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**Catalog mailings:** If you want to receive future catalogs, we can add you to our mailing list. E-mail or call us with your request.

**Cover photos:** (top) **Greg Comegys'** 8" f/4.8 Newtonian astrograph. (middle) **Jeff Morgan's** 12.5" f/6 ultralight Dob made with carbon fiber strut tubes. (bottom) Upper cage assemblies for two of **Kevin Collins'** truss Dobs.



Photo courtesy of Joe Doyle

**Joe Doyle's** 12.5" three-strut ultralightweight Dobsonian is inspired by Albert Highe's designs. It uses a **Protostar 2.14" 3-vane secondary mount** anchored to a minimalistic upper mono-ring.



**Jeff Morgan's** unique 8" Dobsonian features oversized altitude bearings to reduce the telescope's balance sensitivity. It was also designed to work with a binoviewer.

The tube is thin-walled aluminum from Hastings Pipe with a **Protostar air-spaced tube liner** to prevent light scattering and thermally insulate the inner tube wall. He also uses a **Protostar curved secondary mount and mirror**.

# 4-vane secondary mounts

- Thin vanes for low diffraction.
- Unique simplified collimation procedure.
- Optional anti-dew heater and spider offset available.
- Mirror holder can accommodate any mirror size.
- Made from 100% corrosion-proof materials.
- Graphite-impregnated flat black finish.
- Includes mounting hardware, drill bit, and installation instructions.

**METRIC**  
threading now available. See page 7.



2.14" model shown

Protostar secondary mounts are professional quality optical mounts designed for the lowest possible diffraction, and simplified collimation adjustment. They are available for mirror sizes from 0.75" up to 4.00" (mirrors sold separately), and spider diameters up to 31.5 inches. The secondary mirror is mounted with a metal shell, or if you have a non-standard mirror size you can adhesively mount the mirror. The collimation adjustment screws are located on the spider hub which makes them easy to access. The materials used are energy absorbing, making them inherently vibration resistant. A special graphite-impregnated black paint reduces light scatter off of the components. A special graphite-impregnated black paint reduces light scatter off of the components. A built-in antidew heater, custom spider offset, and metric threading can also be specified when ordering (see page 7 for details). Each kit includes the spider, mirror holder, collimation tool, drill bit for installation, mounting screws, and instructions. *Made in the U.S.A.*

## 4-Vane Mount Prices

Price is determined by your tube (or upper cage) inside diameter, and the size of mirror holder required. We make the spider's size to custom fit your telescope. **See ordering instructions on page 8 for more information.**

Secondary size	4.50" to 11.50" tube ID	11.51" to 15.50" tube ID	15.51" to 22.50" tube ID	22.51" to 31.50" tube ID
1.00"	\$86.00	\$86.00		
1.30"	\$90.00	\$94.00		
1.52"	\$94.00	\$98.00	\$102.00	
1.83"	\$100.00	\$104.00	\$108.00	
2.14"	\$102.00	\$106.00	\$110.00	
2.60"	\$114.00	\$118.00	\$122.00	\$130.00
3.10"	\$118.00	\$122.00	\$126.00	\$134.00
3.50"	\$140.00	\$148.00	\$175.00 (1)	\$175.00 (1)
4.00"		\$180.00 (1)	\$180.00 (1)	\$210.00 (1)

**See available options on page 7.**

(1) Heavy-duty spider versions.

# 3-vane secondary mounts

- Produces fainter diffraction spikes.
- 25% less diffraction than 4-vane styles.
- Same collimation functionality of the 4-vane version.
- Includes mounting hardware, drill bit, and installation instructions.



Secondary size	4.50" to 11.50" tube ID	11.51" to 13.50" tube ID	13.51" to 18.00" tube ID
0.75"	\$80.00	\$80.00	
1.00"	\$80.00	\$80.00	
1.30"	\$88.00	\$92.00	
1.52"	\$90.00	\$94.00	\$98.00
1.83"	\$96.00	\$100.00	\$104.00
2.14"	\$108.00	\$102.00	\$106.00
2.60"	\$110.00	\$114.00	\$118.00

## 3-Vane Mount Prices

Price is determined by your tube (or upper cage) inside diameter, and the size of mirror holder required. We make the spider's size to custom fit your telescope. See ordering instructions on page 8 for more information.

See available options on page 7.

