University Lowbrow Astronomers
Ann Arbor, Michigan

REFLECTIONS / REFRACTIONS

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University Lowbrow Astronomers

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14mm 100 degree Explore Scientific

By Mark S Deprest

Most amateur astronomer would agree that Televue has set and been the gold standard in premium quality wide field eyepieces, offering superbly crafted, well corrected, flat field, chromatically sound eyepieces at a premium price. Al Nagler and company have consistently produced eyepieces that amateur astronomers have used for comparing all other eyepieces to. So, it should come as no surprise that when Explore Scientific introduced its 14mm 100 degree eyepiece to the world of amateur astronomy that it would be compared to the 13mm 100 degree Televue Ethos.

However, before we get into all of that let me say that this is a review of a premium 100 degree AFOV eyepiece and that although I purchased the ES 14mm, I also own the 4.8mm and 7mm Televue Naglers as well as the University Optics 32mm MK-80 and 25mm MK-70, in addition to the 8mm and 3.5mm Orion Stratus eyepieces. So, I can honestly say that I do not have any particular preference to one brand over another. Like most amateur astronomer, I purchase and use those eyepieces which give the most pleasing views for the price I can afford.

Now let's get to my initial impressions; the ES 14mm is a large 2 inch eyepiece that weighs 2 lbs; it has a clean ergonomic overall design that fits nicely in your hand with a wide nubbed rubber grip band that provides for confident handling. Since the ES 14mm is advertised as being nitrogen purged and waterproof, I should probably mention that this is feature has merit, promotionally it makes the eyepiece unique, but more importantly by sealing the eyepiece and purging the air with a dry inert gas like nitrogen it should increase the life of the coatings and prevent dust or condensation from forming on the interior surfaces and elements. The eyepiece comes package in a sturdy box lined with high density die-cut foam that holds the eyepiece firmly in place during shipping; both ends have dust caps that fit securely. The rubber eye-guard is rolled down when the dust cap is attached. The 2 inch barrel is smooth but slightly tapered narrower at the housing end that should provide a little assurance that the eyepiece will not accidentally slip out of the focuser. Each eyepiece has a unique serial number and comes with a mail in registration form for its 5 year transferable warranty. Upon close visual inspection I found it to have no defects, scratches, or fingerprints, the elements are fully multi-coated as advertised and there was no visual flaws noted. I mention these facts in detail to illustrate the care and high quality attention to detail that Explore Scientific takes.

I purchased my ES 14mm from Astronomics out of Norman, OK from non-other than Pete Kron, who incidentally is the original builder of my 18" f/4.5 truss-tube Dobsonian. As you all know, anytime one purchases something for our astronomy hobby (addiction, obsession …) the weather gremlins send you cloudy skies. This time was no exception, almost immediately after I hung up the phone with Pete our weather here in SE Michigan began to change from clear skies to cloudy, raining and windy. But here in Michigan we have a saying, "if you don't like the weather, wait a minute and it will change." So, I waiting and after a few days the skies threatened to clear, well at least clear enough to do a little initial testing. As it turns out, my good friend and observing buddy John Causland was having a picnic party on Friday, July

3rd at his house to watch the fireworks his home owner's association puts on to celebrate Independence Day and new eyepieces. (Okay, they didn't know about my new eyepiece) John owns a 24" f/4.5 Starmaster and as luck would have it a 13mm Televue Ethos, that we will use to do some side-by-side comparisons with. After the fireworks, a small group of my club (The University Lowbrow Astronomers) gathered around my 18" f/4.5 a.k.a. the PK-457 to put the new eyepiece thru its paces.

Before I get into the results of our testing I need to point out some caveats; first of all none of us are optical designers or engineers, we are simple but experienced amateur astronomers that have looked thru enough scopes and eyepieces to know what to look for and what we like. Secondly, these initial tests were conducted under less than ideal conditions, the skies were rather hazy (7/10) and somewhat unsteady (7/10) and with a moon that was 4 days from being full. But since both eyepieces would be used under the same conditions I feel that any comparisons are still valid.

Prior to these observations under the night sky, we did take the opportunity to do a little day light testing of the ES 14mm in Jim Forrester's 4" f/6.5 Astro-Physics Apo. We focused on some power lines a few hundred yards away. The first thing I noted was that the entire length of the power line was spot-on in-focus across the entire field, everyone concurred. The next thing I looked for was any fringe color or hint of it, there was none, and again everyone concurred. Jim mentioned that the power line which was running horizontally thru the FOV appeared to be curved, I pointed out that the power line did sag a bit on its own, but Jim thought that it appear more curved than it should. So, to test if the ES 14mm was causing this I nudged the scope a little bit to put two power lines in the FOV, one of the power lines running thru the top half of the FOV and one running thru the bottom half. If there was any field curvature (like a fish-eye lens would produce) the power lines should show different amounts of curve, there was no difference visually evident in the two power lines, both had the same sag, and Jim concurred.

