Advice on Choosing Birding Optics

By Pete Webb, BBC Program Chairman and former BBC President
November 7, 2013

Two of the most essential tools for most bird watchers are their binoculars and a good field guide to identify the birds they see with them. After they become serious "Birders" they often leave the field guides at home, but not their binoculars. Instead, the second essential tool will be a spotting telescope for viewing more distant birds, mainly waterfowl and sandpipers, and the occasional rare sparrow perched across a field.

Most binoculars come in either of two types: porro and roof prism binoculars.

Porro prism binoculars

Roof prism binoculars

Porro prism binoculars offer more optical quality for the same amount of money, but are bulkier and heavier. These are the ones with the familiar shape, with the eye piece lenses closer together and the larger objective lenses, away from the observer's eyes, further apart. A second variation seen in miniatures places the two objectives closer together than the eyepieces. They both also, due to the way they're built, are more vulnerable to getting knocked out of alignment, causing the person to see double when trying to look through them. Just the normal shocks and bounces of shipping from manufacturer to the store will often knock some of these binoculars out of alignment, especially the cheaper ones. You shouldn't buy these at the store without checking them first for alignment ("collimation").

But **porro prism binoculars offer the best optical quality for the money**.

Roof prism binoculars are lighter in weight, more visually pleasing with the straight-through shape, and **cost more to get good optical quality**. They also are easier to make waterproof,

important for keeping material from getting inside and fogging up the view. They also are less prone to getting knocked out of alignment. Most of the high-priced premium binoculars offered for sale for over a thousand dollars are waterproof roof prism binoculars. This offers better protection for the investment in costly low-dispersion glass in the lenses and fancy multi-layered anti-reflective coatings on the lenses and prism surfaces.

Note that with spotting telescopes, the alignment problem noted above for porro prism binoculars doesn't apply; there's only one telescope, not a pair. You can't see double through only one eye.

A recent innovation in spotting telescopes has been the introduction of the angled eyepiece. This is mostly useful for having a 'scope set up on a tripod when observers of varying heights want to look through the 'scope. Taller observers can simply bend a little lower to view through the angled eyepiece, while shorter observers stand up straight and look through. With a straight-through 'scope, taller observers have to hunch down to look through a 'scope if it's low enough for the shorter observers to see through.

What about those mini-sized binoculars?

Some ultra-cheap binoculars are available with objective lenses about an inch in diameter (21 to 28mm diameter - an inch is 25.4mm). They are very small and easy to stuff in a pocket and weigh next to nothing. But they have a problem - they are tiny and weigh next to nothing. In your hands they don't hold steady. Larger, heavier binoculars tend to hold steadier in your hands, so the image doesn't jump around as much. This jumpy image is also a problem with higher magnification even in the larger, heavier binoculars. Another thing to consider - cheap roof prism binoculars won't offer the optical quality of porro prism binoculars. At that price range, they won't have the "fixes" needed to deliver the bright, clear, detailed image of porro prism binoculars. But it's not cheap or easy to waterproof porro prism binoculars.

What does "7x35" or "8x42" mean?

The number before the "X" is the magnification.

The number after the "X" is the size, in millimeters, of the objective lens.

Magnification means how many times as large or "close" the image will be compared to what you see with your eyes without the binoculars. As noted, it also magnifies minor motions in your hands, causing the image to jump around while you're trying to get a look. The more you magnify the image, the jumpier it will get, and the smaller the piece of the world you will see in the image. But that's also how much larger the image of your bird will be if you find it.

I recently compared and found that a high quality 8x42 binocular made it slightly easier to read a book text 15 feet away than the medium quality 10x42 binoculars I normally use.

The **size of the objective lens** determines how much light the binoculars can "pull" in for your image. Popular belief is that this determines how bright and how well defined your image will be. The reality is a bit more complicated - it has to do with the size of the opening in the pupils of your eyes, the magnification, and the objective lens size. The diameter of the objective lens divided by the magnification yields the actual diameter of the shaft of light coming out of the eye piece of the binoculars to your eyes. This is called "Exit Pupil". If the pupil in your eye is smaller, then a portion of that shaft of light will bounce off the opaque part of your eye's iris and won't go into your eye. That light is "wasted" and won't make your image brighter. But the wider shaft makes it easier to "find" it and get your eyes to take in a full image. Also, if you use the binoculars for star gazing at night, the wider lens and exit pupil will let your eye's pupil get wider and still take it all in. In daytime use, your eye's pupil is normally about 2-3 mm wide, and any binoculars with an exit pupil that wide will produce an image about equally bright, popular belief to the contrary. At night, a young person's iris might open up as much as 7 to 9mm wide, while a middle aged person's iris usually won't open up more than about 5mm. So a 5mm exit pupil will give you all you can use even at night if your pupil doesn't open beyond 5mm. Brightness can also vary with lens coatings and prism glass formula. I'll get to that later.

There's another thing about the size of the objective lens - larger objective lens also means bigger, heavier binoculars. As with magnfication, there's a "sweet spot" in there that's best for you. Larger and heavier does make the binoculars steadier in your hand, and the image doesn't jump around

quite as much. See note earlier on those mini binoculars. But too big and heavy can make them tiring to lug around and fatigue your arms and hands when you're trying to hold them and look through them.

It's best to try different sizes and weights for feel, comfort, how jumpy the image is, and find your own "sweet spot" for the right weight and easiest viewing.

I generally recommend 7x35 porro prism binoculars, for about $30, for people who are beginners or only use them occasionally. This includes "extra" binoculars intended for **visitors** to use. The extra price for more expensive binoculars would be **wasted** on them, because the 7x35's are much **easier for them to use**. Hard-core heavy users generally "graduate", when they have the skill, to 8x42 roof prism binoculars costing anywhere from $100 to $3,000, depending on how much they can afford and want to spend. I currently use $300 10x42 binoculars.

