

# The Shoreline Observer



*Newsletter for the  
Shoreline Amateur Astronomical Association*

**President-** Peter Burkey

**Vice President-** Steve Tuls

**Secretary/Treasurer-** Mark Logsdon

*Robert Wade, Editor*

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## February Meeting

The February meeting of the Shoreline Amateur Astronomical Association will be held on February 20th, beginning promptly at 7:00 PM in the West Ottawa Middle School Planetarium in Holland, Michigan. The agenda will be as follows:

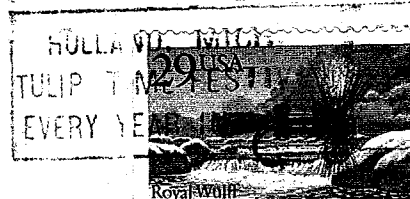
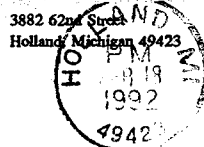
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| 7:00-7:15 | Refreshments and socializing.  |
| 7:15-7:30 | The February Night Sky Tour by Sandy Plakke.   |
| 7:30-8:30 | Mark Logsdon will present a tour of the constellations Monoceros and Canis Major. Following this, we will have an astronomy video. |

## January Board Meeting

Pete called the meeting to order at 7:00 PM, Arlin and Mark were also present. Treasurer's Report: \$346.39

Pete has been contacted by someone from *The Sentinel* for information concerning an upcoming article.

Upcoming SAAA meetings were reviewed. A big thanks to Muskegon astrophotographer Bill DeVette for an excellent January program on the 1991 total eclipse. We had a great turnout and everyone was held in awe at the beauty portrayed



in Bill's slides. February will include an astronomy video as well as a constellation tour by Mark. In March, WWMT meteorologist Peter Chan will present a program on the Aurora Borealis.

In anticipation of Astronomy Day, Saturday May 9th, the Westshore Mall will be contacted concerning a mall display similar to last years.

Two Messier Marathon dates have been set: March 6/7 and again April 3/4.

Welcome to new SAAA member John Parker!

Respectfully submitted by Mark Logsdon

## Make a High Quality 50mm Finderscope

by Robert Bunge

One recent trend in amateur astronomy has been the Telrad reflex or one power sighting device. The Telrad works by projecting the image of a bull's eye onto a piece of clear plastic angled 45° from the optical axis of the telescope. By looking through the plastic, the observer sees the bull's eye projected against the sky.

There are, perhaps, many reasons for the explosive popularity of these one power finders. One is the Telrad's ease of use. Another has to be the low cost and simple installation. Where as a Telrad can be purchased for about \$40 and glued - with the use of supplied double sided tape - directly to any telescope tube, the cheapest finders cost from \$40 to \$300, require the purchase of finder rings (about \$20), may demand the drilling of holes in the telescope tube and dictate more experience on the part of the observer. Also, many commercial finder telescopes use lower quality eyepieces with narrow apparent fields of view and little eye relief.

Nonetheless, I've never been too much of a Telrad fan - unless the telescope is equipped with both a finder and a Telrad. I have found that while looking through the clear plastic, the dimmest stars are lost - either because of the absorption of light by the plastic, or by the illumination of the bull's eye. Furthermore, while the Telrad is great at pointing at objects like brighter stars and planets, or objects near brighter stars, it lacks the precession necessary to either hunt down many very faint objects or to pin-point where the telescope is pointed to better than about 1/2° of arc. With larger (10-inch or larger) telescopes, hunting up a particular galaxy in a galaxy rich region can sometimes be very frustrating while using a Telrad, without resorting to "galaxy hopping" from a naked eye star.