## Comparison of diffraction patterns

4-vane spider

3-vane spider

Curved arch



These simulated views of Jupiter at low magnification show how different spider styles affect diffraction artifact. A 4-vane spider produces *eight* diffraction spikes, but four lay on top of the other four. This produces what appears to be four spikes. A 3-vane spider produces more spikes (six), but they are dimmer. Our curved arch mount creates no linear spikes, but instead spreads diffraction evenly around. **Note: The simulated diffraction patterns in this image are exaggerated for clarity. Diffraction effects are far more subtle at the eyepiece.**

# Curved secondary mounts

- Eliminates diffraction spikes.
- Low total diffraction design.
- Fully adjustable within the optical tube.
- Easy-to-access collimation adjustment.
- 100% corrosion-proof materials.
- Graphite-impregnated flat black finish.
- Includes mounting hardware and installation instructions.



1.52" model shown



Protostar curved mounts eliminate diffraction spikes, and the total diffraction is about the same as our 4-vane mounts. The 180° arch design uniformly spreads diffraction rendering it almost invisible. The arch is made of laminated layers of thin stainless steel, providing high rigidity while maintaining the thinnest possible thickness (0.026" to 0.040" depending on arch size). The arch is invisible from the focal plane, which eliminates a common source of direct scattered light. The mount

features the same simplified collimation adjustment design of our straight-vane mounts, and is available for secondary mirror sizes up to 2.14" and tube diameters up to 15 inches. Adjustable brackets anchor the arch to the tube wall providing fine adjustment for positioning, or implementing offset. They are also adjustable to insure the arch is edge-on to the primary mirror. *Made in the U.S.A.*



Each kit supplied with mounting hardware and instructions.

Secondary size	6.00" to 10.50" tube ID	10.51" to 15.00" tube ID
0.75"	\$90.00	\$96.00
1.00"	\$90.00	\$96.00
1.30"	\$94.00	\$106.00
1.52"	\$98.00	\$110.00
1.83"	\$102.00	\$114.00
2.14"	\$106.00	\$120.00

## Curved Mount Prices

Price is determined by your tube's inside diameter, and the size of mirror holder required. [See ordering instructions on page 8 for more information.](#)

The antidew heater option is not available on curved mounts, and the offset option is unnecessary since the curved mounts can be self-adjusted for offset.

# Cassegrain secondary mounts

**METRIC**  
threading now  
available. See  
page 7.

- Available for Cassegrain secondary mirror sizes from 1.30" to 4.00" (33 to 102 mm) in diameter.
- Thin stainless steel spider vanes for low diffraction.
- Rigid 4-vane spider design.
- Made from 100% corrosion-proof materials.
- Graphite-impregnated flat black finish for low light scatter.



Heavy-duty 4.00"  
model shown

The Protostar Cassegrain mounts accept mirror diameters from 1.30" to 4.00" (33 to 102 mm). The holder has a flat aluminum face for adhesively mounting the optic to. Collimation adjustment uses the same simplified principal as our Newtonian mounts. Models for mirror sizes above 3.50" (89 mm) in diameter use heavy-duty spider assemblies. *Made in the U.S.A.*

Secondary size	7.00" to 12.00" tube ID	12.01" to 15.00" tube ID	15.01" to 22.00" tube ID
1.30"	\$105.00		
1.52"	\$110.00	\$115.00	
1.83"	\$115.00	\$120.00	\$130.00
2.14"	\$120.00	\$125.00	\$135.00
2.60"	\$140.00	\$145.00	\$155.00
3.10"	\$160.00	\$165.00	\$175.00
3.50"	\$205.00	\$205.00	\$220.00
4.00"	\$215.00	\$215.00	\$230.00

## Cassegrain Mount Prices

Price is determined by your tube inside diameter, and the size of mirror holder required. We make the spider's size to custom fit your telescope. See [ordering instructions on page 8](#) for more information.

## Hub & holder assemblies

Hub and holder assemblies are used in folded refractors, shiefspiegler, and catadioptric telescopes. **Available with either a Newtonian-style holder (45° face), or a flat Cassegrain style holder.** Call or e-mail us for more details and pricing information, or go to our website.



2.14" model shown

## Options for secondary mounts (available on straight-vane spiders only)

Straight-vane Protostar secondary mounts can be ordered with optional features to enhance their functionality. Please note that these options must be specified when you order a mount, as they cannot be retrofitted later.

### Wireless anti-dew heater

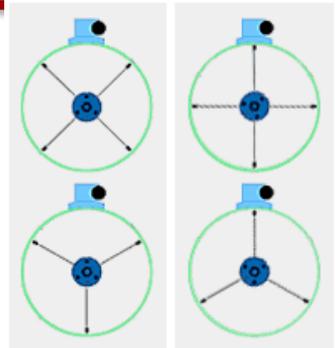
Keep your secondary mirror dew-free all night long. Small ceramic heater elements are encapsulated into the holder body, and two of the spider vanes conduct electrical current. There are no external wires or conductive tapes to thicken the spider vane. A red LED power indicator is recessed into the front face to prevent stray light from interfering with CCD imaging. (Note: There is no LED on 3-vane mounts.) The heater requires a DC power source up to 13 volts that you provide. This option is available on 4-vane and 3-vane secondary mounts with a secondary sizes of 1.52" or larger. Includes supplemental instruction sheet.