Field of View

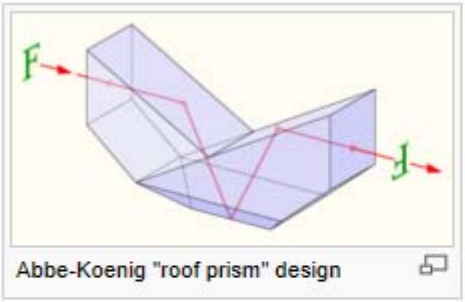
For a lot of people, this can be **VERY IMPORTANT**. For the first few years, I used 7x35 porro prism binoculars with a very good field of view and was still often frustrated when I wanted to look at a bird in a tree. I'd bring up the binoculars and focus, and find myself looking at leaves, twigs and branches. But **which** leaves and twigs and branches? Where was the **bird**? Which **tree** was I looking into? It took years to gain the skill to reliably find my bird. And that was with a very good field of view. Many binoculars have higher magnfication, which means they zoom in more on their target, filling your image with a smaller piece of the real world, a smaller Field of View. This is typically measured in how many feet across you can see at 1,000 yards distance. With lower magnification, you can see more real estate, more feet across at 1,000 yards. That makes it easier to find your bird, even though it will look smaller. With higher magnification, that chunk of real estate is smaller but your bird looks larger, if you can find it. It's a trade-off and depends on your level of skill at finding your bird in the binoculars. For beginners or people who only occasionally use binoculars, I recommend 7x or lower magnification to get the wider field of view and improve the odds of getting to see what you're looking for. Even highly skilled, all-pro level birders usually won't choose magnification higher than 8x, although some birders with above average coordination and skill at getting the bird into view might opt for 10x binoculars, - addicted, like I am, with the larger image of the bird.

Note - field of view does correspond with magnification, but not EXACTLY. Always note the specifications of the binoculars and the advertised field of view in the literature from the manufacturer or seller. Some 8x binoculars don't have more field of view than some other 10x binoculars. They do vary somewhat depending on design.

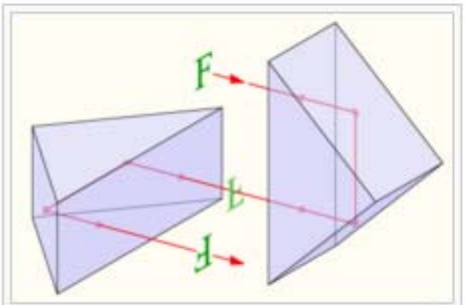
Coatings

All binoculars, even the cheapest, offer at least some anti-reflective coatings on at least some of the lenses to reduce light loss through reflecting when the light should be passing through the lenses and prisms. More expensive binoculars have fancier, more effective coatings that let more of the light through. Most mid-price and high-price binoculars boast "FMC" meaning Fully Multi-Coated on all air-to-glass surfaces of lenses and prisms, letting the most light through.

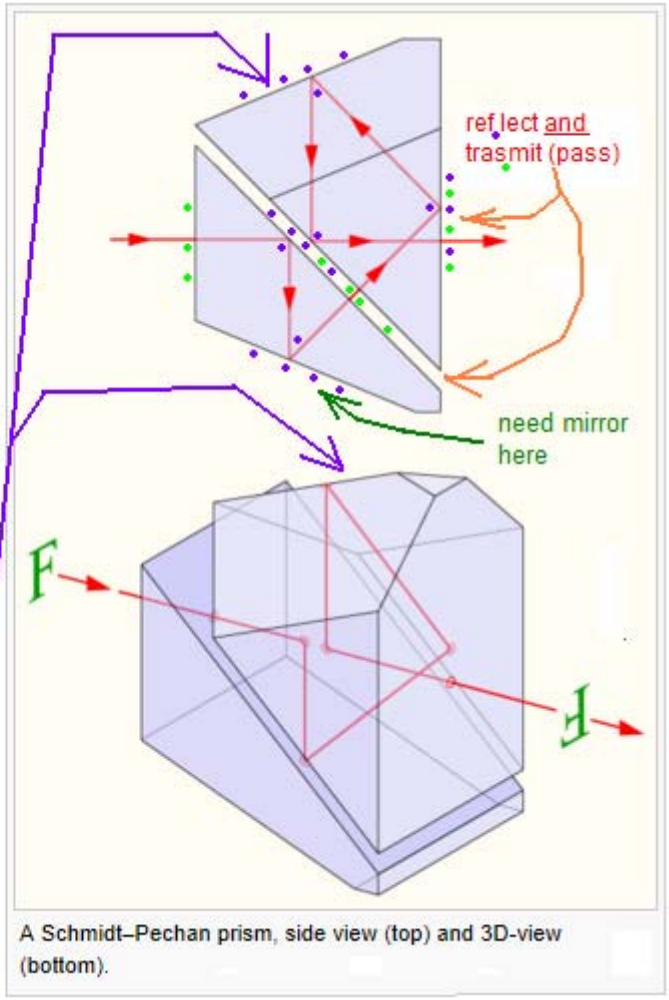
Roof prism binoculars also need additional coatings on certain surfaces of their prisms to keep the light going through properly. The "roof" surfaces that give roof prisms their name need phase correction to keep light reflecting through those surfaces from interfering and getting darker and smudgy. The cheapest roof prism binoculars probably don't have this needed "Phase Correction" or "P-coating" on those surfaces.



Abbe-Koenig "roof prism" design



Double Porro prism design



A Schmidt–Pechan prism, side view (top) and 3D-view (bottom).

Another surface on the Schmidt prism, in the commonly used Schmidt-Pechan roof prism set, needs a reflective coating, similar to the reflective coating on the mirrors in your house, to keep the light going along the path. While the mirrors in your house probably use aluminum, which reflects about 82% of the light, a more expensive silver coating can reflect 87% - 92% of the light. Stepping up in price, one can get a more expensive oxygen-free “HR” coating of either aluminum or silver – the extra steps to keep oxygen away make the metal surface brighter, about 88 – 90% for the aluminum, or 97 – 98% with the HR process silver. A still more expensive di-electric chemical multi-coating, with alternating layers of material of high and low refractive index, up to 64 or 70 carefully placed layers, can reflect over 99% of light across the visible spectrum. For a price. Note that all these mirror coatings are for roof prism binoculars only; porro prisms already reflect 100% of the light at all reflecting surfaces and don’t need either a mirror coating or a phase correction coating.

