectrum
35mm Photographic field at prime focus	0.86 x 1.26 degrees @ F9
35mm Photographic field with Triplet Telecompressor	1.28 x 1.88 degrees @ F6
35mm Photographic field with 2x Barlow	0.43 x 0.63 degrees @ F18
6 x 7 cm Photographic field at prime focus	2.15 x 2.51 degrees @ F9
Secondary spectrum	Less than +-.025 % from r to h wavelengths
Light gathering power	645 times unaided eye
Focuser	Astro-Physics helical rack & pinion; 2.7"I.D.; 2" ,1.25"adapters; 2.5" extension; 4.5"travel
Tube assembly	Aluminum, 7.5" diameter, 28 lb, white, baffled, 9" dewcap

SUPER PLANETARY TRIPLET APOCHROMAT REFRACTOR

The Super Planetary objective is designed to deliver the highest possible contrast 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. Customer observations and comments:

"The 6"f12 triplet is truly phenomenal. Each time I use it, I am amazed at its performance. Increased performance has its price ,however. I can barely stand to use anything else, now. If it doesn't have steel point star images like my refractor I want nothing to do with it. Half the fun is watching people who use Schmidt-Cassegrains look through it for the first time. Each person's comment usually begins with a gasp, followed by some variant of 'Look how sharp the stars are!'" D.R., College Park, GA

"I have now been using your 6"f12 for nearly a year and am constantly impressed every time I use it. The images are superb, no matter if it's lunar or planetary observing, double stars or deep sky ... Thanks for a superb instrument! It's been used nearly every clear night since I got it." B.B., Greendale, WI

"Never in my 15 years of experience as an avid lunar and planetary observer have I seen such high quality optics, I dare anyone to try and examine the moon at 600x with no image breakdown with any commercial scope on the market... After going through scope after scope and disappointments and wasting thousands of dollars, I consider myself privileged to own a telescope with the finest optics I have ever seen. V.M., NY

6 " F12 TUBE ASSEMBLY (152mm F12)

Objective	.Magnesium flouride coated 3 element apochromat, 72" + - 2" efl.
Metric conversion	.152mm diameter, 1829 + -50mm efl.
Light transmission	96.5% over the visible spectrum
35mm Photographic field at prime focus	.0.75 x 1.10 degrees @ F12
35mm Photographic field with Triplet Telecompressor	1.12 x 1.64 degrees @ F8
35mm Photographic field with 2x Barlow	0.38 x 0.55 degrees @ F24
Secondary spectrum	Less than + -0.004% from C to F wavelengths
Light gathering power	460 times unaided eye
Focuser	Astro-Physics helical rack & pinion; 2.7" I.D.; 2", 1.25" adapters; 2.5" extension; 4.5" travel
Tube Assembly	Aluminum , 6.5" diameter , 21 lbs., white, baffled, 9" dewcap

STAR 12 ED APOCHROMAT REFRACTOR

We have developed an exciting new refractor based on a 2 element apochromat lens using a newly developed glass. E.D. glass (E.D. stands for extra low dispersion) has optical properties similar to Flourite crystal. However, E.D. glass is real glass without the crystal planes of calcium flourite materials that can absorb water in humid environments. E.D. glass is also a much harder and tougher material with a significantly lower coefficient of expansion. That means the lenses will stand up to years of use under all kinds of observing conditions.The lens design is a flint leading configuration with a very hard front element that will resist scratches from normal cleaning. Both elements are stain and water resistant. The front element is fully anti-reflection coated. As in flourite lenses, the rear element is left uncoated because E.D. glass cannot be subjected to the extreme temperatures required to fuse the coatings to the surface.

Our Star 12 ED refractor delivers the pinpoint sharpness, clarity and high definition demanded by the perfectionist, yet is priced to appeal to the beginning astronomer. Its light weight 11 lb. package is nicely balanced and fits well on small to medium sized mountings such as our model 600 or the DX mount. The lens is a true APOCHROMAT, capable of focusing the important visual wavelengths into the Airy disc. Visually on the moon and planets, there is little or no color fringing even at the highest powers. Both Jupiter and Saturn show a wealth of detail. Double stars such as Epsilon Bootes show a clean split with plenty of dark sky between.

We have included all the recent refinements such as our custom focuser with brass locking ring, engraved lens cell, screw-on dewcap, fully baffled aluminum tube, and snappy decal identifying the telescope as an E.D. refractor from Astro-Physics.

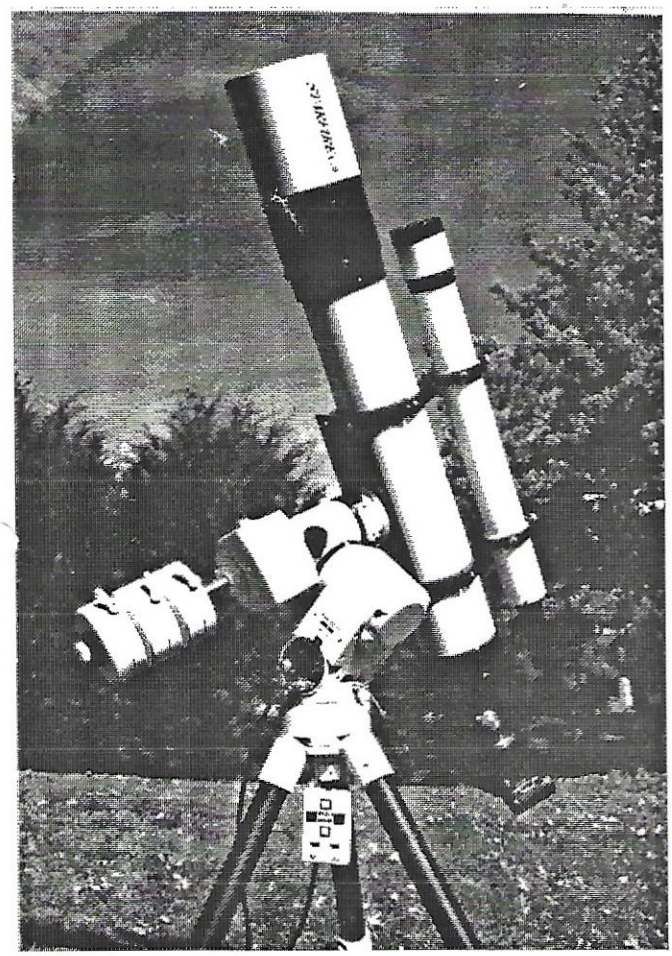
STAR 12 ED TUBE ASSEMBLY (120mm F8.5)