Okay, lets move on to the night sky testing, as I said before the sky conditions were not the best, but here in SE Michigan you have to take what you get and make the best of it. Due to these less than perfect conditions we confined our testing to brighter objects. The side-by-side comparisons of the ES 14mm to the Televue 13mm Ethos were blind to everyone one but myself and we only used the PK-457 scope for our testing. We tested with and without a Paracorr and the consensus is that neither eyepiece needed the Paracorr. Our test targets included the Moon, M13 and M11 here are the results and impressions. Tester involved were Jim Forrester, Mike Radwick, Charlie Nielsen, Chris Sarnecki, Dave Snyder, Paul Walkowski, John Causland and myself.

Moon with an Orion Variable 2" Polarizing Filter:

Both eyepieces showed an equal apparent field of view, a gorgeous 100 degrees. Both fields were very flat and were sharp right to the field stop. Resolution appeared equal, but as time progressed the Moon began to edge into a tree and made this difficult to judge. A very slight yellowish rim around the non-terminator edge of the Moon with the ES 14mm was noted by one of the observers. The Televue 13mm Ethos showed a very pale blue tint to the same edge, and it spilled across the face somewhat this may have been induced by the polarizing filter.

M13:

Resolution to the core, very tight stars, good contrast considering the Moonlight. Again, both eyepieces were sharp right to the field stop. No appreciable difference between the eyepieces was noted. Blind results: 4 preferred the ES 14mm, 1 preferred the Televue 13mm Ethos and the rest including myself felt there was no difference.

While observing M13 I nudged the scope a bit to see if I could fit M13 and NGC 6207 in the some FOV and the answer is yes. Now with M13 on one edge and NGC 6207 (a small spiral galaxy) on the other edge of the FOV any everything across the field in focus at 170x, this was not only a beautiful view, but a nice test of the eyepieces. Even on the very edge of FOV the core stars of M13 were still clearly resolvable and the galaxy's shape and structure were wonderfully evident.

M11:

Tack sharp stars with no pin-cushion effect noted in either eyepiece, all of the field stars were perfectly focused right to the edge. Contrast was very good and even across the field. Blind results: 4 preferred the ES 14mm, 1 preferred the Televue 13mm Ethos and the rest including myself could not decide.

The overall impressions of those who looked thru both eyepieces was that they are of the highest quality and well corrected to produce flat even fields, tack sharp focus with no visual evidence of any type of optical aberrations. I am anxious to do some additional testing under better conditions. One thing that was noted by everyone was the eye-relief of the ES 14mm is noticeably longer than that of the Televue 13mm Ethos; this made the ES 14mm a more comfortable eyepiece to use. The ES 14mm is noticeably heavier than the Televue 13mm Ethos, and is only available in 2" format (the Televue 13mm Ethos is both 1.25" and 2"). With all of this being said and when you look at both eyepieces side-by-side and the views they give, the only real conclusion I can draw is that there is no optical / performance difference in these two eyepieces. That leaves price, both eyepieces are not cheap, however the Explore Scientific 14mm 100 degree is introductory priced over $200 dollars less than the regular price of the Televue 13mm 100 degree Ethos. My only question is when will Explore Scientific begin production on additional focal lengths … I could use an 8 or 9mm and a 19 or 20mm for my collection.