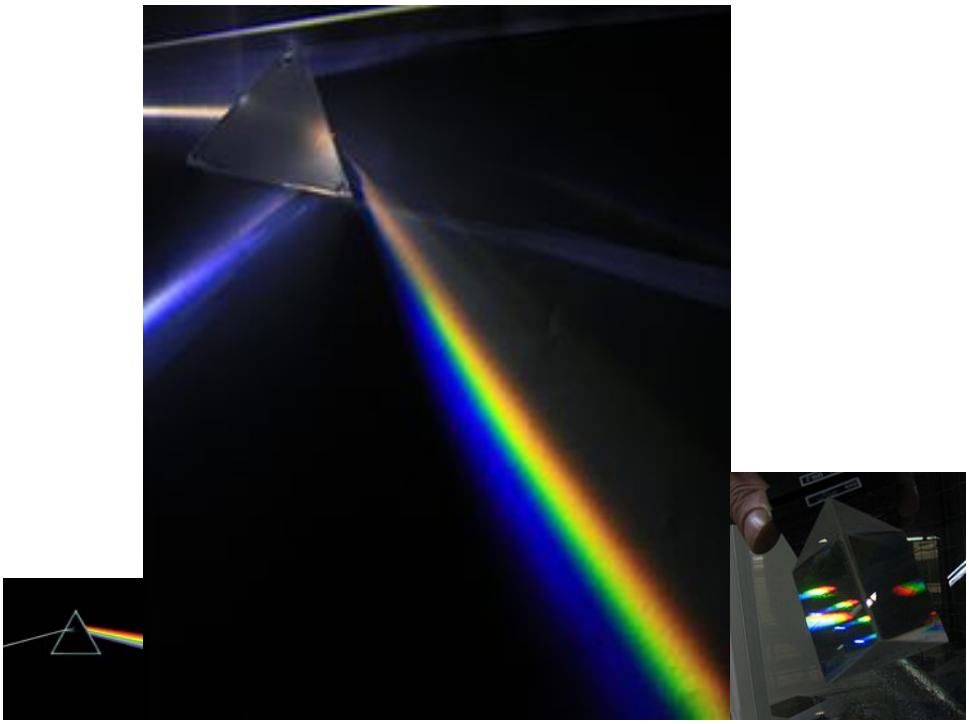
All of these various coatings are used to increase the light transmission efficiency of the binoculars, to yield a brighter, clearer image with less light getting lost along the way. More money will usually get better coatings and more light getting through the binoculars to your eyes with a brighter image with higher contrast.

Prism glass - BK7 versus BaK-4 formulas

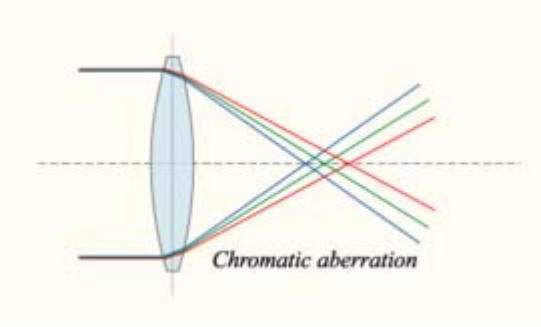
Another factor that affects how much light comes through the binoculars is the formula of glass used in the prisms. BaK-4 glass (Barium Crown formula no. 4) is more transparent (99+% in the prisms), but more expensive, than is BK-7 (Boron Crown formula no. 7) glass in the prisms (85 - 90%). So the more expensive BaK-4 glass in the prisms will yield a slightly brighter image. This is true for both porro prism and roof prism binoculars. Due to the shorter light path in the lenses, BaK-4 glass generally won't be used there, just in the prisms, which have a longer distance of travel for the light going through them. Except for special low-dispersion formulas, most high grade lenses used in quality optical equipment are made with BK-7 glass. Eye glasses, due to the very short distance going through the single lens to the eye, can even use clear plastic, which absorbs more light than glass but weighs less. For the short path through the single lens, that absorption won't be significant. The reason plastic isn't used in binoculars and telescopes is that with multiple lenses, and especially with prisms, too much light would be absorbed with the longer path through the material.

Chromatic Dispersion

Most of you have, in school or elsewhere, seen the example of the visible light spectrum of colors as produced by rainbows and also with glass prisms which break up white light into the colors that it contains, spread out by the prism or rain droplets to show the colors therein. This is fine for prisms used for that purpose, but all glass surfaces where light comes in at an angle do the same thing, to variable amounts, with their incoming light. This includes the lenses in the binoculars. It causes light of different colors to fail to come to a focus at the same place, a problem for telescopes, microscopes and binoculars, where you want a full color, clear, sharp image.

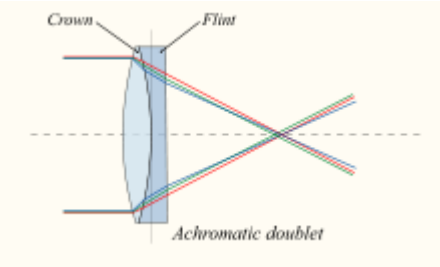


Images of prism and "rainbow" of colors – and on right, lights seen through a prism with colors smeared by the dispersion.

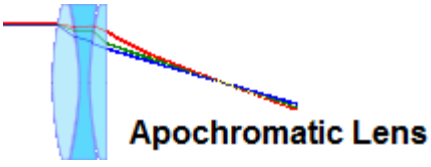


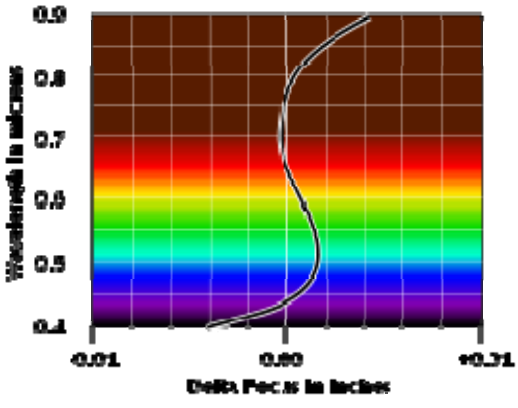
With a “regular” lens without correction, colors don’t focus at the same point.

A partial fix is the use of "Achromat" lenses, which have glass of two different formulas in them, compensating for this color "dispersion" and bringing at least red and blue light into the same focus, leaving a problem with the yellow and greens, which will remain a little bit off.
I believe that all binoculars offered for sale at all prices use at least one achromat lens.