Objective	4.7"diameter,magnesium flouride coated (2 surfaces), 2 element apochromat, 40 " + -0.5"efl
Metric Conversions	.120mm diameter, 1016mm, + -12mm efl
Light Transmission	90% over the visible spectrum
35mm Photographic field at prime focus	.1.34 x 1.97 degrees @ F8.5
35mm Photographic field with Triplet Telecompressor	2.02 x 2.97 degrees @ F5.7
6 x 7cm Photographic field at prime focus	.3.37 x 3.95 degrees @ F8.5
Secondary spectrum	less than + -0.035% from r to h wavelengths
Light gathering power	294 times unaided eye
Focuser	Astro-Physics helical rack & pinion; 2.7"I.D; 2", 1.25" adapters; 2.5" extension; 4.5" travel
Tube Assembly	Aluminum, 5" diameter, 11 lbs., white, baffled, 6"" dewcap

ASTRO-PHYSICS

6 inch EDF Apochromat -The ultimate Astrograph

(EDF = extra low dispersion flat field)



6" EDF REFRACTOR

This 6" Refractor was designed to give uncompromizing performance both visually and photographically. Color correction is flat from 4000 to 7000 Angstroms. Advanced amateurs who have used this refractor say secondary spectrum is completely absent. It looks just like a mirror telescope. Photographic spot diameters measure 15-20 microns over a full 5 degree field (4" circle). The fast f7.5 focal ratio captures elusive and faint deep sky objects easily with incredible detail. This lens has outperformed mirror type astrographs twice its size.

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 E.D. glass, and 2 abnormal dispersion flints. 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.

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. The large photographic back can be quickly interchanged with a standard 2" back for visual observations. The 6" EDF refractor can also be ordered with our custom 2.7" focuser and 6x7 Pentax adapter. The photographic field will be 3.5 degrees with this format.

The EDF lens is superb as a visual instrument as well. It is easily capable of high power visual work on 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. Both 4" and 2.7" focusers come standard with all the appropriate adapters for 2" and 1.25" oculars and diagonals.

ATLUX GERMAN EQUATORIAL MOUNTING.

This new imported mounting is an extremely compact, sturdy and accurate platform for refractors up to 6" and Catadioptrics up to 11". It has massive shafts riding on Timken tapered roller bearings in both axes. Both R.A. and Dec are driven by fine tooth brass worm gears. Advanced stepper motors are powered by a quartz dual axis controller. Both axes can be driven a full 360 degrees at 2x, 4x and 32x rates. An optional power booster with 128x will be available. Setting circles are internally illuminated, and all control wiring is internal. Motors and gears are fully enclosed. The counterweight shaft retracts into the body of the mount when not in use.

The equatorial head sets up quickly on the matching adjustable tripod. The built-in polar scope allows precise polar alignment to be made. This is a must for long exposure astrophotography. The finish on this mount is superb. All casting marks have been carefully eliminated, and a thick coat of pearlescent paint added. The Atlux is without a doubt the most beautiful example of craftsmanship that we have ever seen. Form, fit and function come together in one incredible package.

6" EDF Technical Specifications:

Objective	3 element APOCHROMAT, 6" f7.5, 45" fl
Rear lens set	2 element 4" field flattener
Secondary spectrum	< 0.005% from 4000 to 7000 Angstroms
Photographic f ield	5 degrees, 4" circle
Photographic field with 6x7 Pentax	3.5 x 3.0 degrees
Visual field coverage with 40mm widefield ocular	2.3 degrees
Light grasp over 7mm eye pupil diameter	474x unaided eye
Focuser	Astro-Physics 4" helical rack&pinion, 2", 1.25" adapters
Tube assembly	6.5" diameter aluminum, white, 4 baffles, 9" dewcap, 21lb
Case	foam fitted vinyl covered plywood

Atlux Specifications:

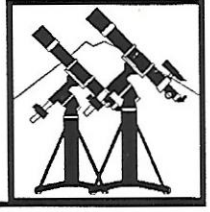
Maximum load	45 lb
Periodic error	+- 4 arc seconds
Polar scope	10X30, 4 degree with illuminator
R.A worm wheel	240 tooth brass
Declination worm gear	180 tooth brass
Drive	built in R.A, Dec pulse motors 2x, 4x, 32x
Setting circles	internally illuminated
Power source	12 volts
Net weight	45 lb w/o counterweights
Tripod	Duraluminum Pipe, 2" dia
Length of tripod	28" to 36"

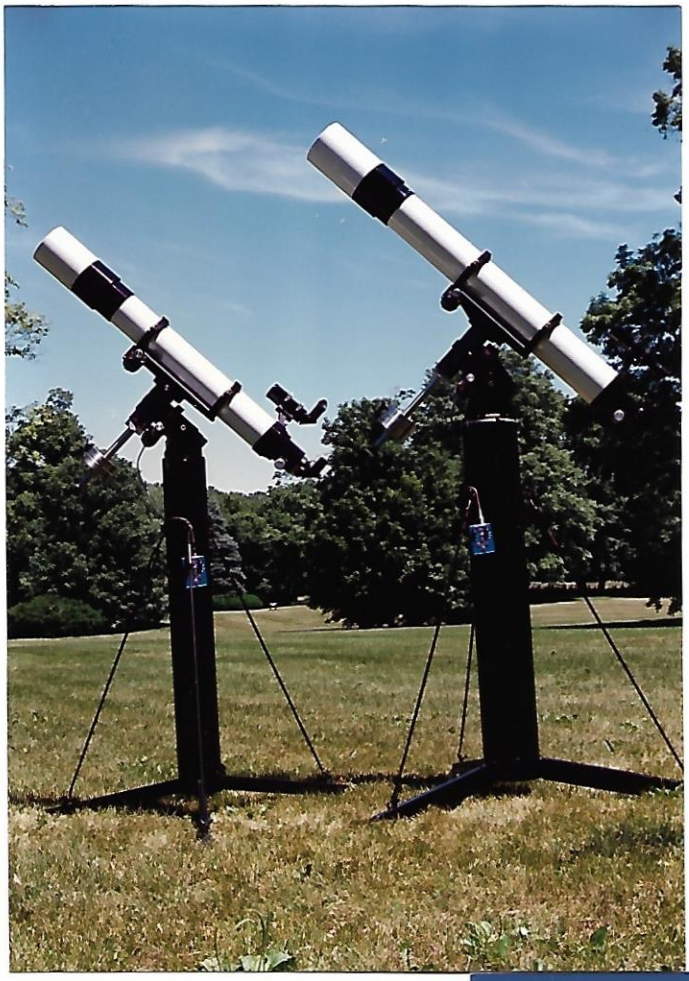
PRICES:

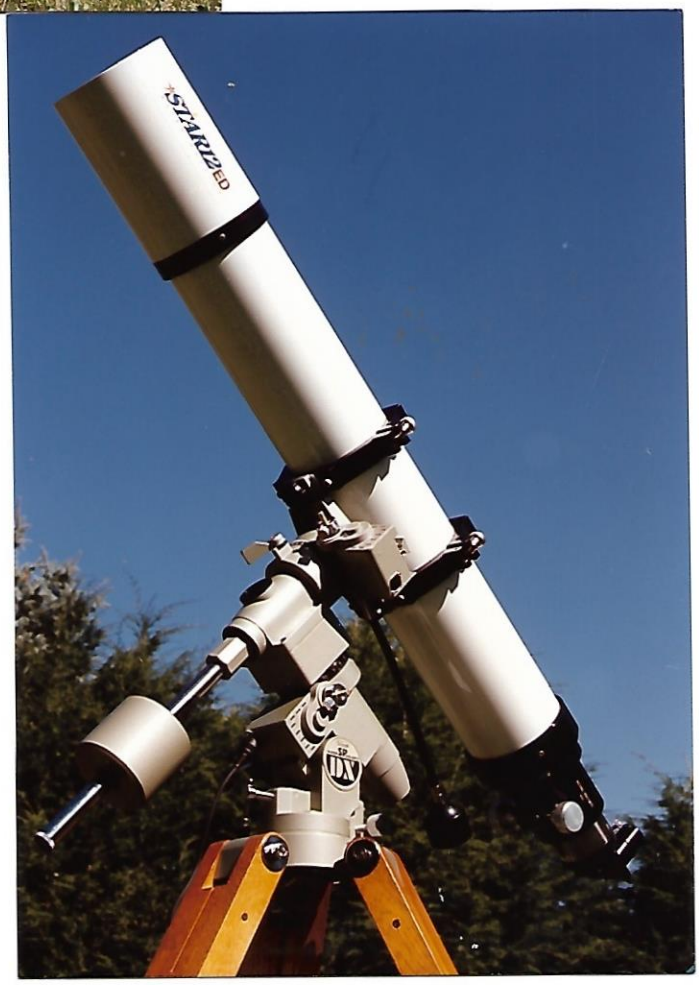
6" EDF Refractor, 4" focuser, 4" widefield astrographic rear assembly, Mamiya adapter, carrying case	6400.00
6" EDF Refractor, 2.7" focuser, 2.7" astrographic rear assembly, Pentax 6x7 adapter, carrying case	5700.00
Atlux equatorial head with 2 axis control, two 12 lb counterweight	3699.00
Adjustable height tripod mounting	928.00

FOR INFORMATION ON THIS AND OTHER TELESCOPE SYSTEMS AND ACCESSORIES, WRITE:

ASTRO-PHYSICS
7470 FOREST HILLS RD.
LOVES PARK, IL. 61111






STARZ2ED

A S T R O - P H Y S I C S

M8 & M20 / 5" f8 StarFire Triplet Refractor / Pentax 6X7cm with Field Flattener, Prime Focus, hypered Kodak 6415, 45 minutes at f8 / May 14, 1988; Tony Hallas and Daphne Mount.

ASTRO-PHYSICS 600 GERMAN EQUATORIAL MOUNT

Our search for a small, portable, stable mounting for our 4", 5" and 6"f9 refractors led us back to our own drawing board. We simply did not find any commercially produced mount, foreign or domestic, that offered the convenience features our customers wanted in addition to rigidity and accuracy. We found that although many of these mounts boasted flexible hand controls, setting circles, polar alignment scopes, etc; they were wobbly and suffered from flexure at critical junctures (between axes and between the mounting and tripod). In addition, the polar setting circles were not driven by the gear, rendering them ineffective only a few minutes after alignment. The ability to use these mounts for high-power visual work and astrophotography was limited. Most did not have provision for declination motor drives and lacked necessary functions for fine guiding in the hand controls.

Since we were already developing the 800 mount, we decided to incorporate the same features in a smaller package. In short, the 600 mount is our answer to the challenge posed by our customers to retain the solid function and mechanical stability of our previous 504 mount, with updated features to make observing sessions a pleasure. The mount is machined of aluminum stock and black anodized.

FEATURES:

- Hollow aluminum stock; precision machined for light weight, yet provides rigid performance.
- Precision 4" Worm Gear with +-5 arc second periodic error.
- Large thrust bearings of UHMW plastic form ultra-stable thrust surfaces for tremendous rigidity in a small package.
- Hollow 1.25" 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 - no more declination drift during those hour-long exposures!
- Removable 1.125" stainless steel counterweight shaft for compact storage.
- Polar and declination axes come apart quickly for light-weight easy handling.
- 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.
  Right ascension circle - 10 minute increments with 2 minute vernier
  Declination circle - 5 degree increments with 1 degree vernier
- Fine altitude adjustment with a range of 0-90 degrees from the equator to the poles.
- Fine azimuth adjustments for quickly and accurately zeroing in on the pole in the field.
- Converts to alt-azimuth mount for comet hunting and terrestrial viewing. Imagine, two mounts in one!
- Damps out in 1-2 seconds with scopes up to 20 lb.
- Dimensions: Distance from pier top to cradle plate - 10.25"
  Cradle plate - length: 15", width: 6"
- Capacity: Will accommodate refractors up to 6"f9 , reflectors up to 8", Cassegrains up to 10".
- Weight of equatorial head with counterweight shaft - 25 lbs.

AVAILABLE OPTIONS
Dual Axis Pulse Motor with 12 Volt Controller
Single Axis Pulse Motor with 12 Volt Controller
Hexagonal Mounting Rings
Stainless Steel Counterweights- 5 lbs., 8 lbs.
Polar Axis Scope with Illuminator
Portable Pier - 6" diameter post ; heights 46", 56" or 66"
Carrying Case

Please see the accompanying information sheets for detailed descriptions of these options.

