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Buying a Telescope Eyepiece

Posted by admin on February 5, 2014



After observing a [supernova in M82](#) with a telescope during a cold winter night, I dropped my 20-year old eyepiece. The glass broke, propelling me into a new learning curve on what to consider when buying a modern eyepiece. I had been using a 35mm Plossl because it had good eye relief and targets stayed in the field of view a sufficiently long time, which were key considerations during public observing sessions. New eyepieces, I discovered, offer wide fields of view with sufficient eye relief, allowing me to use an eyepiece that concurrently yields greater magnification. Paul Surowiec of the [Michiana Astronomical Society Inc.](#) (MAS) offers some useful basics on how to purchase a new eyepiece.

First of all, seeing a supernova clearly defined in the fuzzy oblong M82 galaxy induced giddiness. I could readily see the light of one cataclysmically explosive event 12 million light years away, yet that one kaboom was brighter than the collective light of hundreds of millions of other M82 resident stars combined. That's the kind of stuff that makes it awe-stronomy.

Perhaps that giddiness is why I was reckless and allowed the old eyepiece to fall out. Or perhaps it was the cold air from another polar vortex in the winter of '14 that caused me hastily and wastily to shuffle the telescope from outside to inside the garage, without considering how the jarring move would induce the eyepiece to slip out. As soon as the eyepiece hit the cement garage floor, I recognized the tink of thick breaking glass.

It had been one heckuva utilitarian eyepiece, purchased as my first eyepiece when I ground the 8-inch glass for my reflector telescope under the tutelage of Jim Seevers at Adler Planetarium around 1992. Through that glass I and many others had seen galaxies, nebulae, planets, moons, star clusters, sunspots, comets, the moon, the Milky Way, and transits of Mercury and Venus. The 32mm Plossl did not magnify much--maybe 25 times in my scope configuration--but it yielded sufficient views for the sidewalk astronomy, star parties, and astronomy outreach I had been doing for years.

Now it was time to buy a new eyepiece. To set the scene, here was my inquiry to Paul about what I was seeking:

Paul, forgive my eyepiece ignorance, but I have to ask a basic Q or two. Optics have advanced since I made my scope 20 years ago, and I haven't kept my fingers on the pulse of the industry. I've always pulled out the 35mm eyepiece because it has sufficient eye relief and the object doesn't zip out of my field of view too quickly. When I double up and add the Barlow, the target is moving so fast I have to slew the scope between only a couple of other observers at a public venue. That rapid motion across the FOV is one of the reasons I have not considered a, say, 10mm eyepiece, cuz even if it magnifies greater it would go out of the view too fast for public stargazing.

I've also never considered what the field of view was with my broken 35mm. But if I compare it to a 68 degree or 82 degree FOV, the latter two seem astoundingly large. Either way, a 35mm is a 35mm, regardless of FOV, with the same resultant magnification when using $f_l=35$ in the math. That is, all 35mm magnify the same, regardless of FOV. This suggests to me that I can get a 17mm piece of glass that magnifies more (than the old 35mm) while maintaining a larger FOV, and hence longer viewing time between slews. Is that correct? Does that mean the eye relief is constrained across the entire larger field of view?

The big Q, though, is can I get away with the greater magnification and have a longer viewing time with the wide FOV and have it still be comfortable eye relief? I guess I want it all.



If you're in a similar situation or you have not purchased an eyepiece in awhile, perhaps it's time to consider a telescope upgrade. Paul kindly replied--in detail and yet succinctly--to my email, which he has given permission to re-post below. Hopefully it will help you, too, if you reach this eyepiece crossroad.



The standard Plössl have a field of view around 50-52°. The older style designs of eyepieces Kellner, Orthoscopic, Erfle, König, RKE and Plössl are between 40-56° FOV. The newer designs of eyepieces have added additional optical elements to stretch that FOV and gather way more of the sky, but that drives up the cost. If you look at the 100° and 120° eyepieces the cost is astronomical. Eyepieces in the 68-82° range seem to be the best compromises.

On most of the earlier designs of eyepieces as you increased the magnification the eye relief went down, down, down. Well that is no longer true on the better eyepieces, they just grind the lens different and presto they the eye relief they want. 20mm is generally the ideal eye relief. So now days you can get a wide FOV with good eye relief.

Early design eyepieces have 2-3 elements and a few had a whole 4 elements. Modern eyepiece designs have 5-8 elements. Now with all those lenses the light bends back and forth like it's going on a roller coaster ride. The down side of these eyepieces is that all that glass adds to the size and weight. So you see some of these eyepieces referred to as hand grenades and they are larger and heavier. If you ask why so many elements, well red, green and blue light are all different wavelengths and bend at different amounts going through the same lens. So along comes the next element to compensate and bend the other colors back to get them all back in focus at the same point. If you have ever looked through a refractor with a cheap eyepiece you will usually see a blue or purple halo's around the star's. The second reason for all the elements is to get the entire image center to the edge all in focus at the same point and as flat as they can.

Now with every element of glass you add you loose some small percentage of light transmission and have some reflections. So they coat some or all of these elements to enhance the light transmission percentage and reduce reflections.

Some eyepieces are filled with an inert gas such as Nitrogen or Argon. Well a small percentage of good old air will sooner or later leak through the rubber seals around the lens and into the eyepiece. Unfortunately when this happens a minuscule amount of moisture can be transferred into the eyepiece allowing for condensation or dew within the eyepiece. Well Nitrogen or Argon molecules are much larger in size and are too large to make it between the molecules in the rubber, so they should never leak out. This is the same reason you are now seeing car tires filled with Nitrogen, it prevents leakage and the tire pressure from going down.

The last thing you will note is some manufactures will state that their eyepieces are parfocal. What this means is the focus basically the same for all eyepieces in same manufacturer series. So if you you are using a 24mm Baader Hyperion and change to a 8mm Baader Hyperion you will not have to refocus your scope.

To answer your question: Yes, you can get higher magnification with the same FOV as your old 35mm.

Now for outreach events you will probably still want to stay at lower magnifications of 24mm to 40mm.



Ever since the one lady in front of Walmart pulled the eyepiece out of the scope and then dropped it on the pavement, I am reluctant to use my good eyepieces at outreach events.

Paul

Thanks, Paul. Now I'm eagerly looking forward to the Michiana Star Party on May 30-June 1, 2014, at Dr. TK Lawless Park in Vandalia, MI.

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