Description	Price (US\$)
Anti-dew heater for 1.52", 1.83", and 2.14" secondary mounts	add \$34.00
Anti-dew heater for 2.60" and 3.10" secondary mounts	add \$38.00
Anti-dew heater for 3.50" and 4.00" HD secondary mounts	add \$42.00

### Built-in spider offset

Newtonian telescopes on equatorial or GOTO mountings usually require the secondary mirror to be offset a small distance away from the focuser to prevent pointing errors after slewing to an object in the sky. If the offset requirement is more than 1/8" (3 mm), you can have this built into the spider for a cleaner installation. The spider will be custom manufactured with different vane lengths. When ordering this option, provide the offset value and which orientation you need (see diagram to the right). The "split" orientation places the focuser in between two vanes. The "aligned" orientation has the focuser in line with a vane.



split orientation      aligned orientation

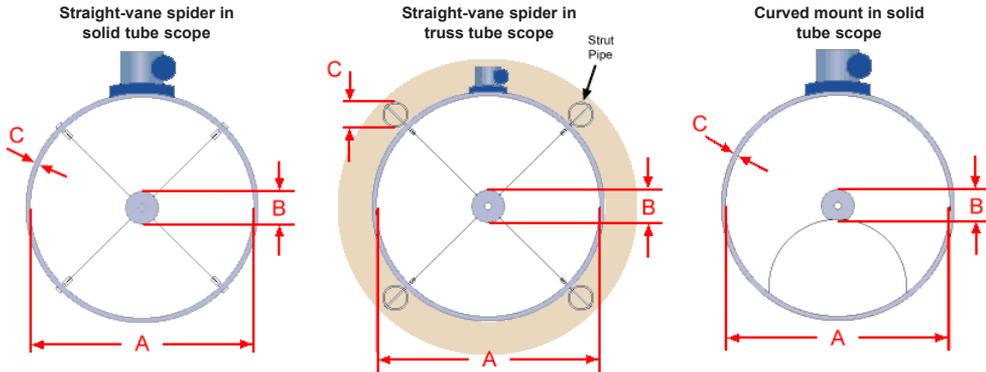
Description	Price (US\$)
Built-in spider offset for any size secondary mount	add \$7.50

### Metric threaded spiders

By selecting this option, the lugs on the spider vane ends and the collimation screws will use M5-0.8 threads instead of English threads. There is **no extra charge for this option**.

## How to Order Secondary Mounts

All Protostar secondary mounts are custom-made to fit your particular tube (or cage) inside diameter (ID), so it's important that we get the proper dimensions from you. Please provide the following information:



**A** = The actual inside diameter of your tube or upper cage. Provide the actual inside diameter of your tube or cage. **We will make your spider slightly smaller (about 1/4" smaller) than this so that it may be properly tensioned and centered.**

**B** = The size of your secondary mirror (minor axis). You can install any size secondary mirror even if it is not one of our "standard" sizes. Non-standard sizes can be adhesively mounted to the holder face instead of using the metal shroud. If you will be doing this, order the next smallest size holder.

**C** = The tube wall thickness. If it is a truss-style scope, please provide the strut diameter (the strut is what the spider will attach to). This dimension lets us give you the proper length mounting screws.

**Options:** Tell us which options you need. If you are ordering a built-in offset, please also indicate the orientation (see [page 7](#)).

## Common Ordering Questions

*My secondary mirror isn't one of your sizes. Can I still use a Protostar holder?*

Yes. If your secondary mirror is a different size than one of our "standard" sizes, choose the next smallest holder, and adhesively mount your mirror. We include spacers and instructions for adhesive mounting with all our secondary mounts.

*Should I get the anti-dew heater option?*

The antidew heater is recommended for observers who frequently stay up well past midnight when dew is most likely to form, or live in a region where dew is a more persistent problem. Also, secondary mirrors in open truss-style cages tend to dew up more frequently than closed tube telescopes.

*Can I order just a spider or a holder by itself?*

We do sell spider and mirror holder subassemblies separately (see [Replacement Parts](#) on our website), but be aware that these two components work together to allow for collimation. The collimation screws are in the spider hub, while the clutch disk and semi-flexible shaft are part of the mirror holder. One part without the other probably won't work unless you have a custom design in mind. For the same reason, our holders will not work in other manufacturer's spider designs.

