

Unusual Eyepieces

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Discussion

I have spent the best part of 40 years acquiring astronomical eyepieces. The process has steadily altered from acquisition through necessity to collecting, mainly out of curiosity.

At one stage it was my purpose simply to build up a useful set for all my observing needs. I would buy newer, supposedly better eyepieces, and sell older, presumably poorer ones. I regret doing so now. I wish I'd kept all the eyepieces I ever bought. It never occurred to me at the time, that so many new eyepieces and eyepiece sets would appear on the market, and that almost all the eyepieces I bought in my youth would become obsolete.

I have retained some unusual eyepieces in my collection, and I am very glad I did. It makes a pleasant change arriving at either a star party, or a friend's observatory, armed with a motley set of old and not so old eyepieces that nobody else has heard of or had the chance to use. And of course it can really set the cat among the pigeons if one of them holds its own against a current much vaunted marque.

The eyepieces to be described are all classics. Some are very old, some are still

available. What they all have in common are properties with which no person who makes a study of eyepieces should be unfamiliar. By which I mean it is no use criticising a particular type of eyepiece because it possesses properties you have been told are undesirable, if you have never seen or used one. That is the one area of eyepiece lore to which I take exception. The stereotypical condemnation of older eyepiece designs, reiterated from hearsay and advertisement inferences.

Unusual Eyepieces described:

76mm Kalliplan (Symmetrical) 2–2 afov 25° multicoated
50mm Erfle type I (ex WW1) 1–2–2 afov 50° uncoated
44mm Kaspereit 2–2–2 afov 65° MgF₂ bloomed
40mm Erfle type II by Rodenstock 2–1–2 afov 70° MgF₂ bloomed
37mm König (ex NATO) 1–2–1 afov 55° multicoated
36mm Galoc (ex MoD) 3–2 afov 70° MgF₂ bloomed
27mm Bertele (ex MoD) 2–1–1 afov 60° multicoated
25mm Galoc (ex MoD) 3–2 afov 90° multicoated
1.5-inch Comet Kellner (Broadhurst & Clarkson) 1–2 afov 40° uncoated
18mm Bertele (Intes-Moscow) 1–1–2 afov 60° MgF₂ bloomed

The 3-inch (76mm) Kalliplan was made for me in 1980 by JD Greenwood, a well known ATMer at the time. He used a pair of binocular objectives, and reground and polished the fourth flat surfaces to a shallow concave which he then figured hyperbolic. It was intended to match my Quantum 6 Maksutov-Cassegrain with which it gave a 5mm exit pupil. The field is crisp from edge to edge @ x30, fov 50'arc. Contrast is excellent. It ghosts slightly, but there is no flaring. Symmetrical eyepieces are similar to Ramsdens and Kellners in giving specular ghosts of off axis bright objects. Eye relief is too long, being 0.5Fe, or 38mm. The eyepiece barrel extends 32mm beyond the eye doublet and terminates in an eye stop. It has a tunnel like narrow 25° afov.

The 2-inch (50mm) Erfle type I dates from the Great War. It is German and comes off a gun sighting telescope. I have used it on my TEC140APO with which it gives a 7mm exit pupil. Eye relief is comfortable, being 0.3Fe or 15mm. Contrast is very good. The outfield is slightly astigmatic with some lateral colour (over-correction). It is uncoated and ghosts slightly, but not annoyingly so, which I found surprising in a six air-glass surface uncoated eyepiece. I would describe the field as orthoscopic, inasmuch as it is flat and undistorted. This is not a property of later wider angle Erfle designs. Designed by Erfle in 1917, it is described in US Patent 1479229 1924.

The 1.75-inch (44mm) Kaspereit dates from WWII, and was sold as war surplus by H.W. English of Brentwood, Essex. I have had several examples of this eyepiece (advertised in English's catalogue as the "Mount Palomar Erfle"). It is an American made tank sight eyepiece. This is the most pristine, so I kept it, and restored it a few years ago. You need to position your eye carefully. It has only 0.3Fe eye relief or 13mm. It gives a 6.3mm exit pupil on my TEC140APO, and a $2^{\circ} 25'$ fov @ x27. The outfield is marred by astigmatism and lateral colour (under-corrected), and it ghosts slightly. Nonetheless it is an impressive eyepiece and provides spectacular wide field views. The field doublet becomes stopped down by a 2-inch sleeve. It is an enormous 55mm aperture, and the 47mm field stop lies immediately behind it. Kaspereit was a student of Erfle's and his 2-2-2 design dates back to 1923.

