University Lowbrow Astronomers

Ann Arbor, Michigan

REFLECTIONS AND R RACTIONS

OF THE UNIVERSITY LOWBROW ASTRONOMERS

JULY 2003

Upcoming Events

July 2003

- **Saturday, July 5 (Starting at Sunset) Regular Scheduled Open House and Star Party at the Peach Mt. Observatory. Weather Permitting.**
- **Friday, July 18 (Starting at 7:30) Monthly meeting held at Peach Mountain. John Kirchoff of the Livonia Rider's Hobby Store will be demonstrating the latest in astronomy gadgets.**
- **Saturday, July 26 (Starting at Sunset) Regular Scheduled Open House and Star Party at the Peach Mt. Observatory. Weather Permitting.**
- **Saturday, August 2 (Starting at Sunset) Regular Scheduled Open House and Star Party at the Peach Mt. Observatory. Weather Permitting.**
- **Friday, August 15 (Starting at 7:30) Monthly meeting held in either room 130 or 807 in the Dennison Building. Meeting Multiple speakers.**
- **Saturday, August 23 (Starting at Sunset) Regular Scheduled Open House and Star Party at the Peach Mt. Observatory. Weather Permitting.**

Doug Nelle on His new tripod. See page 6 for details on making your own

My Coming Comeuppance

by Lorna Simmons
(Astronomer Extraordinaire)

All right, all right. I confess. My main interest in astronomy from the time I was three years old has been more like an interest in cosmology with simple (if there is such a thing) astrophysics taking a close second. At three years of age I had my first glimpse of the magnificent Universe (which event I have remembered down to the minutest detail), when my father, an optical physicist turned patent lawyer (more lucrative), explained everything to me in language reflecting the state of astronomy and cosmology at that early time (probably Steady State Theory). My fascination with celestial sciences has not changed since then. Therefore, if I seldom seem to be interested in finding celestial objects but more interested in the physical characteristics of those objects (which one can read about in books), it all began early. One does not need a dark site to study the appropriate literature on astrophysics and cosmology.

This does not mean that my major interest has always been in astrophysics and cosmology. I have had a lot of competing interests during my life. Since, as a female, venturing outside alone at night was not a good idea then and now, studying about the cosmos seemed to be a far better idea. I have found myself to be much more interested in the complete Electromagnetic Spectrum as it was made available for study during the 20th Century, rather than in the much narrower visual band used in amateur astronomy. I could not venture outside by myself at night when I was young and my father was always busy (or away during World War II). Later, when I was married, it was not nice for a wife to leave her loving husband to go out and play astronomy games with the then (usually male) amateur astronomers. Horrors! Therefore, it was not until several years of widowhood that I ventured out into that great, unknown world of astronomy clubs. After belonging to several clubs, Lowbrows seemed to be the wisest choice for me (considering my interests).

Buying a Questar was possibly inadvertently done (long before my membership in Lowbrows) in homage to my late wonderful optical physicist turned patent lawyer (more lucrative) father who had introduced me to the sky at three years of age. He would have approved of my telescopic selection (since Questars, said to be used on the NASA Space Shuttles by NASA Astronauts, are reputed to be the best small telescopes of that size). Besides, I cannot carry the monsters that the wonderful, strong, real amateur astronomers in Lowbrows so easily coax down the hill to the observatory on Peach Mountain.

So, when you see me with my wonderful little telescope, be patient. Reading about astronomy is easy. Practicing it is difficult. My doctor's orders require that I stay away until the mild weather (when I have to battle the West Nile Virus carrying mosquitoes). If I seem to be unaware of which end of the telescope goes where, have patience. In no time flat I will be able to find nearby celestial objects. Later? Who knows? I will leave the more difficult viewing to the seasoned veterans of Lowbrows.

Full Moon anyone? Given a little help, I am certain that I can find the Full Moon.

About the University Lowbrow Astronomers

The University Lowbrow Astronomers is a club of Astronomy enthusiasts which meets on the third Friday of each month in the University of Michigan's Physics and Astronomy building (Dennison Hall, Room 130 or 807). Meetings begin at 7:30 PM and are open to the public. Public star parties are held twice a month at the University's Peach Mountain Observatory on North Territorial Road (1.1 miles west of Dexter-Pinckney Road; further directions at the end of the newsletter) on Saturdays before and after the new Moon. The party may be canceled if it's cloudy or very cold at sunset. For further information call (734) 480-4514.