# BlackLite telescope tubes

- Phenolic-impregnated kraft paper construction.
- Lined with flocked light absorbing material to suppress stray light.
- Up to 40% lighter than cardboard tubes.
- Economical
- Easy to cut and drill
- Moisture resistant
- Excellent thermal properties
- Unpainted (light tan) with spiral seam



BlackLite tubes are specifically designed to be telescope tubes, and the diameter, rigidity, optical and thermal properties all have that purpose in mind. BlackLite tubes have Protostar flocked light trap material integrated into the interior tube wall during manufacture, saving you the time and expense of separately installing flocking. The hard exterior is ready-to-paint, or it can be used unpainted.

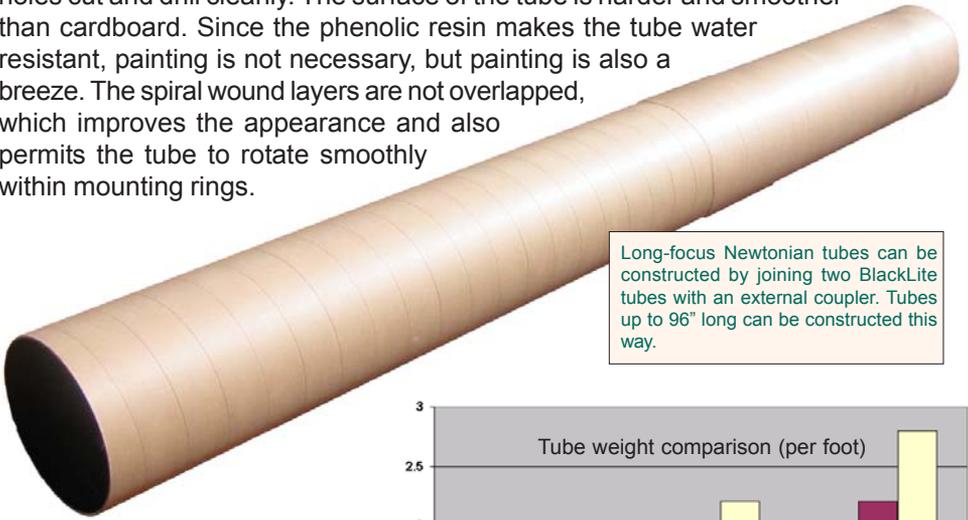
Phenolic is impregnated into the kraft paper construction resulting in over five times the compression strength of cardboard alone. The tubes are up to 50% lighter than cardboard, and up to 40% lighter than typical aluminum tubes.

## Specifications

	BL-8	BL-10	BL-12
Inside diameter inch (mm)	7.65" (194)	9.65" (245)	11.45" (291)
Outside diameter inch (mm)	7.90" (201)	9.90" (251)	11.80" (300)
Wall thickness inch (mm)	0.12" (2.8)	0.13" (3.0)	0.16" (3.6)
Weight per length	1.0 lbs/ft (15 g/cm)	1.3 lbs/ft (19 g/cm)	1.8 lbs/ft (27 g/cm)
Modulus of elasticity, $E$	1400 ksi (9.65 GPa)	1400 ksi (9.65 GPa)	1400 ksi (9.65 GPa)
Inside wall reflectivity @ 0° AOI	< 0.4%	< 0.4%	< 0.4%
Inside wall reflectivity @ 80° AOI	< 0.7%	< 0.7%	< 0.7%
Thermal conductivity, $k$	0.23 W/mK	0.23 W/mK	0.23 W/mK
Thermal expansion coefficient, ( $1/^\circ\text{F}$ )	$8 \times 10^{-6}$	$8 \times 10^{-6}$	$8 \times 10^{-6}$
Design temperature range	-25 to 170 °F (-30 to 75 °C)	-25 to 170 °F (-30 to 75 °C)	-25 to 170 °F (-30 to 75 °C)

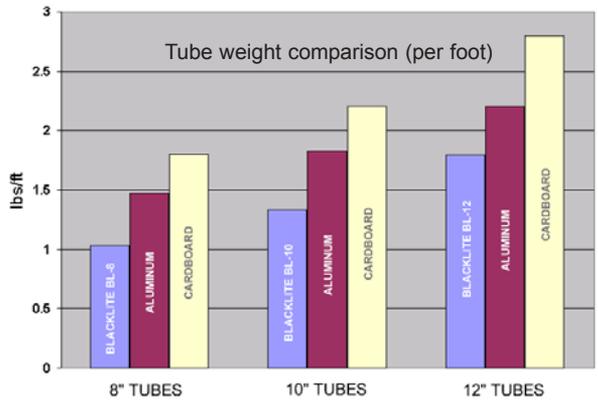
## Working with BlackLite tubes

BlackLite tubes are easy to cut, drill, sand, and finish. The edges and focuser holes cut and drill cleanly. The surface of the tube is harder and smoother than cardboard. Since the phenolic resin makes the tube water resistant, painting is not necessary, but painting is also a breeze. The spiral wound layers are not overlapped, which improves the appearance and also permits the tube to rotate smoothly within mounting rings.



