A Brief History of Astro-Physics Lenses by Thomas M. Back

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I hope the following history of the apochromatic lens designs made by Roland Christen of Astro-Physics is of some interest to the readers. I do not claim complete accuracy.

The first ad that I am aware of was in Sky and Telescope magazine, December 1981. Two lenses were offered: A 6" f/11 magnesium fluoride coated oil triplet for $1800, and an 8" f/11 for $3600, both in cell. These lenses proceeded Roland's article in Sky and Telescope, October 1981, page 376, "An Apochromatic Triplet Objective." This was a groundbreaking article, and was the beginning of the new age of Apochromatic refractors. The prototype was a 5" f/12, and was shown at the Riverside Telescope Making Conference. The images of Jupiter impressed the attendees beyond any telescope on the field, and won the prize for the most innovative optical design.

Roland was very fortunate to find a large supply of an abnormal dispersion flint, similar to Schott KzFS-1, but even better in its color correcting properties. In fact, it was ordered by NASA, but was never used. When Roland found that the supply was available for sale, he gladly bought it up. By-the-way, this "NASA" flint glass was the ultimate in short KZ flint glass. No manufacture supplies a flint glass that can match its abnormal dispersion properties today. The next ad was for two new apochromatic scopes. A 5" f/6 for $950, and 5" f/12 Super Planetary for $975 (what a deal, ask yourself what a 5" apo costs today!). These were complete scopes. They used a design of BK-7/KzFS-1(NASA)/BaF-10 or BaK-1/KzFS-1/BaFN-10 glass.

Then came the infamous 6-inch f/9 NASA triplet, which only (it is said) ~24 were made. The scope was advertised in the July 1984 issue of Sky and Telescope, and priced at a slightly rich $1695, for that time. For another $1300, you could have a complete mount and custom tripod. Astro-Physics then expanded their line to a 4"f/6 ($795) and 5" f/6 ($995). This 5" model had the highest aberration residuals of any Astro-Physics refractor ever produced, but made a fine low to medium power refractor. If this lens was stopped down to 4", it gave good high power views too. It was simply too large and fast before the advent of ED glasses. The last model in the line was a replacement for 6-inch f/9 NASA triplet, the 6" f/8 ($1295), which used KzFSN-4 as the abnormal dispersion flint element. The color and spherochromatism of this model was slightly less well corrected than the older 6-inch f/9, but was $400 cheaper. Interesting that the stated quality was 1/56 wave RMS, virtually the same as today.

At this point, Roland's success made for a big life decision. Quit a safe, well paying job, or go full time into telescope making. The choice was made, and with the help of his wife Marj, and Fred Mrozek (of APOMAX fame – in which Fred made a limited run of superb 5.2" and 8" apochromats), and Fred's father Chester Mrozek (who supplied tooling, a grinding/polishing machine and other important ideas), Roland went into the full time telescope making business.

More ads were taken out in the astro magazines, and a new, more complete line of apochromatic refractors was introduced. The August 1986 issue of Sky and Telescope might have been the most impressive ad for its time. Seven apochromatic refractors were listed, and the most impressive was the 6" f/12 Super Planetary for $1540. The ad read: "Our new long focus refractors are designed for the most discriminating Lunar/Planetary observer who does not want any compromise in performance... The Lunar limb and the disks of the planets are sharply outlined against black sky, resembling charcoal drawings." Well, I can tell you that got my interest! I placed an order for one, and at the next AstroFest Telescope Convention, I viewed Jupiter with a 6"f/12 Super Planetary with the one and only Robert Cox, and we were both staggered with the amount of planetary detail. Robert's own words: "The planet presented a clear, sharp edge with a high contrast view of the surface features." I might add that at this same AstroFest, Roland and Marj brought a custom 8" f/14 triplet, which was giving views of Jupiter at 300x that reminded everyone of the Voyager pictures (just ask Marj), as around 11:00 PM the first night, the seeing was near perfect. The other scopes in the line were a 4"f/6 ($895); 5"f/6 ($1195); 4"f/10 ($895); 5"F/8 ($1195); 6"F/8 ($1440), and the 5" F/12 ($1225). This last scope was Terence Dickinson's first AP purchase and was so impressed with. Roland was also taking orders for larger, custom lenses. A 8" was purchased by Sue and Alan French, and they took this scope to many star parties. All these scopes were based on a similar design, crown glass (BK-7 or BaK-1), abnormal dispersion flint (KzFS-1 or KzFSN-4) and Barium flints (BaF-10, BaFN-10). To learn more about this type of apochromatic lens design, see Telescope Making issue 28, page 20. A little known fact about the early 6" f/12 Super Planetary scopes is that they also used the "NASA" glass. The later models (I presume the NASA flint glass ran out) used K-7 crown and KzFSN-4 flint glass.