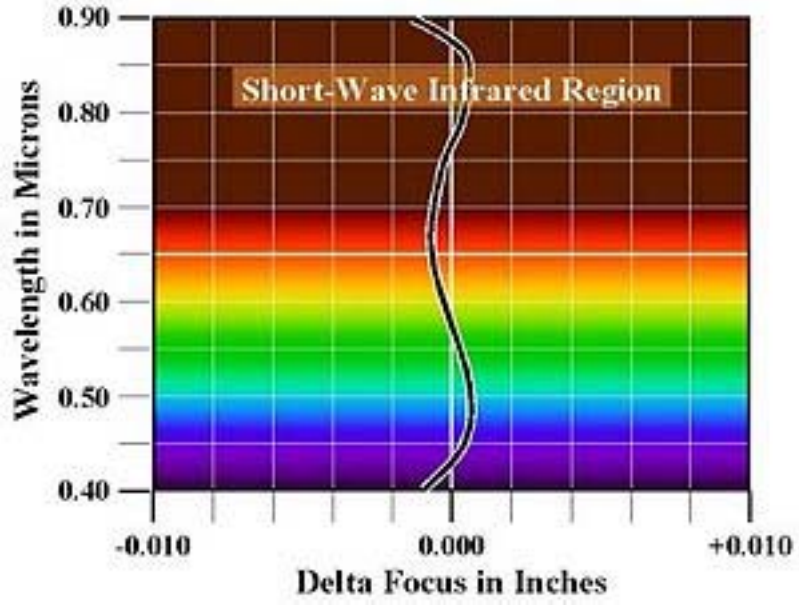


Yet another step in cost and refinement is the “Apochromat” lens, with **three** elements, and the “Superachromat” lens with **four** elements, all with differing dispersion properties, used to focus three (Apochromat) or four (Superachromat) colors of light onto the same focal point. These lens types also use the aspheric shapes (see below) to correct for geometric distortion asscociated with differing lens thickness, so a full “Apochromat” lens will correct for both dispersion and geometric distortion problems at three colors, at a price in cost, size and weight.

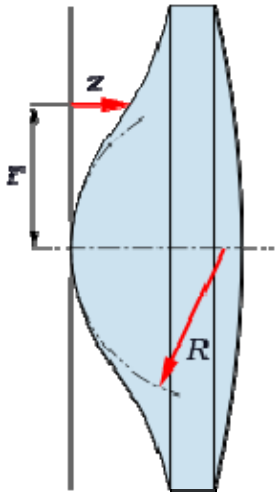




Superachromatic Lens (4 elements)



"Aspheric" lens elements

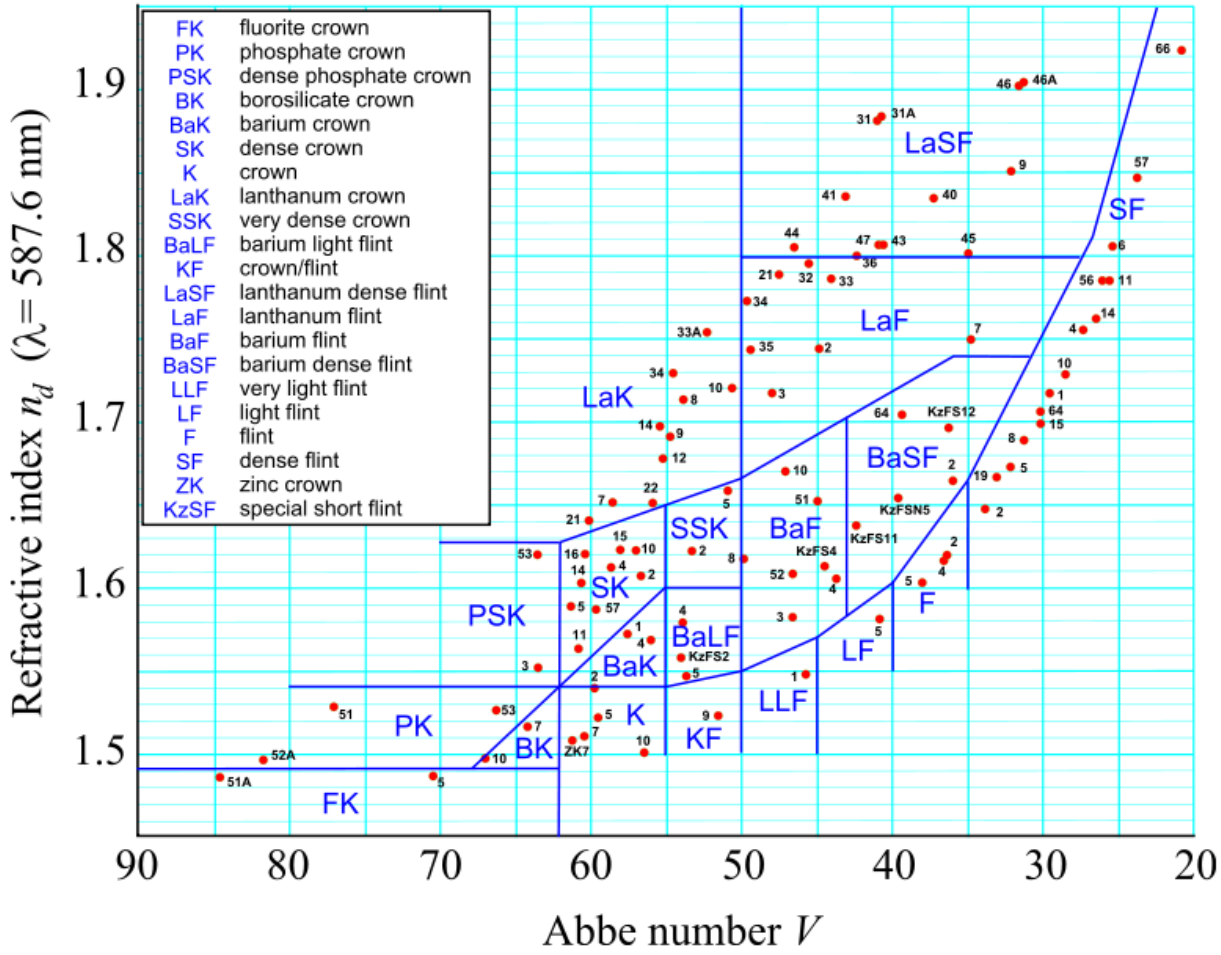


Another problem with refractive lenses is a geometric abberation in the way the light is bent, due to the varying thickness of the lens at different parts, thicker in the center and thinner out towards the edges. Some optical manufacturers make special "aspheric" lenses of complicated shapes to try to compensate for these effects and bring the outer part of the field of view into clearer, sharper focus, for a more uniform clarity across the field of view. They also try to make the shape of the image "flatter", more accurate and less geometrically distorted, an effect most easily seen when slowly moving the binoculars side to side and observing a "wave" effect where the objects seem to move toward or away from each other as the binoculars scan across the scene.