Long-focus Newtonian tubes can be constructed by joining two BlackLite tubes with an external coupler. Tubes up to 96" long can be constructed this way.

Sold in 48-inch lengths. Short extensions (up to 8") can be created with a coupler/extension tube (sold separately), and two tubes can be joined to make a tube up to 96" in length. Shipped by parcel post. *Made in the U.S.A.*



Part No.	Description	Price (US\$)
	48" long tubes	
BL8-48	8" BlackLite telescope tube; 48" long	\$85.00
BL10-48	10" BlackLite telescope tube; 48" long	\$95.00
BL12-48	12" BlackLite telescope tube; 48" long	\$115.00
	Coupler/Extension Tube Sections (for joining or short extensions of BlackLite tubes)	
CT8	Coupler/extension tube for BL8 tubes; 7.5" length	\$15.00
CT10	Coupler/extension tube for BL10 tubes; 8.5" length	\$18.00
CT12	Coupler/extension tube for BL12 tubes; 10.0" length	\$22.00

## BlackLite telescope tube accessories

### Tube end covers

Keep dust off of your optics when your telescope is in storage, or being transported. Our slip-on tube end covers are custom-made to fit our BlackLite tubes. They also fit Hastings aluminum tubes, and common sizes of cardboard tubes. They will fit with, or without, the tube end trim installed.

Made in the U.S.A.



Part No.	Description	Price (US\$)
EC-8	Tube end cover for 8" OD tube; 1 pc.	\$12.00
EC-10	Tube end cover for 10" OD tube; 1 pc.	\$14.00
EC-12	Tube end cover for 12" OD tube; 1 pc.	\$19.00

### Tube end trim

End trim is not just a cosmetic improvement, but it also protects the tube ends from chips and cracks. Our high-quality tube end trim has a metal core for a secure fit without glue. It is black with a sand textured finish. Installs easily with light hammer tapping. Fits any tube with up to 0.4" wall thickness.

Made in the U.S.A.



Part No.	Description	Price (US\$)
TT-060	Tube end trim; 1/16" wall thickness (works for 0.05" to 0.08")	\$0.25 per inch
TT-125	Tube end trim; 1/8" wall thickness (works for 0.10" to 0.13")	\$0.25 per inch
TT-156	Tube end trim; 5/32" wall thickness (works for 0.14" to 0.18")	\$0.25 per inch
TT-250	Tube end trim; 1/4" wall thickness (works for 0.22" to 0.26")	\$0.35 per inch
TT-312	Tube end trim; 5/16" wall thickness (works for 0.29" to 0.34")	\$0.35 per inch
TT-375	Tube end trim; 3/8" wall thickness (works for 0.36" to 0.40")	\$0.35 per inch
TT-BL8	Tube end trim kit for BL-8 BlackLite tubes (2 pcs pre-cut to length)	\$10.00
TT-BL10	Tube end trim kit for BL-10 BlackLite tubes (2 pcs pre-cut to length)	\$12.50
TT-BL12	Tube end trim kit for BL-12 BlackLite tubes (2 pcs pre-cut to length)	\$15.00

# Newtonian Astrograph

Greg Comegys



Imager **Greg Comegys** made his 8-inch f/4.8 Newtonian astrograph with an emphasis on functionality. The optical tube is a Protostar BlackLite BL-10 tube with a 2.60" 4-vane mounting and ULS Quartz secondary mirror. He writes, "This tubing was a dream to work with compared to cardboard tubes." For astrographic Newtonian telescopes tube rotation is a necessity. Greg's unique rotating ring cage is made from Baltic birch and aluminum tubing, and features a rotational indexing feature made from press-fit ball plungers. This allows repeatable, precise rotational positioning of the tube for convenient camera positioning.

# ULS Quartz secondary mirrors

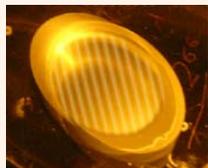
- Each piece is serialized, tested, and supplied with interferometric report.
- 10-5 scratch/dig, and 2 to 4 nm (rms) roughness polish quality.
- High-efficiency IAD metal-dielectric broadband coating (98% avg reflectivity).
- CNC-shaped fused silica substrate for a precise holder fit.