As a telescope builder, I tend to be a purist. I like to make many of the items most TMs buy. This includes the spider assembly, the mirror cell, the focuser and the finder. Because I have always built telescopes on a tight budget, I have learned to use many, many household or workshop items in the construction of my telescopes. In some cases, this has knocked hundreds of dollars off the cost of a telescope. Over the course of the last four years, I have pretty much perfected a method of making a (sometimes - if you have an old eyepiece on hand) cheaper, high quality finder telescope.

The heart of the finder is a 50mm achromatic objective lens of 185mm focal length (f/3.7) made by Hoya and sold by University Optics of Ann Arbor, MI (1-800-521-2828) for \$15 in brand new, unopened

condition. However, I have purchased several (about 15) of these lenses from the owner of University Optics, at various midwest star parties for prices ranging from \$5 to \$9 a piece. While the lens is an excellent performer, perhaps the most important feature of this lens is that it will fit just inside a piece of 2-inch PVC tubing.

The tube of the finder is 2-inch PVC tubing, sold in most hardware stores. Because I almost always use PVC as a focuser tube for my telescopes, I normally have several feet of it on hand. Many hardware stores will sell it by the foot. For the finder, you need about an 8-inch length of it. Point of interest: in the course of the manufacture of PVC tubing, close tolerances are maintained only for the OUTSIDE diameters. Inside diameters can vary by as much as 1/8-inch or more. Careful selection of a piece of 2-inch PVC, which is 2 3/8-inch on the outside and 2-inch on the inside can sometimes provide a piece of tubing that any 2-inch eyepieces slip snugly inside of for use as a focuser.

The other important part of this finder is a spare low power 1 1/4-inch eyepiece. I generally use a 24mm Brandon eyepiece that provides 7.7 power with a 6.4mm exit pupil. A 20mm eyepiece will provide about 9.25 power with a 5.4mm exit pupil - ideal for most moderately light polluted observing sites where the observer may not achieve a 7mm pupil entrance. The primary advantage of this system is that you have a wide choice of eyepieces, with a corresponding wide choice of apparent fields of view, real fields of view, magnification and eye relief. If you do not have an eyepiece, but are still interested in making your finder, the cheapest eyepieces on the market tend to be Kellner type eyepieces from firms like Orion or Edmund. These will work quiet well in this finder.

I generally cut the tube to be about 7-inches long (if you don't have access to a table saw that can provide square cuts, cut the tube a 1/2-inch too long and use a file or coarse sand paper to square up the ends using a T-square). I have found if the filings from PVC come into contact with my skin, it causes an itch, so I wear long sleeves and gloves while cutting and trimming the tube.

The lens is held in place with two retaining rings made from either a discarded plastic cap of a large aerosol can (paint cans, Lysol cans, etc. - caps from black spray paint cans are best!) or 1/8th inch plastic stock from a hobby store. Quarter inch wide strips are cut from the cap using either a good pair of scissors or a hobby knife. The length of the strips are cut so they snugly fit INSIDE the PVC. With one on each side of the lens, the objective is secured into place. I generally glue the inside ring - the one closest to the eyepiece - first, about 1-inch from the end of the tube. I have used a number of different glues ranging from PVC cement to Elmer's carpenter glue, all with good results. If the aerosol can plastic is of the glossy smooth type,

I will sometimes use a hobby knife to etch a cross-hatched series of grooves into the side of the retaining ring that will be glued to the PVC. This helps the plastic to stick to the PVC.

Use a ruler, or make a measuring rod from a match stick to make sure the retaining ring is square with respect to the end of the tube - this will in turn insure that lens is pretty much square in respect to the optical axis. Before painting the inside of the tube flat black, take a piece of masking tape and mask off where the outside retaining ring - the one that will be closest to the sky - will be glued. Most glues will not stick to the painted tube, or the paint will pull off the tube wall. Next paint the inside of the tube. I avoid flocking paper and or felt because it will interfere with the baffle (more on this later).