Handy Accessory

by Paul J. Etzler

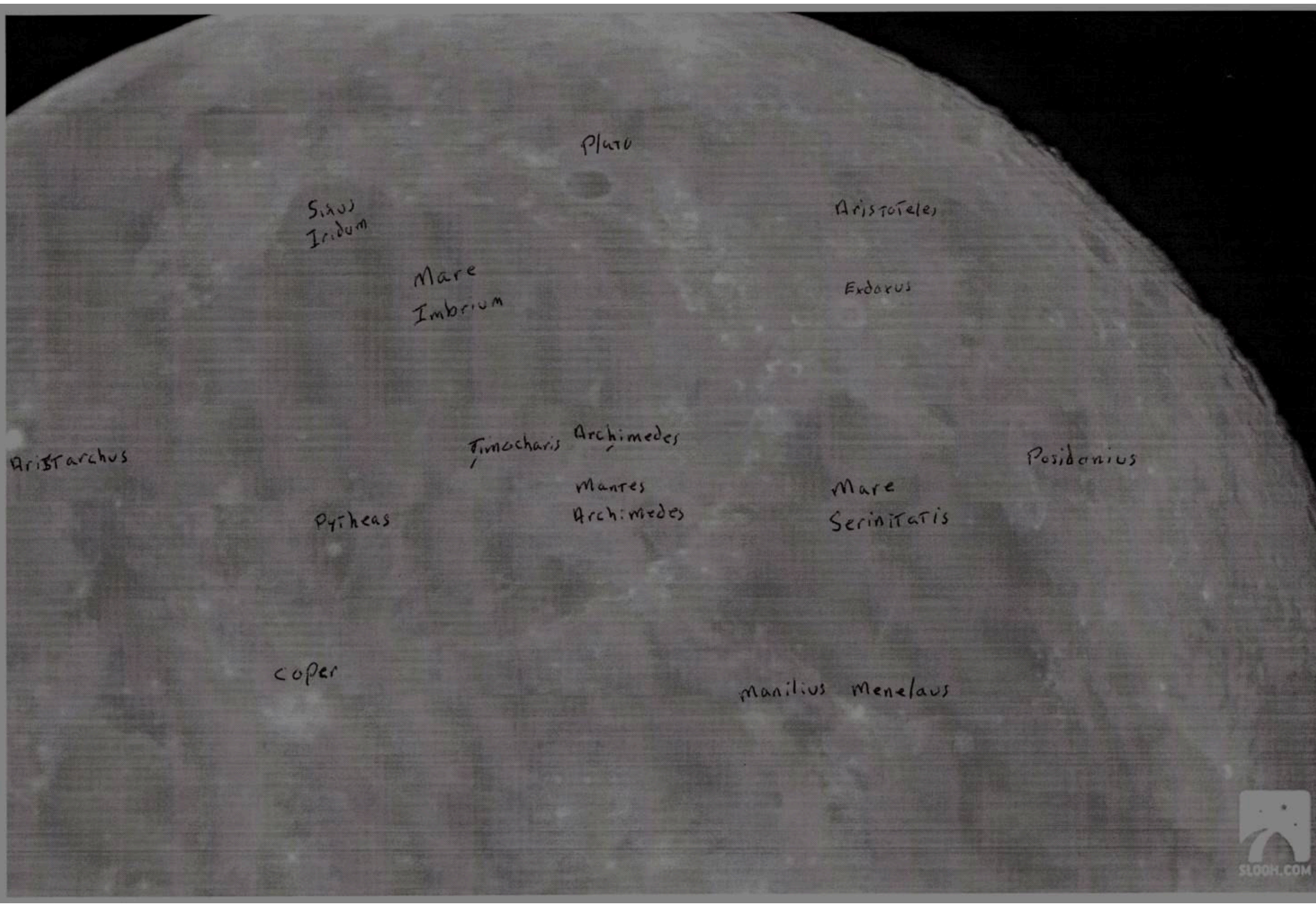
When I purchased my 6-inch, f/15 achromatic refractor in 1990 it had a 2-inch focuser, but no 1-1/4-inch adapter. I called Jan Seyfried of *University Optics* and asked if he had any for sale. He said " No, but I'll make you one". Since he was making it, I asked him if he could put filter threads in it, and he did. He simply epoxied an empty filter ring in the backside of the adapter (see photos).

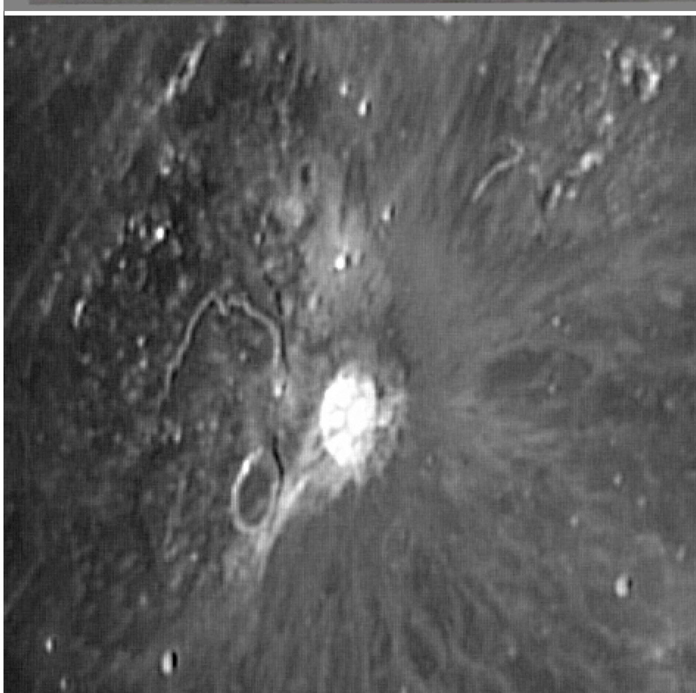
This adapter has been one of the handiest telescope accessories I have ever purchased. Consider the advantages. (1) I do not have to buy a 1-1/4 inch and a 2-inch filter since the 2-inch one now fits all eyepieces. (2) When observing at high power, I can switch eyepieces as the seeing permits, without constantly changing the filter. And (3) I can use my old 6mm *University Optics* Orthoscopic eyepiece which hasn't any threads, and still use a filter. This eyepiece produces 381X in my scope and works great, but the few times I use it doesn't justify buying a new one with threads.

I have never seen another adapter with threads like this one. What I cannot understand is why in this day and age, don't all adapters have filter threads. It is such a simple concept. Perhaps there is an optical reason for keeping the filter close to the eyepiece especially in fast scopes, but this system sure works great for me and my long focus instrument. Maybe the opticians in the club can debate this topic. My guess is that un-threaded adaptors sell more filters. Van Slyke engineering is now making an update on *Unitron's Uni-Hex* rotary eyepice holder, which has a filter holder in the body, far away from the eyepieces. This holder suggests that the concept of an adapter threaded for filters cannot be totally amiss. Go make one, you'll love it.