ASTRO-PHYSICS 800 GERMAN EQUATORIAL MOUNT

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.

Our 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 hobbs on a highly accurate gear cutting machine. With easy polar alignment capabilities, it is possible to take excellent astrophotos with minimal or no guiding with most telescopes.

FEATURES:

- Virgin aluminum castings, precision hollow cast and machined for light weight, yet provides rigid performance.
- Precision 6" Worm Gear with +-5 sec periodic error.
- 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 - no more declination drift during those hour-long exposures!
- Removable 1.125" stainless steel counterweight shaft for compact storage.
- Polar and Declination axes come apart quickly for light-weight easy handling.
- 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.
  Right ascension circle - 10 minute increments with 2 minute vernier
  Declination circle - 5 degree increments with 1 degree vernier
- Fine altitude adjustment with a range of 0-90 degrees from the equator to the poles.
- Fine azimuth adjustments for quickly and accurately zeroing in on the pole in the field
- 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.
- Dimensions: Distance from pier top to cradle plate = 16"
  Cradle plate - length = 15", width = 6"
- Capacity: Will accommodate refractors up to 7",reflectors to 10", Cassegrains to 12".
- Weight of equatorial head with counterweight shaft - 45 lbs.

AVAILABLE OPTIONS:

Dual Axis Pulse Motor Drive with 12 Volt Controller
Single Axis Pulse Motor Drive with 12 Volt Controller
Hexagonal Mounting Rings
Stainless Steel Counterweights - 5 lbs., 8 lbs.
Polar Axis Scope with Illuminator
Portable Pier - 8" diameter with heights 46", 56", 66"
Foam Lined Carrying Cases

Please see accompanying information sheets for detailed description of these options.

ELECTRONICS OPTIONS FOR 600 AND 800 GERMAN EQUATORIAL MOUNTS

Synchronous or Stepper? The high-tech solution to modern telescope drives is now the stepper or pulse motor. Although the synchronous motor is a reliable way to achieve smooth, accurate guiding, the modern high-resolution stepper has definite advantages in controllability and power consumption. A stepper can be operated from a 12 volt source (with the proper electronic circuit), which eliminates the extra conversion to 110 Vac that a synchronous motor needs. This results in a smaller controller with far less power loss. The controller is so small that it can be put into the normal remote push button chassis with no separate power converter box needed. Unlike a synchronous motor, a stepper can be driven very slowly, or very fast, or can be instantly reversed to accomplish guiding and slewing functions all in one device. The extra convenience of the added controllability of the stepper system will be appreciated by casual observers and serious astrophotographers alike. Some mount manufacturers have given the stepper motors a bad name due to improper application. Too slow a stepping rate can cause stars to vibrate at high powers. Our steppers are driven at high pulse rates, effectively eliminating this problem. Our pulse motor drives are every bit as smooth and much more responsive than synchronous drives.

DUAL AXIS PULSE MOTOR WITH 12 VOLT CONTROLLER:

Designed for the utmost in convenience for the serious astrophotographer, this drive system operates from a portable battery pack or the cigarette lighter of your automobile. The palm-sized controller is a complete command center for all the guiding functions you will need for successful astrophotography. High resolution stepper motors deliver 150 inch-oz. torque with a fraction of the power required by normal synchronous motor-drive corrector systems. Included in the hand control is a variable drive rate for lunar/solar and sidereal 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 is designed for leisurely cruising on the lunar surface or for rapidly centering objects in the field of view. Both guiding and slewing respond crisply to push button commands without hesitation, delay or backlash, thanks to the high resolving rate of the stepper motors. A built-in reticle control allows you to adjust the brightness of the guiding reticle of your guidescope during an exposure. NOTE: The electric declination option is available only with the dual axis control package and must be ordered at the time of purchase since it is factory installed.

FEATURES:

- Dual high-resolution stepper motors for R.A. and Dec.
- Palm-size controller, 4"x 3"x 1.5" inches
- Power consumption: 0.25 amps @ 12 volts
- 4 Push buttons arranged in east-west, north-south configuration
- Adjustable drive rates for solar, sidereal, and lunar
- Toggle switch for guiding or slewing in both axes
- Toggle switch for reversing declination buttons
- Adjustable brightness control for guiding reticle
- Southern hemisphere: reversed R.A. on request

SINGLE AXIS PULSE MOTOR WITH 12 VOLT CONTROLLER:

This economical drive package was designed for the visual observer who does not require electric declination adjustment. The controller operates on 12 volts as above with a power consumption of only 0.15 amps. Dual push buttons control the R.A. drive rate in either fine-guiding or fast-slewing mode. Astrophotography can still be accomplished easily by adjusting the declination axis manually.

FEATURES:

- High resolution stepper motor for right ascension
- Palm-sized controller, 3.5"x 2.5"x 1.5"
- Power consumption: 0.15 amps @ 12 volts
- 2 Push buttons for R.A. in east-west configuration
- Adjustable drive rates for solar, sidereal and lunar
- Toggle switch for guiding or slewing in R.A.
- Southern hemisphere: reversed R.A. on request

6 AMP-HR, 12 VOLT PORTABLE BATTERY PACK WITH RECHARGER:

This 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 standard wall outlet. Since it has no memory, it will recharge fully every time without a loss of capacity (unlike ni-cad batteries) The battery pack comes with a handsome carrying case, shoulder strap and self-contained battery charger.