How many times have you read or been told that an Erfle is a 2-2-2 design? Next time tell them they're wrong. All Erfles have five elements, types I & III are 1-2-2, and the type II is 2-1-2. A 2-2-2 "*Erfle*" is not an *Erfle*, it is a Kaspereit. All Erfles have external field stops immediately in front of the field lens. How you distinguish a Kaspereit, should you be lucky enough to find one, is by its internal field stop, placed between the field doublet and the mid-doublet.



The 40mm Rodenstock type II Erfle is a modern ex military NATO eyepiece made in Germany. I purchased it from Marcus Ludes. I have used it many times on my TEC140APO and 10-inch f/10 Calver. It performs admirably. Contrast is excellent. There is no outfield astigmatism, defocus or lateral colour on these two telescopes. However I would not recommend it for a fast(ish) Newtonian. I have used it on a 10-inch f/6.5 Newtonian and it reveals the telescope's inherent coma wonderfully, and also exhibits lateral

colour (over-correction). Eye relief is generous @ 0.8Fe or 32mm. It gives a 5.7mm exit pupil & a $2^{\circ} 50'$ fov x25 on my TEC140APO. It copes well with the TEC's relatively steep field curvature ($r = 370\text{mm}$).

The 37mm Konig is also a modern ex NATO eyepiece which I purchased from Ian Poyser two years ago. Ron Irving adapted it to 2-inches push fit. On my TEC140APO it gives a 5.2mm exit pupil and fov $2^{\circ} 10'$ @ x26. The field stop is 37mm and the outfield crisp, no astigmatism, no defocus and no lateral colour. Like all Konig designs (there are many) the field is orthoscopic. There are no ghosts or flare and the field is dark and contrasty. Eye relief is generous, 22mm. However the rubber eye cup takes up most of it, so you still cannot use spectacles with it. That doesn't bother me. I like to nestle the eye cup into my eye socket. The rubber eyecup also has an eye flap to mask the other eye.

The 36mm Galoc is a 1980's military eyepiece which I purchased in 1993 from David Lukehurst who advertises in Astronomy Now magazine. On my TEC140APO it gives a 5.1mm exit pupil and fov $2^{\circ} 38'$ @ x27. Eye relief is an over generous 1.2Fe or 43mm. I retro-fitted the large rubber eyecup to enable me to cope with the clearance. The outfield shows slight astigmatism but no defocus or lateral colour. There are no ghosts or flaring.

The 27mm Bertele is also a 1980's military eyepiece which I purchased in 1995 at an arms fair. On my TEC140APO it gives a 3.9mm exit pupil and fov $1^{\circ} 33'$ @ x39. Eye relief 1.0Fe or 27mm. There is slight outfield astigmatism and lateral colour (over-corrected). There is slight ghosting but no flare. The field is dark and contrast very good. The eyepiece came off a laser sighting telescope. Arms fairs are a good source of eyepieces and mounted lenses.

The 25mm Galoc is also a 1980's military eyepiece which I purchased in 1995 at an arms fair. It is a very unusual design, having a steeply concave eye lens final surface. The afov is an enormous 90° . On my TEC140APO it gives a 3.6mm exit pupil and fov $2^{\circ} 22'$ @ x38. Eye relief is a generous 1.0Fe or 25mm. There is moderate astigmatism in the outfield, no lateral colour, and no noticeably rectilinear distortion. The field is dark, contrast is very good and there are no ghosts or flaring. This is my most prized low power wide field eyepiece. It is a remarkable wide field 3-2 orthoscopic design. It came off another laser sighting and guiding telescope. When you compare this eyepiece with other ultra-wide angle types, it out scores them all in having only 5 elements in two groups and only four air-glass surfaces. It was a pity the man only had one unit left because a pair would have the ultimate bino-viewer.