The Further Adventures of Amateur Astronomers and Jr. Lowbrows

By George W. Ferrier





We have not been able to do much observing over the last month due to the Tripod not working properly. The legs will not lock, so we spent the month studying the Moon. We worked with plaster and created craters using marbles, ping pong & golf balls. We also studied the phases of the Moon using a light and a large ball. We also spent time on SLOOH looking at the Moon and watching the terminator transit the lunar surface and looking at rays and craters. We are currently charting the Moon's positions viewed from our neighborhood; the kids are tracking the position of the moon and its phase as seen from their homes. These are some of the pictures we snapped on SLOOH and we were able to do some identification some of the features.

(Editors note: Thank you George for these updates on the progress you and your little group have made we all remember our first tentative steps into the wonderful hobby and the pitfalls and issued we've experienced.)

Mirror Mounts

By Tom Ryan

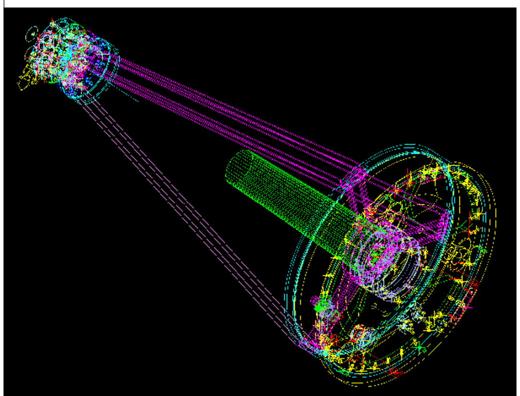
The first telescopic mirror mount I ever saw was part of my 1964 Edmund “Sky Conqueror” 4” F/10 reflector. I remember nothing about it, other than I could use it to adjust the mirror’s tilt. (I was too busy conquering the sky to notice much else!) The next mirror mount was part of a very much up-market 8” f/4.5 Cave Astrola. It, too, was adjustable with springs and wing nuts. I learned a lot about optical system alignment from that mount and the diagonal mirror’s mount. Mostly, I learned that there were a lot of things that could become misaligned in a Newtonian telescope.

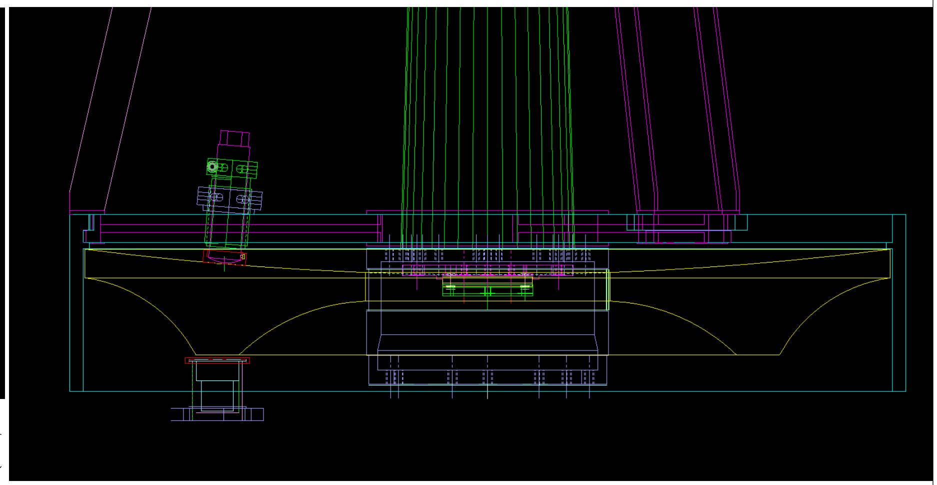
Every time I threw the Cave into the car to take it to some observing site, the optics shifted and needed to be aligned before I used the telescope. At the time, I just figured that that’s the way things were. Reflectors need to be constantly aligned, and Refractors never needed alignment. There were so many big things to learn in Astronomy, I never wondered why this should be the case.

I bought the three volume set of Amateur Telescope Making, and learned that mirror mounts also support the mirror’s weight. Well, OK. Big mirrors seem to have lots of triangular pads, and small mirrors have three. My 8” Cave had three cork pads at the 70% zone. It had three cork-covered retaining clips to keep the mirror from falling out of the cell when the telescope pointed down. I carefully adjusted these so they would not quite touch the mirror’s front surface. This meant the mirror was basically free to slide around, but I thought that was normal, too.

Above is a picture of the mount and the mirror, along with a whiffle-tree mount. Note the three white nylon set screws in the Cave mount, to the left. These were intended to keep the mirror from sliding around, but since the mirror blank had strongly tapered sides, tightening these had the effect of popping the mirror out of the mount. Even as a teenager, I knew this was not good. Nevertheless, this was state-of-the-art for amateur telescopes, and this state of the art didn't change until the advent of big, thin Dobsonian mirrors. At which point, the art got significantly worse.