HEXAGONAL MOUNTING RINGS

These mounting rings attach to the cradle plate of the mount to support your tube assembly. The unique hexagonal 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 following sizes are available:

5.0" Mounting Rings - for 5.0" tube diameter
6.0" Mounting Rings - for 6.0" tube diameter
7.0" Mounting Rings - for 7.0" tube diameter
5.5" Mounting Rings - for 5.5" tube diameter
6.5" Mounting Rings - for 6.5" tube diameter
7.5" Mounting Rings - for 7.5" tube diameter

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. 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:

4"f8 StarFire Tube Assembly - one 8 lb. weight
6"f9 StarFire Tube Assembly - two 8 lb. weights
7"f9 StarFire Tube Assembly - three 8 lb. weights
5"f8 StarFire Tube Assembly - two 5 lb. weights
6"f12 Tube Assembly - two 8 lb., one 5 lb. weight

POLAR AXIS SCOPE WITH ILLUMINATOR

This 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 screws into the base of the polar axis. 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 OF POLAR AXIS SCOPE:

Magnification - 5 x
Achromatic objective - 20mm
Eyepiece - K22mm (Diopter adjustable)
Field of view - 8 degrees

SPECIFICATIONS FOR ILLUMINATOR:

Rated Voltage - 3VDC
Power consumption - 16mA
Light - red LED
Battery - Button type: two Varta V76 PX or equivalent

CARRYING CASES FOR 600 AND 800 GERMAN EQUATORIALS

These carrying cases will allow you to transport your mounting in a protective and stylish manner. The polar axis, declination axis, cradle plate, hex rings and counterweight shaft all disassemble quickly for packing. Your mount will not rattle around on the back seat any longer! Please note that these cases were not designed for airline transport.

The 800 mount is packed in a set of two 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

The 600 mount case was designed to carry the entire 600 Equatorial Head as well as the hand control, power cords and one counterweight.

	dimensions L x W x H	weight of case w/o mount	weight of case w/mount parts (excluding counterweights)
800 Polar Axis Case	13" x 12" x 17"	14 lbs	45 lbs
800 Declination Axis Case	18" x 18" x 11"	16 lbs	36 lbs
600 Mount Case	22" x 14. 5" x 9"	12 lbs	41 lbs

PORTABLE PIER

This pier mounting features a unique tension design that combines rugged construction with light weight while eliminating fexure and annoying vibrations. Legs and tension rods attach without hardware, allowing field assembly in seconds. Tension rods are designed to 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 with a steel base bolted firmly in place.

SPECIFICATIONS:	Pier for 800 Mount			Pier for 600 Mount		
height of pier	46"	56"	66"	46"	56"	66"
diameter of post	8"	8"	8"	6"	6"	6"
length of legs	24"	24"	24"	24"	24"	24"
cradle height	62"	72"	82"	56"	66"	76"
weight of pier post	13 lbs	15 lbs	17 lbs	8 lbs	9 lbs	10 lbs
weight of pier base	21 lbs	21 lbs	21 lbs	10 lbs	10 lbs	10 lbs
weight of each leg	6 lbs	6 lbs	6 lbs	5 lbs	5 lbs	5 lbs
weight of 3 struts	4 lbs	4 lbs	4 lbs	4 lbs	4 lbs	4 lbs
total weight assembled	56 lbs	58 lbs	60 lbs	37 lbs	38 lbs	39 lbs

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. The helical rack and pinion provides ultra-smooth motion for precision focusing. Our knurled 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 our 7"f9 StarFire and offered as an option for all other Astro-Physics refractors or 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.
- 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 screws securely into the focuser drawtube of the Astro-Physics 2.7" focuser and accepts 2" accessories. This extension will provide you with 2 additional inches of focuser travel necessary for straight through viewing.

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.

FLAT FIELD PHOTOGRAPHIC TRIPLET TELECOMPRESSOR (0.67X)

Three elements of special optical glass are used to match the characteristics of out triplet objectives in this flat field design. The result is a telecompressor with diffraction-limited performance over the 35mm format. The field is absolutely flat with no coma, astigmatism or distortion. Deep sky objects are recorded 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. Please order either the 2" and 2.5" version depending on your focuser. Please specify the type of camera that you plan to use.

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.

PENTAX 6 x 7 cm CAMERA ADAPTER WITH FIELD FLATTENER Please specify 4", 5", 6" or 7" StarFire.

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.

CARRYING CASES FOR TUBE ASSEMBLIES

Attractive, durable cases are now available to protect and transport your Astro-Physics tube assembly. These cases were made to our specifications to be reasonably lightweight, yet sturdy. They are constructed of wood with an attractive, vinyl covering. Your tube assembly will be cushioned on the sides and bottom with a layer of 1" foam and on the top with a thick foam padding. All corners are protected with a stainless steel reinforcing cap. Latches assure that the case remains closed. The 4"f8 StarFire case has one handle, all the other cases have three handles.

CASE SPECIFICATIONS:

4"f8 Tube Assembly with dewcap	39.0" x 8.0" x 8.0"	12 lbs
5"f8 Tube Assembly with dewcap	42.0" x 9.5" x 9.5"	15 lbs
6"f9 Tube Assembly with dewcap	66.5" x 10.5" x 10.5"	23 lbs.
6"f12 Tube Assembly with dewcap	81.0" x 10.5" x 10.5"	30 lbs.
7"f9 Tube Assembly	69.0" x 11.0" x 11.0"	26 lbs.

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 and a Polaris alignment scale 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. Replacement batteries include: Duracell PX-14, Everready EPX-14 or equivalent. 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.

80 x 900 mm GUIDESCOPE
For serious astrophotography, a full 80mm (3") of aperature 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. We suggest these optional guidescope accessories:

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.

ACCESSORIES

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.

1.25" AMICHI 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 Amichi or porro prism diagonal with your favorite eyepiece.

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.

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.

VARIABLE PROJECTION CAMERA ADAPTER WITH T-RING
For high magnification astrophotography this accessory can't be beat. Besides allowing you to project the image onto 35mm film with your favorite eyepiece, you can vary the magnification by adjusting the inner sliding tube. You can also remove the sliding tube and use it without an eyepiece as a prime focus adapter. Please specify the type of camera that you plan to use.

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.

2" FOCUSER
This imported 2" focuser is supplied with our 4",5" and 6" refractors and is offered as an individual item for amateurs who wish to construct their own tube assemblies. A smooth, helical rack and pinion and a focus-locking screw make this focuser a pleasure to use. Dustcaps are included for the 2" and 1.25" adapters.