ULS Quartz secondary mirrors start as a machined (not casted) quartz substrate, and are polished to a flatness better than 0.10 p-v *reflected wavefront* error. Typical RMS values range from 0.015 to 0.010 wavelength for smaller sizes, and 0.020 to 0.015 wavelength for the larger sizes. Each flat is individually tested, serialized, and supplied with an interferometric test report. (Call or e-mail before ordering, and we can tell you what the best part in stock is.) The low-scatter property of quartz makes ULS mirrors ideal for demanding visual applications such as planetary viewing. They are also excellent for high quality imaging systems, lab test references, and low/medium power laser applications (including near-UV and near-IR wavelengths). The metal-dielectric hybrid 98% coating is applied with an advanced ion-assisted deposition process, and meets MIL-M-13508 standards. *Made in the U.S.A.*

## About Protostar's certification methods

Since the entire surface of a Newtonian secondary mirror can be "optically active", our interferometer reports are for the entire surface, edge to edge. There is no "edge trimming" in the report. Most of the surface error is at the extreme edge, so ignoring even a millimeter or two of the edge will erroneously produce better "numbers". Protostar test reports give you an accurate (and conservative) representation of the surface.



Secondary Size (minor axis)	Part No.	Description	Price (US\$)
0.75"	QM-075	ULS Quartz secondary mirror; 0.75" minor axis	\$75.00
1.00"	QM-100	ULS Quartz secondary mirror; 1.00" minor axis	\$85.00
1.30"	QM-130	ULS Quartz secondary mirror; 1.30" minor axis	\$105.00
1.52"	QM-152	ULS Quartz secondary mirror; 1.52" minor axis	\$118.00
1.83"	QM-183	ULS Quartz secondary mirror; 1.83" minor axis	\$135.00
2.14"	QM-214	ULS Quartz secondary mirror; 2.14" minor axis	\$165.00
2.60"	QM-260	ULS Quartz secondary mirror; 2.60" minor axis	\$225.00

# Pyrex secondary mirrors

- Each mirror is supplied with an interferogram.
- High-efficiency broadband coating averages 96% reflectivity.
- Made from precision annealed Pyrex.



Larger flats are more difficult to produce to given flatness specification, so each of these mirrors is supplied with an interferometric test report. Sizes up to 3.10" are 0.1 p-v surface flatness (1/10th wave) or *better*, and larger sizes are 0.13 p-v (1/8th wave) *minimum* surface flatness. (Measured with 633 nm wavelength light.) The dielectric overcoated aluminum has an average reflectivity of 96%. Each mirror is supplied with interferometric certification, and the ratings are expressed as true edge-to-edge values. The surface is polished to a 40-20 scratch/dig specification. *Made in the U.S.A.*

## Specifications

Size (minor axis)	Thickness	Coating	Reflectivity	Surface scratch/dig	Weight
2.14" (54.4 mm)	0.50" (12.7 mm)	aluminum + IAD dielectric pair	96%	40-20	93 g
2.60" (66.0 mm)	0.54" (13.7 mm)	aluminum + IAD dielectric pair	96%	40-20	158 g
3.10" (78.8 mm)	0.65" (16.5 mm)	aluminum + IAD dielectric pair	96%	40-20	265 g
3.50" (88.9 mm)	0.75" (19.1 mm)	aluminum + IAD dielectric pair	96%	40-20	400 g
4.00" (101.6 mm)	0.85" (21.6 mm)	aluminum + IAD dielectric pair	96%	40-20	470 g

Secondary Size (minor axis)	Part No.	Description	Price (US\$)
2.60"	PM-260	Pyrex secondary mirror; 2.60" minor axis	\$165.00
3.10"	PM-310	Pyrex secondary mirror; 3.10" minor axis	\$195.00
3.50"	PM-350	Pyrex secondary mirror; 3.50" minor axis	\$320.00
4.00"	PM-400	Pyrex secondary mirror; 4.00" minor axis	\$420.00

# Air-spaced tube liners

- Solves the "cold wall" air recirculation problem.
- Flocked light trap on inside liner wall to suppress stray light.
- Lighter in weight compared to cork and separate flocking.
- Fits 8", 10", and 12" OD aluminum tubes sold by Hastings Pipe.
- Cost effective solution compared to separate flocking, cork, adhesive, and tube end trim.



The Protostar tube liner slips inside your Hastings aluminum tube, and is sized to create a small air gap between the liner and metal wall. The liner is centered within the tube with foam strips at both ends. This solves two traditional problems with aluminum telescope tubes. First, it thermally insulates the interior of the tube. Radiative heat loss to the night sky causes the metal tube to drop several degrees colder than the ambient temperature, and cooler air will spill within the optical path all night. The resulting temperature gradient will degrade the image quality. The air gap created by the tube liner insulates the interior of your telescope from the colder metal wall (air is a very good insulator). The liner wall is also flocked to suppress stray light from reaching the focal plane. The liner can be removed if you need to do future work on the telescope.