Around 1981, Doug Nelle got a gigantic 17.5" mirror made by Coulter Optics, and if I'm not mistaken, it was originally mounted on a disk made of two layers of ¾" chip-board, and was fastened to it using several wraps of duct tape around its edge. Kinematics tells us that two rigid bodies will contact each other at three points. I'm still wondering where those three points were on the Coulter mirrors. Not where they were supposed to be, I'll bet.

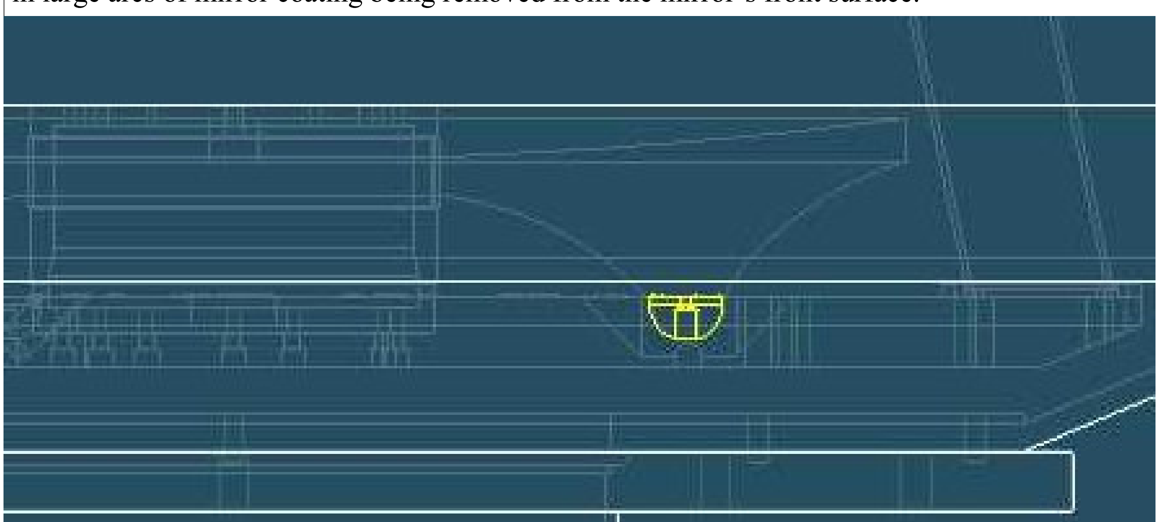




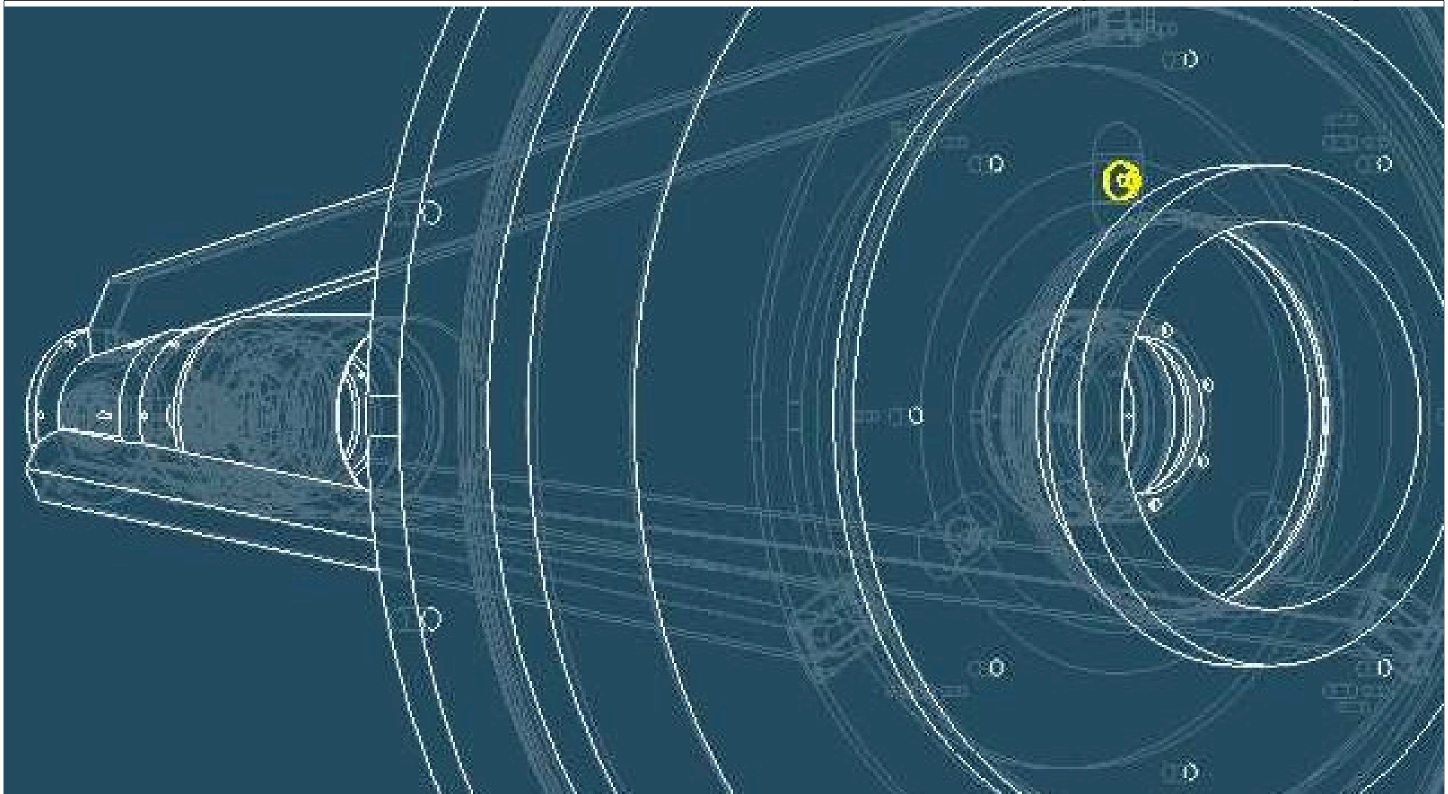
If you are trying to support a long beam (like a strip of telescope mirror, or a twenty-foot long piece of wall molding) and intend to keep it very straight, you'll have to support it at enough points to keep the sag that the beam experiences between supports below your bend requirements. It helps if your beam is fairly thick (hence the 6:1 diameter-to-thickness ratio recommended by old telescope makers), and it also helps to have lots of supports. Clearly, the beam thickness and number of supports are related.