What Do Telescopes Do?

by Doug Scobel

Sounds like a simple enough question, doesn't it? But the answer isn't as simple as you might think. The telescope must perform a number of functions all at once, and all these functions are interrelated.

Basic Functions of the Telescope

Since most if not all of you already know this, I'll just touch on them lightly. There are three basic functions of a telescope (at least those used by most amateurs) - light gathering, resolving, and magnifying.

Light gathering power is a measure of how much light the objective (primary mirror in a reflector, lens in a refractor) can collect from distant objects. Nominally, it is proportional to the square of the diameter of the aperture. Doubling the aperture results in gathering four times as much light.

Resolving power is a measure of the amount of detail that is possible to see in the image. Nominally, it is proportional to the diameter of the aperture. Doubling the aperture results in resolving details that are half the size, ideally, at least.

Magnification is not an inherent property of the telescope, but rather something that the telescope must be made to do to be able to see anything through it. In other words, the image produced by the telescope's optical train must be made large enough so that you can see details in it. As we'll see later, there are upper and lower limits to how much magnification you should use visually.

What's More Important, Magnification or Aperture?

Many believe that magnification is the most important factor in a telescope. Well, this is partially true, because a telescope that does not magnify is pretty useless (single power reflex type finders notwithstanding). But, too much magnification causes a host of problems in the image. A partial list of these problems is:

- The image becomes too dim, because the light is spread out over a too large area
- Optical train aberrations become overly noticeable
- Atmospheric effects become objectionable.
- Vibrations and/or instability in the mounting prevent the image from staying in one place.
- The image can be magnified to the point where it is no longer useful.

Others believe that simple aperture is what's important, the more the better. Well this is also only partially true, because a telescope that does not collect more light than your unaided eyes is just as useless as one that does not magnify. But, too much aperture (some believe this to be an oxymoron!) also can cause problems, such as:

- Weight and bulk of the telescope can become excessive, making it less or not portable.
- Height of the eyepiece (in Newtonian reflectors) when pointing near the zenith can require climbing a tall ladder, in the dark, potentially on uneven ground, when you're tired, etc.
- Tube length (in refractors) becomes so long as to become nearly impossible to mount effectively.
- The telescope becomes overly expensive.

Often, a telescope that is too large and difficult to transport and/or set up and/or use will tend not to be used much.

There obviously needs to be some kind of happy medium, where the aperture and magnification are balanced and work with, instead of against, each other. In fact, the two depend on each other.

Magnification

Magnification in a telescope is determined by the simple expression:

In virtually all telescopes, the focal length re-

> Magnification = Effective Focal Length of the Telescope / Focal Length of the Eyepiece

mains fixed, so you vary the magnification by using eyepieces with different focal lengths.

EXIT PUPIL

Before we go on, we need to talk about the exit pupil. The exit pupil is what we call the small disk of light coming out of the eyepiece. If you put an eyepiece into the focuser and then stand back a ways, you'll see a small circle that appears be suspended in space a little way back (towards you) from the eyepiece. This distance from the eye lens of the eyepiece to the exit pupil is known as the eyepiece's eye relief. The exit pupil is actually an image of the telescope's objective, and if the telescope is an obstructed reflector, then you'll see the silhouette of the secondary in the center as well. For optimal viewing, you must place your eye such that your eye's pupil is coincident with the telescope's exit pupil.

The diameter of the exit pupil is dependent on the aperture and the magnification, in particular:

Lower magnifications produce a larger exit

Exit pupil diameter = Aperture / Magnification

pupil, and higher magnifications produce a smaller exit pupil. As we'll see later, the exit pupil diameter comes into play when choosing eyepieces, and can be critical when choosing a low power eyepiece.

HIGHEST USEFUL MAGNIFICATION

From a practical standpoint, there is a highest magnification you should use, for the reasons outlined above. As a general rule of thumb, the upper limit is about 50x per inch of aperture. But this is a generality – sometimes you can use more, sometimes you can't go that high. Just a few of the factors that can limit how much magnification you can use are poor atmospheric steadiness, poor optics, a shaky mount, difficulty getting an eyepiece with a short enough focal length or with enough eye relief, etc.