Sized to fit Hastings 8", 10", and 12" OD tubes. Most aluminum tubes offered by other astronomy vendors originate from Hastings, so our liners will fit their tubes as well. (You can also consult the specifications table to see if the liner will fit your tube.) Each kit includes the liner, foam centering strips, and instructions. *Made in the U.S.A.*

## Specifications

Part no.	inside dia., inches (cm)	wall thickness, inches (mm)	weight per inch, ounces (grams)	avg. reflectivity @ 0° AOI	avg. reflectivity @ 80° AOI
TL-8	7.65 (19.4)	0.030 (0.75)	0.31 (9)	< 0.4%	<0.7%
TL-10	9.65 (24.5)	0.030 (0.75)	0.40 (12)	< 0.4%	<0.7%
TL-12	11.45 (29.1)	0.040 (1.00)	0.53 (15)	< 0.4%	<0.7%

*Important note:* Hastings offers an optional inward fold on the ends of their tubes called "rolled ends". We don't recommend this option, as reduction in ID makes it difficult to insert the liner.

## Tube liner prices

Tube liners are sold by the inch. The maximum continuous length available is about 60-inches, but it is easy to join sections to make longer liners.

**Shipped by FedEx Home Delivery. We can only ship tube liners to U.S.A. addresses.**

Part No.	Description	Price (US\$)
TL-8-XX	Tube liner for 8" OD aluminum tube; 'XX' length (in inches)	\$1.00 per inch
TL-10-XX	Tube liner for 10" OD aluminum tube; 'XX' length (in inches)	\$1.25 per inch
TL-12-XX	Tube liner for 12" OD aluminum tube; 'XX' length (in inches)	\$1.50 per inch

# Flocked light trap material

- Absorbs over 99% of visible light.
- Peel-n-stick application.
- Effective even at high angles of incidence.
- Made from moisture-proof synthetic material.

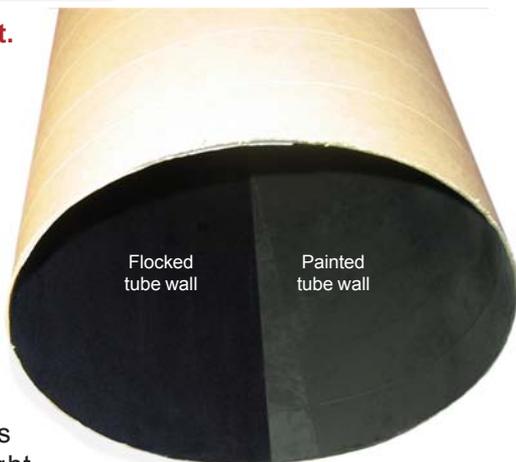


Image contrast suffers when stray light reaches the focal plane. The best flat black paint still reflects about 5% of incident light, and even more when viewed at high angles of incidence. Protostar flocked light trap is specifically engineered to be a light absorbing surface, and is effective at all angles of incidence. Unlike “decorative” flocking grades, the fibers don’t shed on your optical surfaces. The material is 100% synthetic based, so it's not damaged by moisture. Small pieces can be used to cover exposed edges of secondary mirrors and primary cells, covering annular baffle surfaces, and Barlow lenses. The improvement in field contrast is most noticeable when you look at a bright planets and the Moon.  
*Made in the U.S.A.*

### Specifications

	English units	SI units
Weight per area	0.71 oz/ft <sup>2</sup>	0.20 kg/m <sup>2</sup>
Thickness	0.018-0.020"	0.46-0.53 mm
Avg. reflectivity at 0° AOI	< 0.6%	< 0.6%
Avg. reflectivity at 80° AOI	< 1.0%	< 1.0%
Adhesion strength (on aluminum)	12.8 lbs/in	23.6 N/cm
Temperature range	-30 to 150 °F	-35 to 65 °C



## Hi-tack flocked light trap prices

Flocking is cut-to-length to your requirements, and sold by the inch off of a 30-inch wide roll (except for the die-cut sheet which is 28" x 20"). The die-cut sheets are sized to be economically shipped anywhere in the world. Installation instructions and tips included. *Made in the U.S.A.*

Part No.	Description	Price (US\$)
FPR-01	Hi-tack flocked light trap material; cut from 30" wide roll	\$0.50 per inch
FPR-02	Hi-tack flocked light trap material "mini roll"; 30" wide x 200" length	\$85.00
FPR-03	Hi-tack flocked light trap material bulk roll; 30" wide x 500" length	\$195.00
FPS-01	Hi-tack flocked light trap mat'l; 28" x 20" die-cut (sized for airmail shipment anywhere in the world)	\$12.00

## Repair and refurbishing service

We offer a repair and refurbishing service for our secondary mounts. Damaged components will be repaired or replaced, and the assembly is refinished with our graphite impregnated painting process. In most cases, we can make your mount look new again.