I drop the lens into the tube without getting finger prints on it by pushing the end of a ruler or piece of 1x1 wood that I've taped several layers of tissue paper to, up the tube from the eyepiece end. With more tissues laid across the palm of one hand I place the lens on my palm with the eyepiece side of the lens (the thick element goes closest to the eyepiece) facing up. Next, I lower the tube with ruler in it down onto the lens. I use the ruler to keep the lens from dropping in too fast or wedging in the tube cockeyed and use my fingers with the tissue on it to push the lens up into the tube. If the lens does get stuck cockeyed in the tube, gently use the tissue covered ruler to push on the side of the lens farthest from the eyepiece end of the finder. Normally, the lens will rotate in the tube and can then be pushed out with the ruler. Sometimes, it will "pop" out, so be careful! The next step is to glue in the outside retaining ring. Be careful to use as little glue as possible, or you may get glue on the lens. In an effort to increase the contrast, I also use a thick, black marker pen to darken the rim of the lens black.

There are at least (probably more) two ways to make the eyepiece end of the finder. The easiest, is to use a standard 2-inch to 1 1/4-inch eyepiece adapter to hold the eyepiece. Focus is achieved by manually sliding the eyepiece in and out. NOTE: if you choose to use this method, the tube might have to be a bit longer than 7-inches. To hold the adapter in place, I like to drill a 1/4-inch hole in the tube and use a 1/4-20 tap (1/4-inch diameter, 20 threads per inch) to tap threads into the PVC (which, by the way, taps very nicely!) for a set screw. Since adapters cost money, sometimes, if I've had access to a wood lathe, I've made adapters from various types of woods or plastics. One advantage of this method, this that it will allow the use of 2-inch eyepieces in the finder! A 32mm eyepiece will provide 5.7 power at the cost of a 8.7mm exit pupil.

The other method is to buy, for about a dollar, a PVC 1 1/4-inch sink trap squeeze fitting at a hardware store. This fitting has a rotating collar that squeezes

a rubber (better) or plastic (useable) ring. Sometimes, the inside diameter of this ring is a bit too small for a 1 1/4-inch eyepiece to fit into, but that can be fixed with some 80 grit sandpaper and about five minutes work! This fitting works nicely because once you find your focus, you can rotate the collar to lock in the eyepiece and the rubber/plastic will not scratch your eyepiece. The only problem with this fitting is that the outside diameter is about 1 3/4-inches - too small to fit snugly inside the tube. I normally solve this by wrapping several, (well, really many!) layers of rubber electrical tape around the outside diameter. With the tape, you can achieve a snug fit that can be glued (but not yet!) into place. Also, because the sink-trap fitting has a outside lip that is larger than 2-inches, it will automatically square the eyepiece holder up with the tube (and therefore the lens).

At this point, a word about focus. In a perfect world, the proper distance from the lens to your eyepiece will be about 180mm (roughly, the back-focus - or distance from the back of the objective lens to the infinity focus of the lens (185mm)) from the backside of the lens to the field stop inside your eyepiece. However, in the process of figuring this out, it is pretty easy to miscalculate this distance. Therefore, I tend to make tube about a 1/2-inch longer than the calculations call for. Once the lens is mounted and the eyepiece holder made, I snug fit it together and test it out. If the eyepiece won't go in far enough to focus, I then trim a bit of tube off until it does. It is clearly better to error on the LONG side, you can always chop a little bit of the tube off.