Special extra-low dispersion glass formulas

Another additional partial solution is to use a more expensive formula of glass called "low disersion" glass, or XP, HD, ED, or FL glass. The various low-dispersion formulas differ in cost and effectiveness in reducing this color dispersion, or chromatic abberation. The symptom of this problem is often seen as color fringing and degraded image quality at the outer portions of the field of view. These more expensive glass types reduce this. (These lenses use the low-dispersion formula glass in the main part of the lens. They still are achromat lenses, with a second high-dispersion formula in the compensating part.) Fluoride (FL) glass, the highest-performing formula, has been with us in apochromat and superachromat lenses (see above) since 1963, and is still very expensive.

Here is a chart showing different properties of refractive index and chromatic dispersion in different formulas of glass. Higher Abbe numbers mean LESS chromatic dispersion.



Higher Refractive Index means the lenses can be thinner (with less geometric distortion) and still bend the light as much as thicker lenses with a lower refractive index. Note that this chart does not include a third, important variable: Transmission, or how much light the glass absorbs as it passes through the glass.

Most of these problems, and some of their partial solutions, have been with us for centuries, addressed by astronomers wanting to get wide-field photos of the night sky without distortion or loss of focus across their photographic films. Some of the low-dispersion glass formulas have been around at least since the 1930's, while others, especially the new top-of-the-line FL formulas with fluorine ions in the glass, are newer. The introduction of ED and FL glass into binoculars and spotting telescopes for bird watching is relatively new and still very expensive.

So what's out there now?

Binoculars seem to come in four general classes with successively better optics and higher prices:

(1) cheap miniature roof prism (under $100), probably without phase correction coatings.
These models probably have one 2-element "Achromat" objective lens and single element lenses elsewhere in the binoculars. I did find one model in this group which is, however, both roof prism and waterproof and should be more durable than most of the others in groups 1 and 2. It could serve as an inexpensive backup mini-spare or as a "starter" for kids until they get more reliable in caring for their binoculars.

(2) economic porro prism (both miniature and "normal" size, under $100)
These outperform all entries in group 1, because they have porro prisms. But they aren't waterproof or shock proof. Handle with care. Like group 1, one achromat objective lens and single element lenses in the binoculars otherwise. These are the best choice for casual users, beginners, and "visitor" loaner binoculars.

These economic porro prism binoculars are the best value for the money.

(3) mid-priced roof prism ($100 - $500) All of these are sealed Schmidt-Pechan roof prism binoculars with metallic mirror coating on the Schmidt surface, phase correction on the "roof" surfaces, and two-element achromat lenses throughout, with anti-reflective multicoatings. Differences among the models in this group are relatively small, since the basic design is the same for all. However, differences are there, hence the need for the ratings from the comparison studies. Some of the higher-priced ones use silver instead of aluminum for more light through the prisms, and the HR process also helps. All of them do produce nicer images than either of the two preceding groups, as demonstrated at the bird club lecture demo table last September (2013). A new additional sub-grouping of three models has the added feature of ED glass in the lenses, producing a brighter image with brighter colors.

(4) premium roof prism ($1,000 to $3,000). These have the three-element "Apochromat" objective lens to correct the focus of three colors and also aspheric correction surfaces. The other lenses are achromat lenses. The mirror coating in the prism is a 60 to 70 layer iridescent dielectric coating. These refinements produce a noticeably brighter, clearer, sharper image with less eye strain, but are more of a strain on the budget. This class sub-divides into

4a premium without FL glass, less expensive, and

4f premium with FL glass, highest price but best optical performance and brightest image with brightest colors money can buy. After using one of these for any length of time, you won't want to settle for anything less. Zeiss is possibly creating a new, higher sub-class, 4ht, with a special FL glass formula with extra high transparency, which, in combination with an Abbe-Koenig roof

prism yields an unprecedented 95% transmission measurement through the binoculars, with the new Zeiss Victory T* HT series. I hope a new Cornell review coming out this fall will show how well this new series performs compared to the other already established elite premium models.

With each step up from one class to another, the image will get clearer, sharper (more detailed), and brighter, with less eye strain for the observer over long periods of viewing. Within each class, there is some variation in optical and mechanical or handling quality, which generally but not exactly follows with the price. But each class will outperform anything in the next class down in image brightness, contrast, and clarity.

Of special note in group 2 is 7x35 porro prism binoculars available for about $30. These are best for casual or occasional users; the higher-priced class binoculars will be more frustrating and harder to use for the casual observer, due to limited field of view compared to the 7x35's.

One problem is that there's very little information on the quality and performance of the low and mid-priced binoculars, to know which ones to buy and which to avoid. The $30 porro prism 7x35 binoculars can be well worth buying and using, while some others costing considerably more might be headache-makers not worth owning even for free. Only the very top-of-the-line best-of-the-best, most expensive binoculars have reliable information on their actual optical quality, along with a select few of the mid-priced models. That information comes from comparison review studies where observers compared multiple binocular models by various makers and rated them for optical quality and comfort of use. The manufacturers' websites don't have this information. One can go to most manufacturer's websites and get some specifications, such as field of view, close focus, and exit pupil, but light transmission (published in only two models), resolution, contrast, uniformity of resolution, and geometric distortion information is not published, even with the most expensive premium models. The comparison studies feature subjective reviews by testers trying out each model and scoring them on performance in various categories. No scientific measurements are presented.