### Shop services price schedule

Service	Price (US\$)
Refinishing w/graphite paint	\$25.00
Spider resizing; 3-vane (includes refinish)	\$35.00
Spider resizing; 4-vane (includes refinish)	\$40.00
Repair bent vanes & refinish	\$30.00

Note: For spider resizing, they can only be made smaller, and the new size must be at least 0.4" smaller than original size.

## Replacement parts

We offer separate holders and spider subassemblies as replacements for damaged parts. It's important to note that both a spider and holder are required to have collimation functionality, which is why they are normally sold together. Protostar mirror holders will not fit into other manufacturer's spiders. Call us or see our website for more information about replacement parts.

## Visit Protostar on the web

There is more on our website, including:

- Secure online ordering
- Download current installation and
- User & install manuals
- Order replacement parts
- Up-to-date product FAQs
- Product specifications



[www.protostar.biz](http://www.protostar.biz)



### Product Warranty Information

Protostar guarantees your satisfaction with our products with our return policy and limited product warranty:

**30-day return policy.** With exceptions noted below, Protostar products can be returned for any reason within the first 30-days. The product may be returned for replacement, repair, or refund (your choice). Special exceptions are:

**Telescope tubes and tube liners** that have been drilled or cut by the customer, or cut to a custom length by us, cannot be returned except in the case of a defect.

**Straight-vane secondary mounts** (i.e., "spiders") cannot be returned because of wrong sizing if we were provided with an incorrect tube ID. In many cases we can modify your spider to a new dimension for a small fee.

**Secondary mirrors** must be returned in "like new" condition except in the case of a defect.

**One-year limited warranty.** In addition to the 30-day return policy, Protostar products are warranted against defects in material and workmanship for one year after the shipping date. Defective products will be repaired or replaced if they are out of the 30-day warranty period. The warranty does not cover normal wear, damage, or loss, and is void if the unit is modified from the original design or disassembled beyond the intent of the design.

## Methods for Placing Your Order

**Ordering online:** Use our secure online order form on our website at [www.protostar.biz](http://www.protostar.biz).

**Ordering by phone:** Telephone orders can be placed by calling 614-855-5341. Regular business hours are Monday through Friday, 9:00 AM - 5:00 PM (Eastern Time Zone).

**Ordering by mail:** Mail orders to: Protostar, P.O. Box 448, Worthington, OH 43085, U.S.A. Be sure to include all the information requirements listed above if you're ordering a secondary mount. Call or write us for the shipping charges, and if you are in Ohio (U.S.A.), please include 6.75% Ohio sales tax.

### Payment Method

We accept major credit cards (Visa, MasterCard, American Express, and Discover), PayPal, personal checks issued from U.S.A. banks, money orders, and bank checks. We do not accept C.O.D. orders, or electronic money transfers.

### Delivery Lead-times

Stocked products like flocked light trap and secondary mirrors are normally shipped within 1-3 days of your order. Secondary mountings are necessarily custom-made, so there is a lead-time of several weeks. An approximate lead-time will be quoted to you when you place your order, and current lead-times can also be found on our web site.

### Shipping Charges

Most of our products are shipped using the U.S. Postal Service (Priority Mail). The shipping charge is based on the accumulated weights of the products you order, and we strive to keep the shipping charge as close to the actual costs as possible. For larger shipments (like BlackLite tubes), we use Parcel Post (U.S. Mail). If you wish to mail in an order, please e-mail or call us in advance to get an accurate shipping charge quote.



### Foreign Orders

#### How to place foreign orders

Protostar welcomes international orders! The easiest method to place an order from outside the U.S.A. is through our secure online shopping cart using a credit card. We also accept bank-issued checks and international money orders (in U.S. dollars) if you prefer to mail your order in. We can quote shipping costs to you before processing the order. Note that import duties vary from country to country, and our shipping quotes do not include these fees. Foreign orders are normally shipped by postal methods (i.e., airmail).

#### Foreign shipping methods

We ship most products by airmail through the United States Postal Service. We use insured airmail, Priority Mail International®, or Global Express Mail® depending on the product. We must ship to the same address as the credit card holder for non-U.S.A. orders.

#### Estimated foreign shipping costs

We will quote exact shipping charges at the time you place your order, or you can e-mail us in advance if you need a shipping quote before ordering. We strive to keep shipping costs as low as possible for customers outside the U.S.A., and we charge only for the actual shipping, insurance, and packaging costs.



**ProtoStar**

P.O. Box 448

Worthington, Ohio 43085

U.S.A.