I was asked to redesign the mount of a telescope mirror which was boosted above the atmosphere. The original designer had wanted to keep the number of supports to a minimum (three, that is), and wanted to keep the mirror adjustable. His solution consisted of using a light-weighted mirror (he adjusted the beam thickness) called a double-arch, and three really big bolts.

The existing design had three bolts under the support arch of the mirror blank (in yellow in the above drawings) and three more bolts pressing against the face of the mirror to keep the mirror in place. They were in-line with the lower bolts to minimize any bending stresses. The mirror was located axially by a strip of Teflon between the mirror's central hole and the baffle support tube hub. However, the mirror was not prevented from rotating, so when the rocket was launched and began to spin up like a bullet for stability, the mirror's inertia caused it to spin between the bolts, resulting in large arcs of mirror coating being removed from the mirror's front surface.



The mount had other problems, believe it or not. Teflon cold flows (that is, it acts like cold molasses) and has a bump in its expansion curve near room temperature. It is, therefore, not a reliable locator. The bolt-support beams were made of Invar for temperature stability, but Invar is a very weak metal, and the beams



kept getting bent upon landing. The bolts and nuts were both made of stainless steel, which naturally galled and tended to weld together. Grease is not an option in UV spacecraft.

My solution to this was to epoxy three Invar hemispheres to the back of the mirror, and to remake the mirror support cell so that it had three radial V-grooves, into which the hemispheres dropped. This is a kinematic mount, and the mirror can be removed and replaced within microns of its old position. The Invar pads were threaded, and bolts secured the mirror to the back plate. The system has no adjustment, so I lapped the hemispheres until the axis of the mirror and telescope were within 0.003" of each other, measured at the secondary mirror. Once set, this system never goes out of alignment. (Unless something catastrophically breaks.)