SPECIFICATIONS:
Inside diameter of focusing tube . . . . . .2.0"
Focusing travel . . . . . 5.0"
Overall length of the focuser when fully racked in with 2" adapter . . . . . 3.1"
Overall length of the focuser when fully racked in with 1.25" adapter . . . . . .5.0"
2" adapter . . aluminum, screws into focuser tube

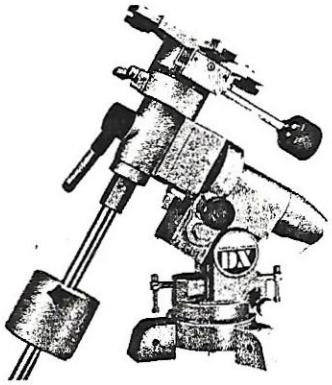
IMPORTED MOUNTS FOR 4" AND 5" STARFIRES AND STAR12 ED REFRACTORS

DX MOUNT

This mount is rugged and stable enough to make astrophotography and high power observing possible, without sacrificing true portability. The equatorial head is equipped with setting circles, fine azimuth and altitude adjustments, slow motion controls on flexible shafts, worm gears in both declination and polar axes, and a 8 lb. counterweight. It features a high quality brass gear train with 7 arc second accuracy, and a built in polar alignment scope with penlight illuminator that allows you to quickly align your mount on the pole stars to ensure greater tracking accuracy throughout your observing session. With a simple adjustment, this mount can be used as an alt-azimuth as well. An optional dual axis motor/controller for smooth tracking, and a very sturdy wood tripod are available. The mount is easily disassembled. A new computer control will be available in early 1990.

SPECIFICATIONS:

Polar axis shaft	.1.77" dia. steel
Declination axis shaft	.1.38" dia. steel
Polar axis gearing	.144 tooth brass gear set
Periodic error	.7 arc seconds
Declination adjustment	. continuous 360 degree
Alignment adjustment	.buit-in polar axis scope, illuminator
Manual adjustment	.flexible cables in both axes
Equatorial head weight	.18 lbs.



DUAL AXIS PULSE MOTOR WITH BATTERY PACK

Following the motions of the stars is easy with the pulse motor drive. The motor is a high resolving type with fine steps for smooth motion at very high powers. This portable accessory operates off its own battery pack with buttons for reversing, stopping and 16x speed increase. The dual motors can easily attached and detached from the mount or can remain permanently bolted in place.

SPECIFICATIONS:

Quartz Stepping Motor	
Rated voltage	7.5V to 12V DC
Battery	.Six C Cell batteries; dry cell or car battery with AC 12 volt adapter
Power consumption	.480mA
Weight of controller	.6 oz.

WOOD TRIPODS

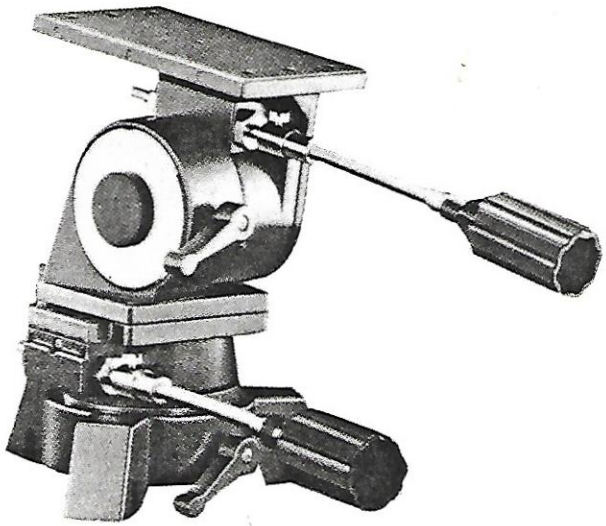
These are the most rugged wood tripod legs that we have seen for a small mount. The tripod casting is bolted directly to the legs so that the mount attaches and detaches to the tripod very quickly. No more fumbling with awkward leg and shelf attachments. Flexure problems at the junction of legs and tripod are minimized because the leg does not slide into a slot as many other mounts do. Two styles are available. One is adjustable from 30 to 40 inches and the other has a fixed height of 43 inches.

ALT-AZIMUTH MOUNT

A silky smooth mounting for comet hunting, low-power sweeping or terrestrial observing. Teamed up with the aluminum tripod, it makes a very portable mounting for scopes up to 5 inches. Both axes have continuous worm gear drives with flexible cables and locking clutches.

ADJUSTABLE ALUMINUM TRIPOD FOR ALT-AZIMUTH MOUNT

This light-duty tripod is fully adjustable and collapses for compact portability. Although not as sturdy as our piers or tripods, it is light weight and can be carried short distances with the mount attached. A central shelf provides convenient storage for your accessories.



HEXAGONAL MOUNTING RINGS FOR DX AND ALT-AZIMUTH MOUNTS

These mounting rings attach to the mount to support your tube assembly. The unique hexagonal 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.

5.0" Hexagonal mounting rings for 5.0" tube diameter
5.5" Hexagonal mounting rings for 5.5" tube diameter

ASTRO-PHYSICS

PRICE LIST EFFECTIVE OCTOBER 1, 1989

All prices are subject to change without notice.

STARFIRE PHOTO-VISUAL REFRACTORS

4 inch f8 StarFire Triplet Apochromat Lens in Cell, 32"efl	975.00
4 inch f8 StarFire Triplet Refractor Tube Assembly, 2" Focuser, Carrying Case	1395.00
4 inch f8 StarFire Triplet Refractor Tube Assembly, 2.7" Astro-Physics Focuser, Carrying Case	1565.00
5 inch f8 StarFire Triplet Apochromat Lens in Cell, 40" efl	1450.00
5 inch f8 StarFire Triplet Refractor Tube Assembly, 2.7" Astro-Physics Focuser, Carrying Case	2230.00
6 inch f9 StarFire Triplet Apochromat Lens in Cell, 54" efl	2150.00
6 inch f9 StarFire Triplet Refractor Tube Assembly, 2.7" Astro-Physics Focuser, Carrying Case	2995.00
7 inch f9 StarFire Triplet Apochromat Lens in Cell, 63" efl	3200.00
7 inch f9 StarFire Triplet Refractor Tube Assembly, 2.7" Astro-Physics Focuser, Carrying Case	4195.00

SUPER PLANETARY REFRACTOR

6 inch f12 Super Planetary Triplet Apochromat Lens, in Cell 72" efl	1750.00
6 inch f12 Super Planetary Refractor Tube Assembly, 2.7" Astro-Physics Focuser, Carrying Case	2760.00

ED REFRACTOR

Star12ED Doublet Apochromat Tube Assembly, 2.7" Astro-Physics Focuser, Carrying Case	1585.00

ASTRO-PHYSICS 600 AND 800 GERMAN EQUATORIAL MOUNTS:

600 German Equatorial Head with Right Ascension Axis Drive and Hand Controller	1650.00
600 German Equatorial Head with Dual Axis Drive and Hand Controller	1865.00
800 German Equatorial Head with Right Ascension Axis Drive and Hand Controller	2250.00
800 German Equatorial head with Dual Axis Drive and Hand Controller	2465.00
5 lb. Stainless Counterweight with Hand Knob	60.00
8 lb. Stainless Counterweight with Hand Knob	70.00
Portable Rechargeable Battery Pack with Charger and Carrying Case	79.00
Polar Axis Scope with Illuminator	145.00
5.0" Hexagonal Rings (for 4"f8 StarFire and Star12ED), per pair	138.00
5.5" Hexagonal Rings (for 5"f8 StarFire), per pair	138.00
6.5" Hexagonal Rings (for 6"f9 StarFire and 6"f12),per pair	155.00
7.5" Hexagonal Rings (7"f9 StarFire), per pair	165.00
46" Portable Pier for 600 Mount	350.00
56" Portable Pier for 600 Mount	365.00
66" Portable Pier for 600 Mount	375.00
Adjustable Davis & Sanford Tripod with adaptor for 600 mount (4"f8 & 5"f8 StarFires and Star12ED)	220.00
46" Portable Pier for 800 Mount	400.00
56" Portable Pier for 800 Mount	420.00
66" Portable Pier for 800 Mount	440.00
Adjustable Davis & Sanford Tripod with adaptor for 800 mount (5"f8 StarFire and 6"f9 StarFire)	740.00
Carrying Case for 600 Mount	To be determined
Carrying Cases for 800 Mount, set of 2	197.00

DX MOUNT

DX Equatorial Head with 8 lb. counterweight, polar alignment scope and illuminator	675.00
Extra 4 lb. Counterweight	30.00
Extra 6 lb. Counterweight	38.00
Extra 8 lb. Counterweight	48.00
Dual Axis Pulse Motor Drive with Hand Control	325.00
Accessory Plate	60.00
5" Hexagonal Rings (for 4"f8 StarFire and Star12ED), per pair	138.00
5.5" Hexagonal Rings (for 5"f8 StarFire), per pair	138.00
30-40" Adjustable Wood Tripod (for 4'f8 StarFire, Star12ED)	245.00
43" Fixed Height Wood Tripod (for Star12ED, 5"f8 StarFire)	199.00

ALT-AZIMUTH MOUNT

Alt-azimuth Head	450.00
5" Hexagonal Rings (for 4"f8 StarFire and Star12ED), per pair	138.00
5.5" Hexagonal Rings (for 5"f8 StarFire), per pair	138.00
Aluminum Tripod	220.00

ACCESSORIES:

2.7" Astro-Physics Focuser (to make your own tube assembly) 2" & 1.25" adapters & 2.5" extension	295.00
1.25" Adapter for 2.7" Focuser	30.00
2" Adapter for 2.7" Focuser	30.00
2.5" Focuser Extension for 2.7" Astro-Physics Focuser	40.00
2" Focuser (to make your own tube assembly), includes 1.25" adapter	100.00
1.25" Prism Diagonal	38.00
1.25" Amichi Prism Erecting Diagonal (90 degree viewing)	66.00
1.25" Porro Prism Erecting System (straight-through viewing)	48.00
2" Precision Mirror Diagonal	170.00
2" Photo-Visual Barlow Amplifier (2x)	165.00
2.7" Flat Field Photographic Telecompressor with "T"ring for 35mm cameras (use with 2.7" focuser)	195.00
2" Flat Field Photographic Telecompressor with "T"ring for 35mm cameras (use with 2" focuser)	195.00
6x7cm Pentax Camera Adapter with Field Flattener Available only for 4"f8, 5"f8, 6"f9 and 7"f9 StarFires. Please specify.	295.00
Prime Focus Camera Adapter with "T"ring for 35mm cameras	55.00
Prime Focus Camera Adapter with Eyepiece Projection and "T" ring for 35mm camera	85.00
Variable Projection Camera Adapter with T"ring for 35mm cameras	78.00
Piggyback Camera Bracket for 35mm photography	65.00
8x50 Right-Angle Finder with Illuminated Reticle and Quick Release Bracket	189.00
8x50 Straight-through Finder with Illuminated Reticle and Quick Release Bracket	189.00
Quick Release Bracket for your 8x50 Finder	55.00
80mmx900mm Guidescope with 1.25" rack & pinion, rings, dewcap, dewcap cover	360.00
12.5mm Illuminated Guiding Eyepiece	105.00
3x Barlow, 1.25" (216x with 12.5mm illuminated guiding eyepiece)	65.00
Guidescope Rings, 3.9" I.D. per pair, (for guidescope you may already own)	88.00

SUGGESTED COMBINATIONS: These are just a few of the many possible combinations.

4"f8 StarFire, 2" Focuser, Case, 5" Rings, Alt-azimuth Mount, Aluminum Tripod	2203.00
4"f8 StarFire, 2" Focuser, Case, 5" Rings, DX Mount, Polar Scope, 8 lb cwt, Adj. Wood Tripod	2453.00
4"f8 StarFire, 2" Focuser, Case, 5" RIngs, DX Mount, Polar Scope, 8 lb cwt, Dual Axis Drive, Adjustable Wood Tripod	2778.00
Star12 ED, 2.7" Focuser, Case, 5" Rings, Alt-azimuth Mount, Aluminum Tripod	2393.00
Star12 ED, 2.7" Focuser, Case, 5" Rings, DX Mount, Polar Scope, 8 lb cwt, Adjustable Wood Tripod	2643.00
Star12 ED, 2.7" Focuser, Case, 5" Rings, DX Mount, Polar Scope, 8 lb cwt, Dual Axis Drive, Adjustable Wood Tripod	2968.00
5"f8 StarFire, 2.7" Focuser, Case, 5.5" Rings, DX Mount, Polar Scope, 8 lb & 6 lb cwt, Dual Axis Drive, Fixed Height Wood Tripod	3605.00
5"f8 StarFire, 2.7" Focuser, Case, 5.5" Rings, 600 Head, Dual Axis Drive, two 5 lb cwts, 46" Pier	4703.00
6"f9 StarFire, 2.7" Focuser, Case, 6.5" Rings, 600 Head, Dual Axis Drive, two 8 lb cwts, 56" Pier	5520.00
6"f9 StarFire, 2.7" Focuser, Case, 6.5" Rings, 800 Head, Dual Axis Drive, two 8 lb cwts, 56" Pier	6175.00
6"f12, 2.7" Focuser, Case, 6.5" Rings, 800 Head, Dual Axis Drive, two 8 lb & one 5 lb cwts, 66" Pier	6020.00
7"f9 StarFire, 2.7" Focuser, Case, 7.5" Rings, 800 Head, Dual Axis Drive, three 8 lb cwts, 56" Pier	7455.00
DX Mount, Polar Scope, 8 lb cwt, Fixed Height Wood Tripod	874.00
600 Head, Dual Axis Drive, two 8 lb cwts, 46" Pier	2355.00
800 Head, Dual Axis Drive, two 8 lb cwts, 56" Pier	3025.00