There have been some comparison reviews every few years, with a selection of mid-priced and top-of-the-line models, which give a good idea of how worthwhile those selected models are, and that's where I get most of my information. There also are customer reviews, one to five stars, at Eagle Optics and at Amazon.com, which are much less reliable but better than no information at all. The most reliable information comes from Bird Watchers Digest and Birders World magazines, both bird watcher oriented publications. An older website called "Better View Desired" had older review information, but that site has not been updated for several years now, and most models reviewed there are no longer being made, rendered obsolete with continuing progress and newer, better models now being made. These studies compared a selection of mid-priced and premium models, but there are a ton of additional models and brands out there for which I have no quality information. Some other sites appear to be much less trustworthy and I don't put as much faith in their evaluations, but as with all of this, the selections of models reviewed don't overlap much for comparison, except for the top-of-the-line best-of-the-best models.

My only information on the important 7x35 porro prism binoculars is that the Maryland Ornithological Society has chosen one model to award to promising kids, and that Amazon has a similar model by another maker with even more field of view and about the same Amazon customer ratings and price. I recommend those two on this information alone, which is all I know about them. But quality 7x35 porro prism binoculars, hard to find otherwise, are a far better choice

for the occasional or casual user than any of the other binoculars out there. The more expensive binoculars would actually be a waste of money; the $30 7x35's are easier and less frustrating to use. They're lighter to carry and lighter on the pocketbook as well. Roof prism binoculars can be had for under $100, but those won't match the image quality of the $30 porro prism 7x35's.

For the seasoned and skilled heavy users, who want more, I recommend 8x42 binoculars, and after that it's more a matter of how much you want to spend. Generally, the more you spend, the better the image quality the binoculars deliver. This is where the extra price for more durable roof prism binoculars protects the investment in expensive, high quality optics. Most of the mid-priced roof prism binoculars also have this protection, including the two models of binoculars I currently use.

The most expensive class of binoculars (with the three-element objective lens) will, with their brighter images with more detail, clarity and contrast, show more color and detail on birds in poor lighting, either in deep shade or backlit against a bright sky. When the birds are nearby and well illuminated with a dark background behind them, most binoculars of all classes will produce a very similar image.

So, with the disclaimer that I just don't really know enough about the quality of most of the binoculars being offered for sale, I present below a sample listing of a few models which I believe, based on the reviews of those particular models in the articles I have been able to find, should be a good value for the price. Other models are either more expensive for the same quality, according to the reviews I've read, or are of quality unknown to me.

My listings, which follow, work upwards in price, with a few mini's leading off with the lowest price, working up to about $400, with the premium top-of-the-line models thrown in at the end for contrast. There are some other models worthy of consideration in the intermediate range between $400 and $1000, but I don't know enough about their quality to include them here.

GROUP ONE – CHEAP ROOF PRISM BINOCULARS

Two ultra cheap roof prism mini's which are NOT waterproof and one that is

Tasco Essentials 165RB 8 x 21 $11 field of view 383 ft $8.56 at Adorama plus shipping
4 out of 5 stars in 121 reviews by Adorama customers
Bushnell Powerview 8 x 21 $16 field of view 378 ft $12.52 at Adorama plus shipping
4 out of 5 stars in 291 reviews by Adorama customers
Tasco Sierra TS825D 8 x 25 $17 field of view 350 ft $17.31 at Adorama
4 out of 5 stars only 3 Amazon reviews – but this one is waterproof

None of these cheap roof prism binoculars will match the image of porro prism binoculars. One club member said his Bushnell Powerview lacked the "definition" of his newer $250 Nikon Monarch DCF binoculars. But these cheap mini's might be useful as pocket-size spares, and the waterproof model might also serve as a starter for kids until they can learn to be more reliably responsible with them and "graduate" to better binoculars, like the $30 models listed below.

GROUP TWO – ECONOMY PORRO PRISM BINOCULARS

Bushnell Falcon 7 x 35 $28.18 at Amazon - field of view 420 ft
Tasco Essentials Zip 7 x 35 $30.42 at Amazon - field of view 500 ft

These are the two best suited for casual users and visitors, easier to use than any of the more expensive models listed below, with more field of view. They are porro prism binoculars and are not waterproof, so more care is needed in handling these to keep them in good shape. Other makes and models of porro prism binoculars, including 7x35's, are available; one possible upgrade would be a more expensive pair with BaK-4 glass in the prisms for a still brighter image. Some people also buy and use 7 x 50 and 10 x 50 porro prism binoculars. The 7 x 50's are heavier and won't produce a brighter image in day-time viewing. For magnifications higher than 7, which will also have smaller field of view, I would recommend some of the more durable mid-priced roof prism binoculars instead, with waterproofing to make them still more durable.

GROUP THREE MID-GRADE ROOF PRISM BINOCULARS

Binoculars in this third group are sealed, waterproof roof prism binoculars with the needed phase correction coating for the "roof" surfaces, and a shiny metallic mirror coating on the one surface of the Schmidt prism needing the mirror coating (part of the Schmidt-Pechan prism set everyone uses). These also feature 2-element "achromatic" lenses throughout, not just the objective lens. The glass material in the prisms is the Barium Crown formula number 4, or BaK-4, which is more transparent than the cheaper BK-7 glass used in groups 1 and 2.

FoV = Field of View, in feet wide at 1,000 yards distance
eye = eye relief, in millimeters (mm) – width of that shaft of light
close = close focus, in feet from the objective lens
weight = in ounces

The next two are the cheapest in this group, but have major endorsing recommendations and are known as true quality waterproof binoculars. All of these "mid-priced" binoculars seem to have images better than those from class 1 and class 2 binoculars.

Eagle Optics Shrike 5 of 5 stars in 18 reviews by Eagle Optics customers - rated least expensive waterproof, quality binoculars by a couple who write for Bird Watchers Digest who also conducted one of the major comparison studies and ratings of binoculars in medium and high-price categories - but this model does have the lowest field of view of all binoculars shown in this list.

	FoV	eye	close	weight	price
8x42	341'	17.6mm	13.1 ft	23.2 oz	$100
10x42	304	13.6	13.1 ft	22.4 oz	$110

Atlas Optics Radian 5 of 5 stars in 36 reviews by Eagle Optics customers - rated least expensive binoculars recommended for bird watching by the staff at Eagle Optics internet store, overlooking their own store-brand Shrike recommended above by Bird Watchers Digest, and the Radian does have closer focus and a wider field of view than the Shrike has, for an extra $30.