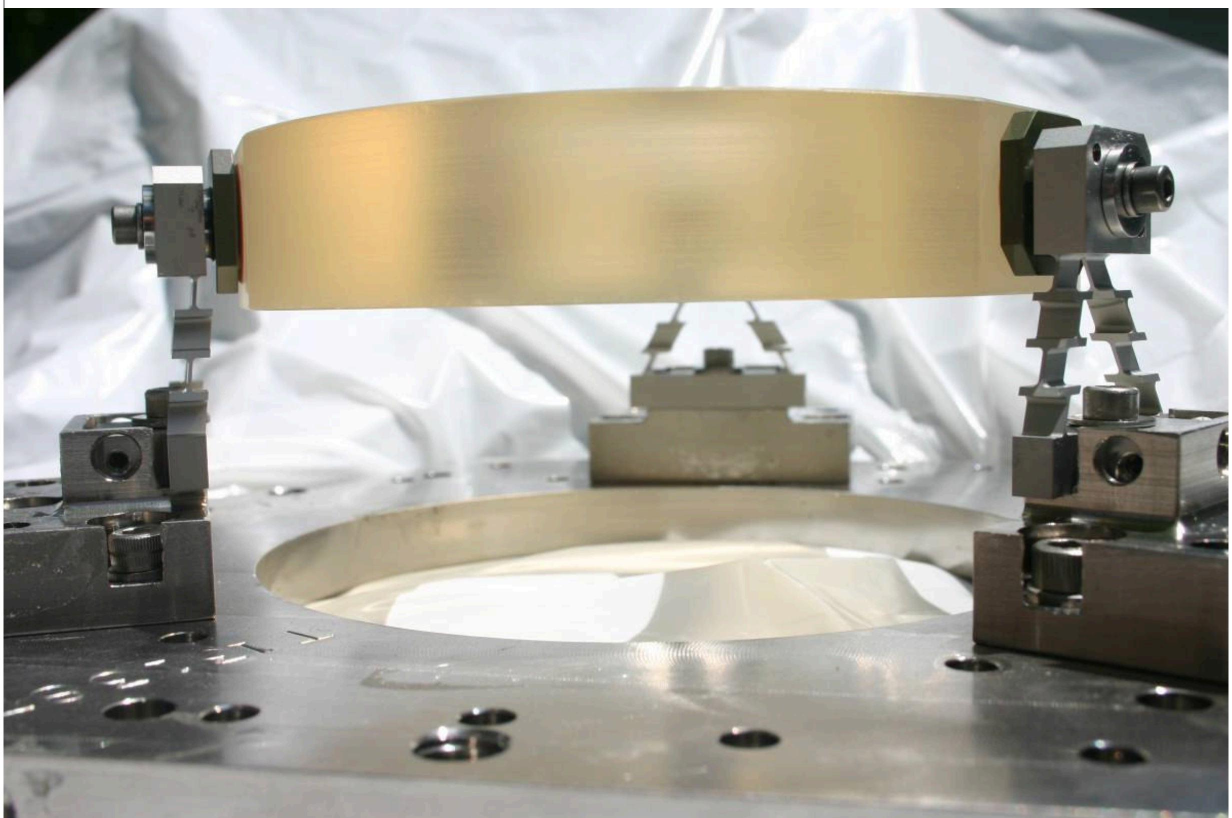
I really like light-weighted, double arch mirrors. They are lightweight and stiff, though expensive to make. But what do you do if your mirror is a thin disk?

At some point in time, from my reading, I made an amazing (to me) discovery. Mirror mounts not only support the mirror and orient it, but they also should not impose local bending on the mirror. Let me explain what I mean by this.

If you are supporting a horizontal beam and several of your support points are too low, you can simply adjust their height until the beam is straight. The makers of the Hubble mirror took this approach when polishing it, face up. They supported the mirror with dozens of individually adjustable pads, each one tunable to support the mirror's local weight. This is much harder to do on a variable orientation telescope mirror, where beam sags on the order of millionths of an inch will affect your image, and local weight on the supports goes from 100% to zero as the mirror's axis is tilted from vertical to horizontal.

Whiffle tree mounts are one solution to this problem. They consist of three-point supports on a rigid plate with a pivoting support point in the middle. These support points can be supported in turn in groups of two or three, and this process can be repeated ad-infinitum. Hence, mirror mounts can be found with 3-, 9-, and 18-support points. They were first popularized by Hindle in ATM vol. I, and one appears in the first photograph in this article.

Multiple supports are where things can get tricky. Theoretically, the pivoting support point pivots with no effort. But in the real world, pivots have friction and tend to stick in place. In sensitive weighing balances, pivots are often made using high hardness, low friction jewels, such as sapphire, to allow the balance to adjust freely to tiny forces. However, mirror mounts usually don't have anything like that level of engineering. (Scales can also be lifted off their pivots, and are usually not tilted sideways.) As a result, the mirror cell's pivot point can stick at one particular angle, and then the three support points don't support equal amounts of the mirror's weight. They cause the mirror to bend, locally. I, personally, saw a "professional" 18-point mirror mount in which only about half the mirror supports were actually touching the mirror. Clearly, those pivots had much too much friction. The challenge is to make the pivot point strong enough to support the mirror's weight, and weak enough to bend before the mirror deflects locally by one-millionth of an inch.



Many Dobsonian (big, thin) mirrors use globs of silicone sealant to both retain the mirror in place and support it. The silicone sticks to the glass very, very well, and in bulk, acts like a soft spring. That is, it deflects a lot under little pressure. This means that if the mount that supports the mirror is bending because of heat or stress, the mount deformations are averaged out over many globs before they get to the mirror.

The disadvantage of this is that those same soft springs allow the mirror to tilt by different amounts at different orientations. The soft springs act in the extreme like a bunch of Slinkies. For amateur Newtonians, which have fairly large fields of fairly good definition, mirror tilt is not a major problem, especially if they are used visually. But for some telescopes, mirror tilt with orientation can be a very big problem.

The solution most professionals use for mid-size mirrors is to mount the mirror using beams which are weak in bending but strong in compression. They also try to place the mounting points at the mirror's neutral axis. The neutral axis is the imaginary surface inside the mirror blank itself which, if the mirror is bent in any way, bends, but neither compresses nor stretches.