The 18mm Bertele is a 1990's INTES Moscow eyepiece which I purchased off a Canadian dealer in 1994. On my TEC140APO it gives a 2.6mm exit pupil and fov almost exactly 1° @ x60. Eye relief is 0.8Fe or 14mm. Outfield exhibits no astigmatism but slight defocus, no lateral colour. I like Bertele eyepieces. I used to own one made by Horace Dall, and have always regretted selling it. They are an orthoscopic 1–1–2 design with a 60° afov, similar in many ways to 2–1–1 Zeiss Konigs. It is a pity the Bertele is rarely made for amateur astronomical use.

The 1.5-inch Kellner is an antique. It was sold by Broadhurst & Clarkson for many years under the name "Comet", having been first made at the time of the Comet Halley apparition in 1910. I have had four of them over the past 35 years, and have one that looks almost identical to that shown in the photograph, dating back to the early C20th. The lenses are uncoated, the fov is tunnel like for a low power eyepiece, and it has more ghosts than Borley Rectory! The field lens is crossed convex, and any dust mote on it is thrown into magnified focus by the eye doublet. The outfield exhibits slight astigmatism and lateral colour at f/7 but none at f/10 or slower.

Findings:

EYEPIECE	AXIAL DEF	EDGE DEF	ASTIG	LATCOL
76mm Kalliplan	vg	vg	no	no
50mm Erfle type I	vg	g	slight	slight
44mm Kaspereit	vg	g	slight	slight
40mm Rodenstock	ex	vg	no	no
37mm Konig	ex	vg	no	no
36mm Galoc	ex	vg	slight	no
27mm Bertele	ex	vg	slight	slight
25mm Galoc	ex	g	mod	no
18mm Bertele	ex	vg	no	no

EYEPIECE	GHOSTS	DEFOCUS	FIELD STOP
76mm Kalliplan	yes	no	sharp
50mm Erfle type I	yes	no	sharp
44mm Kaspereit	yes	no	sharp
40mm Rodenstock	no	no	sharp
37mm Konig	no	no	sharp
36mm Galoc	no	no	sharp
27mm Bertele	no	no	sharp
25mm Galoc	no	no	sharp
18mm Bertele	no	slight	sharp

Conclusions

The frequently overlooked advantage of using modern military eyepieces is that their optical quality and aberration correction is to a standard that would be commercially uneconomic. Their polish is also to a much higher standard, as is glass purity and the multicoatings. Surface finish is quoted using a "scratch/dig ratio". The minimum standard passable in commercial optics, is a ratio of 80/50 or 60/40. Military requirements in laser rangefinders and target acquisition optics are much higher, being between 20/10 and 40/20, which means military optics scatter less light and produce better image contrast as a consequence.

Value for money:

If you can find eyepieces at an arms fair or auction, you will be able to obtain them at a fraction of their production cost, and at a price comparable to a mid-range commercial eyepiece.

New ex NATO eyepieces, like the 40mm Rodenstock and the 37mm Konig are not cheap. The Rodenstock cost €435 and the 37mm Konig £75 plus £20 for the custom machined adaptor. Both are superb low power wide field eyepieces though, that rank alongside the Pentax and TeleVue, when used at f/7 or slower. If you do not need the coma correction, these are better alternatives.

The 90° Galoc is an incredible eyepiece. The only way a 3–2 orthoscopic design could give such incredible performance at f/7 is if at least one surface is aspheric. I am only surmising this, it is not easy uncovering the optical prescription of a military eyepiece. However I have compared this eyepiece to other ultra wides of similar focal length at f/7, and over the same field angle it is just as good. It was very good value too in costing only £40.

There is undoubtedly an element of luck in what you might find at arms fairs or auctions, but it is worthwhile looking. And do not make the mistake of dismissing Erfle types as being inherently inferior to modern ultra wides. The Rodenstock for instance is an updated prescription based on the Erfle II. It performs just as well as the Pantoptic at f/7 and slower, on a refractor or a Maksutov. If you do not need coma correction at f/4 why pay for it?

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