Roland correctly perceived that the market wanted faster apochromats, that were extremely well suited for photography. Thus the "StarFire" line. The first ad was very craftily placed right by the famous article by John Gregory and his 8" f/15 doublet apochromatic lens in the June 1987 issue, page 662, the ad, page 665. Roland made a funny typo in the ad, when he called costly

imported Fluorite Refractors "costly imported Fluoride Refractors." Fluoride is used as a coating material in anti-reflection coatings (among other purposes), while Fluorite is a crystal used in objectives because of its super low dispersion. If it was placed there by chance or otherwise, it couldn't have been in a better place in the magazine. This design used the same flint as the older Astro-Physics scopes, but to increase color correction, two abnormal dispersion flints were used. I can't tell you what the two other flints are (keeping Roland's design proprietary), but it is sufficient to say that the violet correction was as much as 5x times better in the new StarFire design. There was a 4"f/8 ($1195); 5" f/8 ($1660); 5.6" f/7 ($1850); 6"f/9 ($2395) and the king of production StarFires, the 7" f/9 at only $3600! In the last production runs of the larger non-ED StarFires, he airspaced the design and also allowed the six different radii to vary on each surface. These last production StarFires' were almost the match of the current ED Astro-Physics scopes, and the final price was $4495.

In a letter dated February 16, 1989, I received information on a 8" f/15 airspaced StarFire, coated in cell for $7985. I believe one or two were sold. I'm sure the owner of such a lens is very happy with its planetary performance. Then the new era began. It was AstroFest 1990, and Roland brought his ultimate line of ED EDT triplets. I had my 6"f/12 setup next to the new 6.1" f/9 EDT, and at first glance cast on Saturn, I knew it was all over. This scope was a knockout, and in color correction and contrast, clearly beat my 6" f/12 Super Planetary. This was a prototype, was airspaced and not even coated. I asked Roland if he was considering a 7.1" version, and he said possibly. When I got the news from Astro-Physics that indeed a 180mm f/9 EDT was to be made, I said GREAT! I sent in my deposit and patiently waited for my dream scope. The first EDT design used ZKN-7 crown glass and FPL-52 ED glass. The last runs of the smaller EDT models used the same crown glass but FPL-53 ED glass. They were even better corrected for monochromatic and polychromatic aberrations. Prices for the EDT's: 105mm f/5.8 ($1725); 130mm f/8 ($2450); 155 f/9 ($3195) 180mm f/9 ($4595). There was also a very small run of 130mm f/8 ($1795) and 155mm f/9 ($2595) doublets, but Roland discontinued these because the demand for the EDT triplets far exceeded the ED doublets, and figuring made them as hard to make as the triplets. I left out the first ED Astro-Physics scope, the Star12 ED. At $1585, it was a steal, and I know some very happy owners of this scope. While not having the color correction of the EDT triplets, they were nevertheless very sharp. My friend Gordon Garcia (expert Solar photographer) took some 1 arc second shots of the Sun with this scope, and his work can be seen in Astronomy, Sky and Telescope, ALPO, and the book "Solar Astronomy Handbook." He currently uses an AP 130mm f/8 EDT.

Roland then set out to make the ultimate astrograph. It was the first "EDF." It used the StarFire design, but with FPL-51 with an airspace. With a 4-inch field corrector and focuser, it took some of the most impressive widefield astrophotos ever taken. The 152mm f/7.5 EDF ($6400) was the first apochromatic telescope that I had ever seen that was completely color free -- even out of focus. There were a few 206mm f/7.9 EDF's ($12500), and as most of you know, they sell for 3x to 4x as much now.

FPL-53 was the next step, and the 180mm f/7 EDF was born. At $8200, they sold instantly. Tony Hallas has used his extensively for wonderful deep-sky imaging. Once again, when they ever hit the used market, the going price is much higher than retail. A few 9-inch and 10-inch apochromats were sold to Universities and rich individuals, the design details being kept secret. A new telescope was brought into the line up -- the 92mm f/4.9 fluorite triplet Stowaway, and the last run of this telescope, the 92mm f/7 FPL-53 triplet Stowaway. The fluorite version has the advantage of a faster focal ratio and portability, but does suffer from some residual spherochromatism, whereas the f/7 version is well corrected for residual spherochromatism.

The next evolution in the design of Astro-Physics lenses were in the new EDT and EDF designs. Roland found that by combining FPL-53 with two different crown glasses, he could reduce spherochromatism even further, and keep the design well corrected out to 10000A in the near infrared. This is important for CCD imaging, as CCDs still have sensitivity at those wavelengths. He also instituted the use of a vertical interferometer, Opticam CNC glass surface profiler and an U of R magnetic polishing machine. The Astro-Physics lenses have good optical qualities and unit to unit consistency. The lenses are optimized for imaging, as the latest Astro-Physics longitudinal aberration graphs show. The tube assemblies and matched accessories are finely machined. The latest evolution is a new line of air spaced ED EDF triplets, the first being a 160mm f/7.5. Little is known why Astro-Physics, after decades of using oil spaced lenses, decided to go to an all air spaced design. It may increase the yearly production of Astro-Physics telescopes, due to the lack of the extra work needed with the oil spaced lenses aspherical surface(s). Only time will tell how the new air spaced lenses compare to the oil spaced lenses.