Because telescopes, observers, and observing conditions vary so much, it's really up to the observer to decide when too much is too much. It's a self-correcting problem, though. When adding magnification makes the image worse, rather than better, then you know that you've gone too far.

LOWEST USEFUL MAGNIFICATION

Conversely, there is a lowest magnification you should use, at least if you want to use the entire aperture of your telescope. The idea is to match the diameter of the telescope's exit pupil to that of the pupil of your dark-adapted eye. For you youngsters out there, that's about 7mm. For older folks like me, it's more like 6 or even 5 mm. If you go with too little magnification, then the exit pupil becomes too large, and some of the light is blocked by your eye's iris rather than entering the pupil. It's just like stopping your scope down to a smaller aperture.

The fortunate part is that it is easy to calculate the diameter of the exit pupil. For example, an eight inch (203 mm) telescope at 30x will provide almost a 7 mm exit pupil. So, your lowest power eyepiece should have a focal length to provide about 30x. If you were to go lower, say to 20x, the exit pupil will be more than 10 mm in diameter, which is too large to fit into your eye. Your eye's pupil will then act as an aperture stop, effectively stopping your eight inch telescope down to under six inches in diameter!

It's more convenient to express this optimal low power eyepiece (OLPE) in terms of its focal length, which happens to depend only on your telescope's focal ratio. The expression is:

For example, for all f/5 telescopes, and a de-

OLPE Focal Length = Exit Pupil Diameter x Focal Ratio

sired exit pupil of 7 mm, the OLPE would have a 35 mm focal length.

So how do you know if your exit pupil is too big, since most people don't know the diameter of their dark adapted eye's pupil? What you can do is put in your lowest power eyepiece, center a relatively bright star in the field (but not too bright, because your pupil may constrict a little), and then defocus the star's image until you see a large disk. If your exit pupil is too large, then you will see the outer edge of the expanded disk move around and change shape as you try to keep your head steady. You will actually see how your eye's iris is blocking some of the light. But if the outline of the image seems to "stand still", and remain circular, then you're OK and all the light is entering your eye.

Now there is a time when it is valid to go with a "too low" magnification, and that is when you need that larger real field of view, say while scanning for some faint object like a comet. Nothing bad will happen, just realize that you're not using the full diameter of the objective when you do, and you are simply sacrificing image brightness for a larger actual field of view. But once you've found your target, switch to your OLPE for the optimal low power view.

RESOLVING POWER

Resolving power can mean at least two things. One is the amount of detail you can see in an extended object, say a planet. Another is how well your telescope can split close double stars. They are not necessarily the same measure.

To see the maximum amount of detail in a planet, top optical quality is essential, especially when the object's detail has low contrast. Good optics will concentrate as much light as possible into the center of the diffraction pattern, and scatter a minimal amount of light outside of it. This not only requires good optics, but it also requires that those optics are clean, well aligned, with little or no thermal currents in the light path, shielded from stray light, on a steady mount, with a steady atmosphere, etc.

But, to resolve close doubles, top optical quality is not necessarily required. In fact, you'll be able to split slightly closer doubles with a telescope with a little less than perfect optics, than you can when your optics are perfect. The reason is that with less than perfect optics, less light goes into the so-called Airy disk in the diffraction pattern, and more goes into the surrounding diffraction rings. This makes the Airy disk appear smaller, and hence it is easier to discern whether there are two stars or one. You can take this too far, though. Too poor of optics cause the diffraction pattern to degrade to the point where the two star images kind of merge together.

WHAT IT ALL MEANS

In the end, the single most important factor in determining how well a telescope will perform is aperture. The more aperture you have, the more light in the image, and the better the theoretical resolution in that image. Now there are practical limits to how much aperture you can use in practice, but there's too much to write about on that subject, so I think I'll save that for another time.

A New Viewing Technique?

by Douglas Warshow

I woke up on the morning of Sunday, July 13 for the express purpose of viewing Mars. I had only seen it once before during this apparition (due to both bad timing and bad weather); the only feature that I could definitely discern then was the southern polar cap. Of course, that was almost a month earlier and Mars appeared far smaller then.