ACCESSORIES FOR DISCONTINUED REFRACTORS AND MOUNTS

5 lb. counterweight, threaded for 504 and 706 German Equatorial Mounts	60.00
8 lb. counterweight, threaded for 504 and 706 German Equatorial Mounts	70.00
Declination Drive for 504 and 706 German Equatorial Mounts	100.00
6" Hexagonal Rings for 6" tube diameter	155.00
7" Hexagonal Rings for 7" tube diameter	165.00
Carrying Case for 4"f6 Tube Assembly including Dewcap	95.00
Carrying Case for 4"f10 Tube Assembly including Dewcap	110.00
Carrying Case for 5"f6 Tube Assembly including Dewcap	110.00
Carrying Case for 5"f10 Tube Assembly including Dewcap	120.00
Carrying Case for 5"f12 Tube Assembly including Dewcap	158.00
Carrying Case for 6"f8 Tube Assembly including Dewcap	146.00

If you have any questions, please write or call:

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7470 Forest Hills Road
Loves Park, IL 61111
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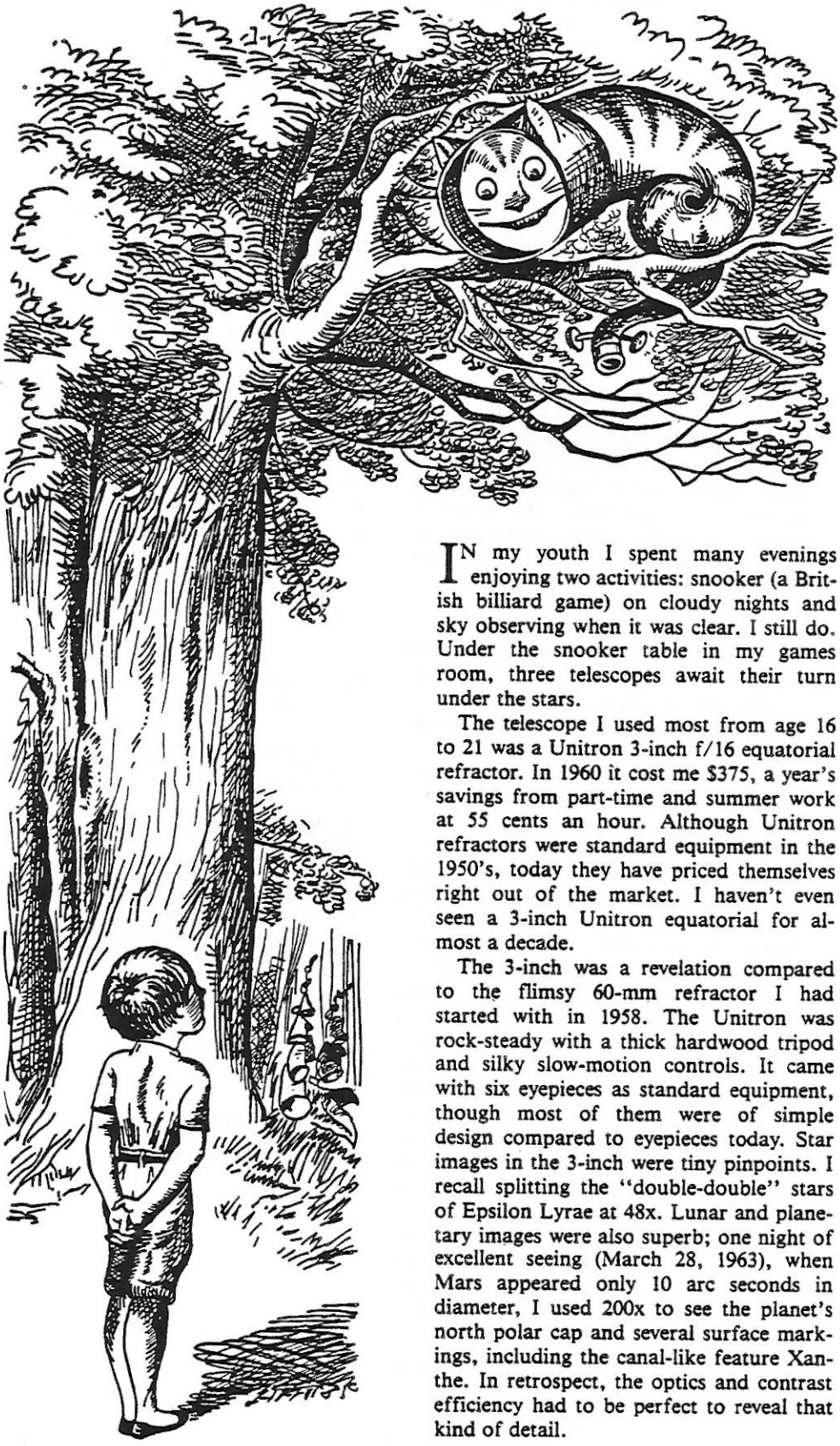
Amateur Astronomers

Conducted by Stephen James O'Meara

ADVENTURES IN REFRACTORLAND



IN 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.

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

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 5¼ 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.

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, Libya in average seeing. By opposition time the detail was overwhelming — more than I could draw. I was delighted to see, for example, the forking of Tithonius Lacus, which might represent detection of 75-mile-wide features on the planet.

In deep-sky tests, three experienced observers 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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Sky Guide (with Sam Brown, Camden House)
Mag 6 Star Atlas (w/ V.Costanzo & G.F. Chaple, Edmund Scientific)
Halley's Comet: Mysterious Visitor From Outer Space (Edmund Scientific)
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