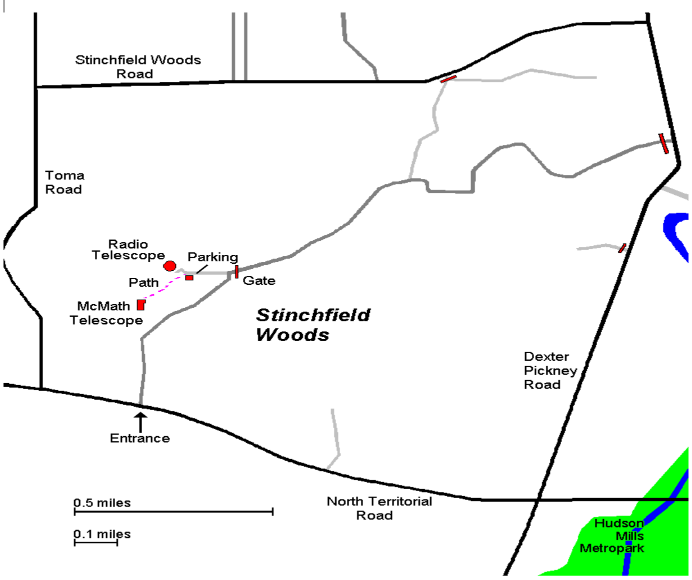
An example of this kind of mount is shown in the following photograph of the system used to mount the Zerodur primary mirror in the Cassegrain telescope used in the Deep Impact mission to Comet Tempel 1. You can see that the mirror supports connect to the mirror at the mirror's neutral axis, the metal mounts are glued to flats ground on the side of the mirror, and the supports are angled to prevent rotation or tilt. They are also cut away so that they act as if they had pivot points at either end, while still retaining the axial stiffness of a rigid beam. These particular beams have been wire EDM'd to shape, but they could as well have been milled or ground to shape.

At some point, the opto-mechanical technology used in space flight will appear in amateur telescopes, the state of the art will advance, and we'll all get better stuff, including a direct return on our tax dollars. Life can be very good.

Places & Times

Dennison Hall, also known as The University of Michigan's Physics & Astronomy building, is the site of the monthly meeting of the University Lowbrow Astronomers. Dennison Hall can be found on Church Street about one block north of South University Avenue in Ann Arbor, MI. The meetings are usually held in room 130, and on the 3rd Friday of each month at 7:30 pm. During the summer months and when weather permits, a club observing session at the Peach Mountain Observatory will follow the meeting.

Peach Mountain Observatory is the home of the University of Michigan's 25 meter radio telescope as well as the University's McMath 24" telescope which is maintained and operated by the Lowbrows. The observatory is located northwest of Dexter, MI; the entrance is on North Territorial Rd. 1.1 miles west of Dexter-Pinckney Rd. A small maize & blue sign on the north side of the road marks the gate. Follow the gravel road to the top of the hill and a parking area near the radio telescopes, then walk along the path between the two fenced in areas (about 300 feet) to reach the McMath telescope building.



Public Open House / Star Parties

Public Open Houses / Star Parties are generally held on the Saturdays before and after the New Moon at the Peach Mountain observatory, but are usually cancelled if the sky is cloudy at sunset or the temperature is below 10 degrees F. For the most up to date info on the Open House / Star Party status call: (734)332-9132. Many members bring their telescope to share with the public and visitors are welcome to do the same. Peach Mountain is home to millions of hungry mosquitoes, so apply bug repellent, and it can get rather cold at night, please dress accordingly.

Membership

Membership dues in the University Lowbrow Astronomers are $20 per year for individuals or families, $12 per year for students and seniors (age 55+) and $5 if you live outside of the Lower Peninsula of Michigan.

This entitles you to the access to our monthly Newsletters on-line at our website and use of the 24" McMath telescope (after some training).

A hard copy of the Newsletter can be obtained with an additional $12 annual fee to cover printing and postage. Dues can be paid at the monthly meetings or by check made out to University Lowbrow Astronomers and mailed to:

The University Lowbrow Astronomers

c/o Liz Calhoun

P.O. 4465

Ann Arbor, MI 48106

Membership in the Lowbrows can also get you a discount on these magazine subscriptions:

Sky & Telescope - $32.95 / year

Astronomy - $34.00 / year or $60.00 for 2 years

For more information contact the club Treasurer. Members renewing their subscriptions are reminded to provide the renewal notice along with your check to the club Treasurer. Please make your check out to: "University Lowbrow Astronomers"

Newsletter Contributions

Members and (non-members) are encouraged to write about any astronomy related topic of interest.

Call or Email the Newsletter Editor: **Mark S Deprest (734)223-0262 or msdeprest@comcast.net** to discuss length and format. Announcements, articles and images are due by the 1st day of the month as publication is the 7th.

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Reflections & Refractions

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This was taken very near the "Causeway" (John Causland's home) on July 3rd. While not exactly stargazing (that came after the smoke cleared), at least we were looking in the right direction (up)! The shot was taking with a Canon EOS 30D, 1 second exposure at ISO 500 F5.0. My hand was none too steady, but the result was interesting.--Mike Radwick

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