In addition to my set of filters, I was armed with a recently purchased Baader Super Contrast filter. I was quite impressed by it during a demonstration in which it enhanced Jupiter's belts without changing any of the planet's colors.

After setting my equipment (a Celestron NextStar 8) and finding my target, I tried viewing Mars through the Baader filter, along with my red, light red, orange and yellow-green filters as well. (The later four are designated W25, W23A, W21 and W11, respectively.) Although each of these filters improved the image to some degree, the only feature that I could make out was a dark band along the edge of the polar cap (and even that was somewhat indistinct).

I wondered if there was any way of improving the contrast. Then again, a dust storm had begun about a week ago. Was I yet again a victim of bad timing?

I then had a maybe-bizarre idea: what if I stacked the filters? I had no clue as to the bandwidths of the various filters, but I figured that I should two that were similar in color so as not to completely darken the image.

I attached the W25 to my 6mm eyepiece and then the W23A to the W25. It seemed that the darker features seemed to be more distinct. As a lark I added the Baader filter to the stack; heck, it wasn't going to affect the color at all.

The final result: far more surface detail than before. I could see a large circular red region with a large dark arc to the south.

Since I hadn't had time to align my scope before observing, I had to constantly slew the telescope in order to keep Mars in the field of view. (With the 6mm eyepiece, the magnification was at 339x.) This made any attempt to create sketch futile. Nevertheless, I kept a mental picture of the view and looked up the longitude in the July issue of Sky & Telescope. At 4:00 that morning, the Martian central longitude was about 85 degrees, which runs through the Tharsis volcano region. Although I could not see any of the volcanoes, the large dark arc resembled the portion of Mars south of Tharsis.

The reason that I inserted the question mark above is that I am not completely certain that the filter stack was the cause of this wondrous effect. First of all, as Mark Deprest has pointed out previously, the more you look at an object, the more detail you will see. Additionally, I noticed that the full moon had finally set below a nearby building shortly before the end of my observing run. It is quite possible that the reduction of scattered light could also have been a major factor.

Has anyone heard of this method from another source? If you have, or if you try it yourself and it works, please let me know.

A Reflections Refractons Special:

Reading Ernie Pfannenschmidt's article in the April 2003 issue of Sky and Telescope about using crutches to make a tripod brought back memories of many similar tripod articles from years gone by. I decided to build one of my own to replace a pedestal I had built for a 5" f/5 refractor.

The pedestal I had built, though good looking, suffered from a horrible case of the wobbles, and took several minutes to put together, considering its small size. I wanted something quicker to set up and, of course, more stable.

Mr. Pfannenschmidt's tripod used old fashioned wooden crutches. I employed metal units that are common today. They quickly adjust for height with just the push of a button. These were purchased at the ReUse Center of Recycle Ann Arbor for 4 dollars a pair. Except for some ¼" oak plywood used to make the tray and ¼" threaded rod and bolts, all other materials were left over from the old pedestal project and some home remodeling. The tools used were a power hand drill, router with circle cutting guide, saber saw, a "chop" saw (bought for the home remodeling job) and a drill press at my place of work for drilling a few holes square to the board. A cheep drill attachment available at most hardware stores could sub for the drill press.

Fig. 7

Fig. 1

Pictures are better than words, so I will let them explain most of the details.

The tray (fig4) is made from ¼" plywood and some quarter round trim. Three pieces of ¾" plywood with groves in them on the underside of the tray (fig2) fit snugly onto treaded rods on the legs. (fig6) The tray's purpose is not only to hold items but mainly to keep the tripod legs form spreading or twisting. The use of hand tools prevented the ability to have very tight tolerances. (Well prevented me anyway.) The result made for some very high class looking craftsmanship. (fig3) The tray goes on the tripod in just one way. Markings on the under side of the tray and one crutch leg line them up. The tripod consisted of the two pieces (fig1) that go together truly in seconds for the final assembly. (fig7)

YOUR OWN TRIPOD, CHEAP!

by Doug Nelle

Fig. 2

The tripod top (fig5) is a single layer of ¾" oak plywood 8" in diameter. The blocks that hold the tripod legs are 2 layers thick with a ¼" grove cut with the router in one and then the 2 glued together. I had a difficult job trying to drill a hole strait through the blocks even with a drill press. ¼" threaded rod runs through the crutch leg and the block with self-locking nuts on the ends. A short piece of wood dowel was epoxied in the end of each cut off crutch top to keep it from collapsing. Existing holes in the crutches were utilized whenever possible.