	FoV	eye	close	weight	price
8x42	375'	17.5mm	6.5 ft	23.0 oz	$100
10x42	305	15.5	6.5 ft	23.0 oz	$110

Unless I get to see these, I can't vouch whether they can match the 7x35 porro's optical quality, but they are sealed, waterproof roof prism binoculars of good quality and will be more durable than the porro prism binoculars. They won't have as wide a field of view at their higher magnification. Since they do have the achromat lenses, they probably are similar, but not quite as bright, as the other,

higher-priced mid-grade roof prism binoculars in this grouping, which would mean a significantly better image quality than that of the 7x35 porro's.

Leupold Acadia – about $200 – my sister-in-law has a pair, and they seem fine to me. My $300 Swift Ultra binoculars have a brighter image, but otherwise I could easily be satisfied with either pair.

"Wild Bird Centers" 8x42 no specs $240 at the Wild Bird Center store
"Wild Bird Centers" 10x42 no specs $250 Kevin Graff (Baltimore Bird Club) loves his 10x WBC's.
These can be bought at Wild Bird Centers stores. They might be house-label versions of Nikon Monarch or some other manufacturer's binoculars.

Nikon Monarch binoculars (not counting the more expensive ED formula Monarch 7's) are probably the best value in the price range around $250. Monarch binoculars currently come as Monarch 3, -5, -ATB, and DCF. There's also a more expensive Monarch 7 with ED glass. The current models listed on the Nikon website are the Monarch DCF and the Monarch 7. The earlier models are discontinued by the manufacturer, but carried by the major sellers. They have the same specifications for field of view etc. When I bought my Swift Ultra binoculars for $300, the first Nikon Monarch model, then also selling for $300, was tied in quality in comparison reviews, and I chose the Swift Ultra at that time because they had slightly closer focus, 6 ft vs 8 ft for the Monarch. Now that they're available for about $250, they're best value for the money at this price. One of our club members compared three or more mid-priced models and chose the Monarch as his favorite.

Alpen Apex XP – $270 - a bit tricky; not to be confused with the older, cheaper Alpen Apex without the "XP" designation. The older ones are models 493 and 495, these are models 693 (8x42) and 695 (10x42). The year 2012 by Bird Watcher's Digest ranked these near the top of the mid-priced group. The older non XP models were ranked in the bottom third in an earlier comparison study. At $270, these are the next step up.

Eagle Optics Ranger - $300 – 5 stars 202 reviews Eagle Optics customers. With silver mirror coating (not aluminum, brighter). I tested these at 8 x 42 (also available in 10 x 42) against my Swift Ultra 10 x 42's and found I could make out fine print in a book at 15 ft distance slightly more easily with the Rangers, due to a slightly brighter image with more contrast. Another club member verified this evaluation, saying they had brighter colors than my Swift Ultra. I suspect this brightness was achieved with a silver metallic mirror coating; the Swift Ultra, like most mid-priced binoculars in this class, uses aluminum. But another club member chose the Nikon Monarch 8 x 42 model over this Ranger as his favorite.

Swift Ultra, like most of these models listed above, comes in 8 x 42 and 10 x 42. Currently available from Amazon for $302. Swift also made these in a porro prism model (now discontinued), which I bought origionally but can no longer use; they broke at the eye piece. By contrast, my replacement roof prism model has withstood the "dog wars" - the family dog chewed them up, mangling the rubber armor coating and chewing off one of the covers on the focus column, but they still work great!

Swift Audubon series. Available in three 8.5 x 45 forms – "regular" porro prism $329, roof prism $388, and ED glass porro prism $430. All are sealed and designed to be shock resistant and durable. Shows what can be done with porro prism binoculars when one tries. These are solid entries in the mid-priced class. I have seen the roof prism model and believe my Swift Ultra's produced a slightly brighter image making distant fine print on signs slightly more legible than the Audubon's image. I did not do a direct comparison with the porro models.

And now that special group of three mid-grade binoculars featuring ED glass. All are sold by Eagle Optics, and when available at Amazon or Adorama, sold for the same price. These will have brighter image, brighter colors. I compared views of a tree trunk in the woods with a hole in it, viewing first with my Swift Ultra and then with my Vanguard Endeavor ED. It was like someone had turned a light on – the view was much more luminous, with colors standing out.

FoV = Field of View, in feet wide at 1,000 yards distance
eye = eye relief, in millimeters (mm) – width of that shaft of light
close = close focus, in feet from the objective lens
weight = in ounces

Vanguard Endeavor ED – listed at $350 minus $50 mail-in rebate at Adorama – I bought these recently on a special one-day sale. These were the least expensive ED binoculars that were tested in the 2011 study by Bird Watchers Digest, scoring at the very top of their mid-priced collection for optical and other qualities. I find that the image does come out perceptibly brighter, with higher contrast, than the image from my Swift Ultra. Available in 8 x 42 and 10 x 42 models.

	FoV	eye	close	weight	price
8x42	400'	19.0mm	8.2 ft	26 oz	$350 , $50 mail-in rebate $300 net.
10x42	340'	16.5mm	8.2 ft	26 oz	$350 , $50 mail-in rebate $300 net.

Atlas Intrepid ED – with silver mirror coating (brighter than aluminum caoting)

	FoV	eye	close	weight	price
7x36	477'	16.8mm	5.1 ft	22.8 oz	$300 - here's an upgrade for 7x35 binoculars!
8x42	420'	17 mm	6.5 ft	26.6 oz	$290
10x42	342'	15.0mm	6.5 ft	26.6 oz	$300

Zeiss Terra ED (mid-grade ED binoculars, not the premium stuff)

	FoV	eye	close	weight	price
8x42	375'	18mm	5.25 ft	25.4 oz	$350
10x42	330'	14mm	5.25 ft	25.4 oz	$400

GROUP FOUR – THE PREMIUM ELITE TOP-OF-THE-LINE. $1,500 - $2,500

Now we're going into the stratosphere for those ultra-premium elite best-of-the-best at any price class. All over $1,000. Like the mid-price group three preceding, these roof prism binoculars have four lenses – objective lens, focusing lens (used in waterproof binoculars), and two eye piece "ocular" lenses. But these come with a 3-element "Apochromat" objective lens which corrects for color dispersion and "aspheric" correction, resulting in superior image clarity, perceptibly easier on the viewer's eyes than binoculars in the lower classes. The top of this group also use fluoride (FL) glass with extra low chromatic dispersion, which also improves image brightness and clarity. The main three sales sources, Adorama, Amazon and Eagle Optics, offer these premium products at

about the same price. Leica and Nikon offer 7x binoculars which could serve as an ultra-premium alternative to the economy $30 7x35 porro prism binoculars in the second group (above).