But, before you glue the eyepiece holder in, you will need a baffle to keep stray light out of the eyepiece. Without the baffle, light from any nearby bright objects will reflect off the smooth inside tube walls and cause reflections in the eyepiece and a loss of contrast. There are a number of ways to make the baffle. One is to painfully cut it out of flashing metal. The easy way is to use the discarded cap from a can of shaving cream (7oz Edge Gel by Johnson & Sons works great!). You can either use a hole saw, or a hobby knife to carefully cut a hole, about one to 1 1/4-inch in diameter in the top of the cap. Some of these caps have a punch out hole, but normally this hole is too small. The outside diameter of the cap is normally about 1 7/16th inch. A few wraps of electrical tape will snug it up. After painting the baffle, you can push it up the inside of the tube with the ruler. At first, push it up just far enough so you can fit the eyepiece holder in. Then, insert the eyepiece holder in (without the eyepiece) and look up the inside of the tube. The idea is to push the baffle up the tube just far enough that ALL you can see on the other side of the baffle - from ANY LOCATION in the eyepiece opening - is the entire objective lens. If you can still see the inside retaining ring, it needs to be farther up the tube. If you can only see part of the objective, then it is too far up the tube. If

you push it too far up the tube, use a bent piece of wire to pull it back. Once you have the baffle in place, use a stick with drops of glue on it to tack the baffle in place.

Finally, test the finder out. Make sure the finder can focus on the stars. If you are happy, you can glue the eyepiece holder in place.

#### **Notes from the universe of homemade finderscopes.**

**Finishing the outside of the tube:** I leave it white. Acetone will neatly clean the PVC up, including taking the pink writing off. Be sure to wear gloves when handling the acetone. This process creates some sort of finish on the PVC that is pretty tough and looks nice. I have found that most paints don't stick to PVC that well and will scratch off easily.

**Threading the tube:** I almost always drill one hole midway down the tube and tap it with 1/4-20 threads. Now your finder scope can be attached to any photo tripod at will. Makes a great travel telescope.

**Finder Rings:** I like to make these out of (what else!) 3-inch PVC. I mount two 3/4-inch wide rings of PVC onto various types of wood mounts with two nails holding each ring. I drill holes and tap threads into the rings for screws to hold the finder. Don't worry if the rings wobble when the finder isn't attached. As soon as you tighten the screws that hold the finder in place, the entire assemble will become rigid.

I have also made an assembly from three pieces of wood, each about eight inches long that does the job. One piece is perpendicular to the tube of the big telescope and attaches with a screw in manner that allows it to rotate on the axis of the screw. A second piece, parallel to the big telescope and hooked the first piece, has a screw at one end that pushes against the big telescope's tube, while a piece of foam rubber from a pop can insulator at the other end provides a counter push. A third piece, also parallel to the big telescope's tube has a push screw at one end, a piece of foam at the other and a middle screw that holds the finder. Now all adjustments to line up the finder are done using only two screws.

**Dew and dew shields:** If you hunt through the ELECTRICAL section of your hardware store, you will find grey plastic PVC-to-threaded metal electrical pipe joints. The PVC side of this joint will snugly fit over the outside of the front of the finder and makes an ideal dew cap. While some folks will come up with nice rigs of heated wire to protect the objective lens from dew, I just keep an old rag (sometimes an old sock) over the finder objective while I'm not using it, folding it back when I look through the finder and replacing it when I move to the big telescope.

**Using the finder:** When people first look through my homemade finders, their first remark is often that it must be hard to use because there aren't any cross hairs to center the object on. Because I'm using commercial eyepieces, it's true that there are no cross hairs. But, it turns out that actually, the human eye/brain is very, very good at being able to find the center a circle IF THE ENTIRE CIRCLE CAN BE SEEN. Since most commercial eyepieces have enough eye relief that you can see the entire field of view, it doesn't take long to get used to not having cross hairs.

**True Astronomical Binoculars:** For a really good time, make two of these finders and create a mounting that will allow you to hold them parallel and make the fine adjustments needed to aline the optical axes. This is pretty slick and really works! Images are inverted, but a good bit brighter than normal 50mm binoculars because there are no prisms to absorb light. In addition, if you are rich enough, it will be easy to mount twin LPR filters in the optical train. It also allows you to use modern, wide field eyepieces.

During the past three or four years, I have produced about ten or twelve of these finders and sometimes sold them to other amateurs. I have had few complaints and most people seem happy with them. Hope you are too!