Fig. 3

The cost of the whole thing was under 25 bucks. Hardwood plywood is not real cheap. If one could not scrounge up the pieces ordinary plywood may be a better choice. If you have a whole day to yourself you could build it. The longest period of time that I had was about an hour and a half. So it took me about 2 weeks of spare time to complete once I had decided how to go about it and had made up for a couple of mistakes.

Fig. 5

Fig. 4

In the end the tripod is very stable and stiff. It can support far in excess of its own weight as shown in the last image. (fig8) Is your commercial tripod rated for as much?

Fig. 6

P.S. (Coming soon-What I put on top of the tripod)

Summer Parties

by Tom Ryan

Lowbrows have traditionally been willing to go to extreme lengths to get to a good party, and this year they have two to choose from. Astrofest 2003 and the Black Forest Star Party 2003 are both being held this year at the end of summer, when night temperatures and views of the Milky Way are at their best. In past years, the two events have been scheduled on nearly the same weekend. Since they are both five hours away from Ann Arbor, and in opposite directions, it meant that a hard working Lowbrow would have to be a very hard driving Lowbrow to attend both parties. This year, however, is different.

Astrofest 2003 is again being held at Camp Shaw-Waw-Nas-See near Kankakee, Illinois, on September 18, 19, and 20 (Thursday, Friday, and Saturday). The Black Forest Star Party will be held again at the very dark Cherry Springs State Park in Potter County, Pennsylvania, on Friday, August 29, through Sunday, August 31. That's a difference of three weeks, which should give even the most drive-averse Lowbrow time to recover, and the Lowbrow's spouse a chance to have *two* weekends entirely to him/herself. To give your spouse a real incentive to let you go, offer to take the kids. Kids are welcome at both events, and they would then get the chance to eat strange food, sleep all day, and stay up all night. (Its never too early to start them off right.)

Both events have talks by advanced amateurs for the benefit of the insomniacs. Both events have catered food available (I think), and both have plenty of understanding amateur astronomers with whom you can share experiences that would keep you from getting a raise for years were you to relate them at the annual office party. The two events are not, however, identical.

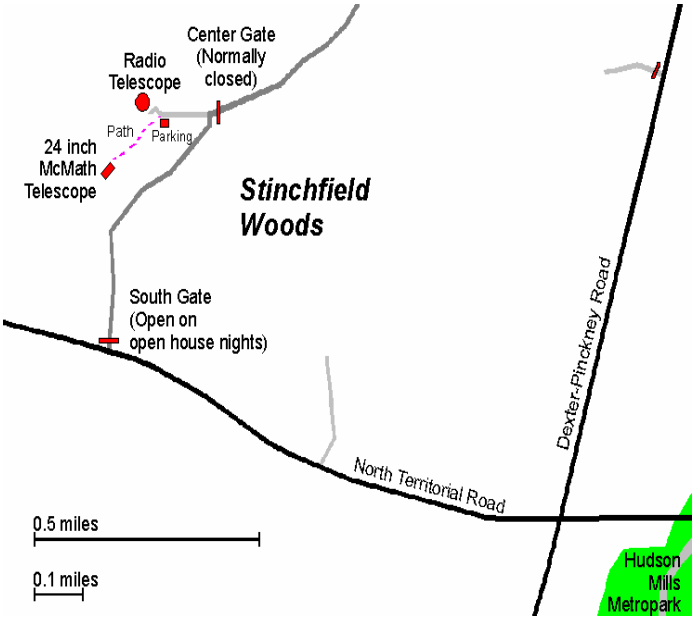
Astrofest is geared mainly to the telescope builders, and while you can observe there, the skies are brightened by the Neon and Sodium loglo of Chicago, and are not very good for deep sky observing. There are usually a few hours of good seeing every year, even on weekends when it rains, so you can star test the manufacturer's equipment and the exotic telescope designs that tend to show up on the observing field. It's amazing what a few minutes at the eyepiece can do to verify quality or debunk hype about equipment, and this, I think, is what I like best about Astrofest. (Have you ever tried to test drive a new Corvette at a dealership before buying it? At Astrofest, you can test drive an Astrophysics 155mm EDF refractor, a Questar, a 24" Dobsonian, and a Coronado Solar filter with the owner's blessings.) The Swap Meet has, in the past, yielded many treasures which fill boxes in my basement. Need a 15" Byers worm gear, a finished set of optics, back issues of S&T, or a focusing screen for your camera? Whatever you need, it can probably be found there.