The following is a price list, starting with the first year that the Astro-Physics EDTs and EDFs were offered, to the best of my knowledge. Let me say that I cannot guarantee complete accuracy. To keep this simple, I will list the models, features and price by the year, starting with the first year that the EDTs and EDFs were offered, to the current product line.

1991

127mm f/8 EDT w/2.7" focuser = $2230
152mm f/7.6 EDF w/4" focuser with field corrector = $6400

1992

105mm f/5.8 EDT "Traveler" w/2.7" focuser = $1725
130mm f/8 EDT w/2.7" focuser = $2450
155mm f/9 EDT w/2.7" focuser = $3195
180mm f/9 EDT w/2.7" focuser = $4595
(yes, I only paid $4595 for my AP 180mm f/9 EDT)
155mm f/7.5 EDF w/4" focuser with field corrector = $6400
206mm f/8 EDF w/4" focuser with field corrector = $12500

1993

105mm f/5.8 EDT "Traveler" w/2.7" focuser = $1895
130mm f/8 EDT w/2.7" focuser = $2695
155mm f/9 EDT w/2.7" focuser = $3495
180mm f/9 EDT w/2.7" focuser = $4995
155mm f/7 EDFS w/2.7" focuser = $4495
155mm f/7 EDF w/4" focuser with field corrector = $6400
206mm f/8 EDF w/4" focuser with field corrector = $12500

1994

105mm f/5.8 EDT "Traveler" w/2.7" focuser = $1995
130mm f/8 EDT w/2.7" focuser = $2695
130mm f/6 EDFS w/2.7" focuser = $2995
180mm f/9 EDT w/2.7" focuser = $4995
155mm f/7 EDFS w/2.7" focuser = $4495
155mm f/7 EDF w/4" focuser with field corrector = $6400

1995

105mm f/5.8 EDT "Traveler" w/2.7" focuser = $1995
130mm f/8 EDT w/2.7" focuser = $2695
130mm f/6 EDFS w/2.7" focuser = $2995
180mm f/9 EDT w/2.7" focuser = $5495
155mm f/7 EDFS w/2.7" focuser = $4495
155mm f/7 EDF w/4" focuser with field corrector = $6400

1996

105mm f/5.8 EDT "Traveler" w/2.7" focuser = $2150
130mm f/6 EDFS w/2.7" focuser = $2995
180mm f/9 EDT w/2.7" focuser = $5995
155mm f/7 EDFS w/2.7" focuser = $4495
155mm f/7 EDF w/4" focuser with field corrector = $6400
180mm f/7 EDF w/4" focuser with field corrector = $8200

1997

No price changes to my knowledge

1998

105mm f/5.8 EDT "Traveler" w/2.7" focuser = $2150
130mm f/6 EDFS w/2.7" focuser = $3250
130mm f/8.35 EDT/EDF w/2.7" focuser = $3250
(what a sweet telescope)
180mm f/9 EDT w/2.7" focuser = $5995
155mm f/7 EDFS w/2.7" focuser = $4495
155mm f/7 EDF w/4" focuser with field corrector = $6400

1999

92mm f/4.9 Fluorite "Stowaway" w/2" focuser = $2400
105mm f/5.8 EDFS "Traveler" w/2.7" focuser = $2400
130mm f/6 EDFS w/2.7" focuser = $3250
155mm f/7 EDFS w/2.7" focuser = $4900
155mm f/7 EDF w/4" focuser with field corrector = $6800

2000

105mm f/5.8 EDFS "Traveler" w/2.7" focuser = $2900
130mm f/6 EDFS w/2.7" focuser = $3950
155mm f/7 EDFS w/2.7" focuser = $5400
155mm f/7 EDF w/4" focuser with field corrector = $7400

Current 2002/2003 Pricing

92mm f/7 EDF "Stowaway" w/2" focuser = $2880
105mm f/5.8 EDFS "Traveler" w/2.7" focuser = $3480
130mm f/6 EDFS w/2.7" focuser = $4740
130mm f/8.35 EDT/EDF w/2.7" focuser = $4740
155mm f/7 EDFS w/2.7" focuser = $6480
155mm f/7 EDF w/4" focuser with field corrector = $8880

Current 2004 Pricing

160mm f/7.5 Air spaced EDF triplet w/4" focuser = $7950

Sincerely,

Thomas Back
TMB Optical