Leica Ultravid HD – with the fluoride lenses

	FoV	eye	close	weight	price
7x42	420	17	10.8	27.2 oz	$2000
8x42	389	15.5	9.8	27.9 oz	$2100
10x42	336	16	9.5	26.5 oz	$2200

Leica Trinovid (not the fluoride lenses, a more economical alternative)

	FoV	eye	close	weight	price
8x42	378	15.5	11.5	28.6 oz	$1450
10x42	324	16	11.4	28.0 oz	$1500

I suspect the "Trinovid" name came from Leitz (now known as Leica) introducing the 3-element objective lens in their binoculars. Similarly, they name their elite telescope APO-Televid, from the "Apochromat" (3-element) objective lens.

Zeiss Victory HT line – 8 x 42 and 10 x 42 models. These use the new "HT" glass invented by Schotz AG, an affiliate company with Zeiss. The "HT" glass is a fluoride formula with unusually high transparency, absorbing less of the light going through them. With the combination of the Abbe-Koenig roof prism, the "HT" glass, which is still FL, and their typically 6-layer "T*" multicoatings on the air-glass surfaces, the Victory HT binoculars achieve a published transmittance of 95%. (The only other published transmittance figure is 90% by the Swarovski binoculars, see below, using "regular" FL glass and Schmidt-Pechan roof prisms.) With the brightest image of any binoculars, these HT's may represent the next step up in top-of-the-line optical technology.

Model	size	field of view	eye relief	close focus	weight	price
Zeiss Victory HT	8 x 42	408 ft	16 mm	6.2 ft	27.7 oz	$2,200
Zeiss Victory HT	10 x 42	330 ft	16 mm	6.2 ft	28.4 oz	$2,250

Zeiss Victory FL – comes in 32mm, and 56mm objective lens sizes. But Zeiss has moved the 42mm lens "FL" models into the new "HT" line. Zeiss now offers only the 32mm and 56mm models in the "FL" line, with the "regular" Schmidt-Pechan roof prism set found in all other roof prism binoculars. The 32mm models will weigh less than the "usual" 42mm models and might be of more interest for people who prefer lighter-weight binoculars. But at that lighter weight, the image might possibly be a bit more jumpy for some users. Note that some of the other lines shown here also carry 32mm models; I'm mainly concentrating on the most popular 42mm size.

Zeiss Victory FL 8 x 32 field of view 420 $1,500 (approximately)
Zeiss Victory FL 10 x 32 field of view 420 $1,900 (approximately)

Nikon EDG – using ED glass, not the more expensive FL glass

	FoV	eye	close	weight	price
EDG 7x42	720'	22.1mm	9.8 ft	27.7 oz	$2300
EDG 8x42	405	19.3	9.8 ft	27.7 oz	$2400
EDG 10x42	342	18.0	9.8 ft	27.9 oz	$2500

Swarovski EL SwaroVision - with fluoride lenses, and with the only other published transmittance figure at 90%. These are the best sellers at present, with best-in-group close focus.

	FoV	eye	close	weight	price
8.5x42	399	20mm	4.9 ft	28 oz	$2460
10x42	336	20mm	4.9 ft	28 oz	$2500

These Swarovski's seem to be the best-sellers among the ultra-premium binoculars as of spring, 2013. Reviews generally show a three-way tie among Leica, Zeiss (FL) and Swarovski for top performance honors.

But those reviews were written before the Zeiss "HT" line appeared. (The HT's are currently available for purchase at the regular outlets.)

Also of note – at the Baltimore Bird Club binoculars & 'scopes talk in September, we had some demo models on the table, and several people concluded that the group 3 and group 4 models had noticeably better images than any of the group 2 porro prism binoculars. The one group 4 model was an older Zeiss model, still with the apochromat objective lens and clearly superior to the group 3 entries, even though they were newer.

Cornell is about to release a new comparison review later this fall, which probably will include a look at the new Zeiss "HT" line. With a more up-to-date review, I may change some of my model-specific recommendations.

Spotting 'scopes aren't as easily identified into classes. I do recommend finding one with waterproofing, same with binoculars. None of my earlier, non-waterproof telescopes or premium binoculars work any more. Both of my current binoculars are waterproof, as is my telescope, and I will no longer buy any that isn't. Fortunately, most of the mid-grade and premium-grade binoculars and spotting telescopes sold today are sealed and waterproof, protecting the investment in the expensive optics. The basic design features, including coatings and fancier lenses, influence price and optical performance the same way they do with binoculars. The prices are a higher than with the binoculars, but not by a huge amount. A cheap telescope will be similar to a cheap pair of binoculars, only much worse – with the higher magnification, the optical flaws stand out more clearly and it's harder to make out the finer details on more distant birds; you won't be able to see much through them. It gets more important to invest in a costlier 'scope which will reveal more details on distant birds, since that's what the 'scope is for. My Alpen 788 'scope costs $323 at Amazon. The best-selling elite-premium 'scopes run anywhere from $2,500 to $4,000 (or $6,000 with image stabilization), made by Kowa, Swarovski, Zeiss and Leica.

For spotting 'scopes, I've found three studies dated 2007, 2009 and 2010, with almost no overlap for models of mid-priced 'scopes covered. I found the Bird Watchers Digest article from 2009 to be most helpful, and used it to choose the 'scope I'm currently using.

Stay tuned; I'll update this article on the club web page. I can also be reached at pete_webb@juno.com with any comments or corrections you might like to make.

= = = = = = = = =

internet binocular best price sellers:

Adorama http://www.adorama.com/
- often has the best price, but always compare price with Amazon
Amazon http://www.amazon.com/
- often has the best price, but always compare price with Adorama
Eagle Optics http://www.eagleoptics.com/ - generally not as deeply discounted, but several models come at Eagle prices exclusively, and exclusively through Eagle.

Best-Price (a price comparison website) http://www.best-price.com/

= = = = = = = = =