The Black Forest Star Party is for observers who want to see the sky the way it should be seen. The camp doesn't have a lot of facilities, but it is located in the middle of a very large, undeveloped part of Pennsylvania (the farmers bypassed this rocky, cloudy area on their way to Ohio), and it does have very, very dark skies. Last year, Lowbrows who returned from there raved about the new objects they had seen, and the old ones which they saw in a new light. For someone who doesn't want to brave the cold of the Upper Peninsula, or the giant bugs and snow birds of the Winter Star Party in Florida, the Black Forest Star Party provides a very good alternative.

If you are thinking of going, you can find more information at the parties' respective web sites, at www.chicagoastro.org and www.bfsp.org/starparty. If you are going to register, do it soon, because these events tend to fill up fast, and attendance is limited. When you are there, have a great time, say hello to the other Lowbrows (and everyone else) whom you meet there, and, for a few days at least, live the life that you were intended to live.

Places and Times

Dennison Hall, also known as The University of Michigan's Physics and Astronomy building, is the site of the monthly meeting of the University Lowbrow Astronomers. It is found in Ann Arbor on Church Street about one block north of South University Avenue. The meeting is held in room 130. Monthly meetings of the Lowbrows are held on the 3rd Friday of each month at 7:30 PM. During the summer months, and when weather permits, a club observing session at Peach Mountain 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 inch telescope which is maintained by the Lowbrows. The observatory is located northwest of Dexter. The entrance is on North Territorial Road, 1.1 miles west of Dexter-Pinckney Road. A small maize-and-blue sign marks the gate. Follow the gravel road one mile to a parking area near the radio telescopes. Walk along the path between the two fenced in areas (about 300 feet) to reach the McMath telescope building.

Public Star Parties

Public Open House/Star Parties are held on the Saturday before and after each new Moon at the Peach Mountain Observatory. Star Parties are canceled if the sky is cloudy at sunset or the temperature is below 10 degrees F. Call 332-9132 for a recorded message on the afternoon of a scheduled Star Party to check on the status. Many members bring their telescopes and visitors are welcome to do likewise. Peach Mountain is home to millions of hungry mosquitoes - bring insect repellent, and it does get cold at night so dress warmly !

Amateur Telescope Making Group meets monthly, with the location rotating among member's houses. See the calendar on the front cover page for the time and location of next meeting.

Membership

Membership dues in the University Lowbrow Astronomers are $20 per year for individuals or families, and $12 per year for students and seniors (age 55/+). This entitles you to the monthly REFLECTIONS newsletter and the use of the 24" McMath telescope (after some training).

Dues can be paid to the club treasurer at the monthly meeting or by mail at this address:

University Lowbrow Astronomers
c/o Micheal Garrahan
7676 Grand Street
Dexter, Michigan
48103-1327

Magazines

Members of the University Lowbrow Astronomers can get a discount on these magazine subscriptions:

Sky and Telescope: $32.95 / year
Astronomy: $29.00 / year

For more information contact the club Treasurer. Members renewing subscriptions are reminded to send your renewal notice along with your check when applying through the club Treasurer. Make the check payable to "University Lowbrow Astronomers".

Newsletter Contributions

Members and (non-members) are encouraged to write about any astronomy related topic of interest. Call or Email to Newsletter Editor at: John Ryan (734) 662-4188 john_edward_ryan@hotmail.com to discuss length and format. Announcements and articles are due by the first Friday of each month.

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Lowbrow's Home Page

http://www.umich.edu/~lowbrows/

Lowbrows at the 1991 Astrofest. Remember how good we looked then?

Left to right, Tom Ryan, Dave Wall, Doug Nelle, Steve Flessa, and Fred Schebor. Not pictured is Roger Tanner.

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Check your membership expiration date on the mailing label.