REFLECTIONS AND REFRACTIONS

OF THE UNIVERSITY LOWBROW ASTRONOMERS

University Lowbrow Astronomers
Ann Arbor, Michigan

Upcoming Events

May 2003

- **Saturday, May 3** (Starting at Sunset) Regular Scheduled Open House and Star Party at the Peach Mt. Observatory. Weather permitting.
- Thursday, May 15 Total Lunar Eclipse visible from 9:05 PM to 2:17 AM
- Friday, May 16 (Starting at 7:30) TBA held in either room 130 or 807 in the Dennison Building.
- Saturday, May 24 (Starting at Sunset) Regular Scheduled Open House and Star Party at the Peach Mt. Observatory. Weather permitting
- Saturday, May 31 (Starting at Sunset) Regular Scheduled Open House and Star Party at the Peach Mt. Observatory. Weather Permitting.

North American Nebula Photo by Doug Scobel

Lowbrow Astronomers 2003 Election Results

The By-laws were passed unanimously by the members in attendance. Listed below are the new Lowbrow officers.

The office of Observatory Director was hotly contended, with Mike Radwick winning against Kurt Hillig by a single vote. The voting included write-in ballots. Kurt had the rare good grace to refrain from asking for a recount.

See? Your vote does matter with the Lowbrows.

President

Charlie Nielsen

Observatory Director

Mike Radwick

Vice Presidents

Jim Forrester

Bernard Friberg

Newsletter Editor

John Ryan

Treasurer

Mike Garrahan

Webmaster

Dave Snyder

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.

Managing the Lowbrow Web Site

by Dave Snyder

I've maintained the club web site for a number of years now. Recently I was talking with Tom Ryan, and the topic of managing the club web site came up. He suggested this could be the basis for an article, so here goes. In the following sections I'll cover a few different aspects of managing the site.

The link exchange. People who create web sites want visitors. While there are several strategies to obtaining more visitors, a common approach is the "link exchange." It works like this: suppose Joe has an astronomy web site and he discovers that Jane also has a web site. Joe asks Jane to put a link from her web site to his. In exchange Joe offers to put a link from his web site back to hers.

However, once an interesting and/or useful web site has been established (which typically requires a few link exchanges), often visitors will arrive without the need for further link exchanges. This generally only works if the site is providing something people want (even if they don't know they want it).

The main purpose of our web site is to tell visitors about the Lowbrows. We are a diverse group of people and the web site needs to reflect that. In addition, our web site provides information to amateur astronomers and attempts to get the general public excited about astronomy. Early on, I made an effort to make sure a few key sites had links to the Lowbrow site (in particular the University of Michigan Astronomy Department). Once that was accomplished, visitors arrived and there was no need to engage in more link exchanges; I now concentrate on adding new material and keeping existing material well organized and up to date. The number of visitors has grown over time, which suggests things are working they way should.

However, from time to time, someone asks me to add a link from the lowbrow site. Links from our web site to other web sites says something about us, either positively or negatively. Poorly chosen links could detract from the purpose of our site. Also our web site uses University of Michigan equipment and for this reason, we are forbidden from using the web site to conduct any profit making operations. I refuse requests that aren't compatible with our site. In particular I won't add links that suggest we are trying to make a profit. Requests from sites that are compatible with our site are typically granted.

Some club members have set up their own web sites, and I have placed links to all club member sites that I know of. If you are club member with a web site devoted to astronomy pictures or astronomy information and I don't already have a link to you, tell me about it and I'll add a link.

Web server logs. When a visitor comes to the Lowbrow site, various pieces of information are recorded. The main items recorded are:

1. The name of the computer used (if a visitor connects through a dial up connection, the name of the computer provided by the Internet service provider is used instead).
2. The URL requested.
3. Whether this URL was valid or not (when a person mistypes a URL, an error is generated and the error is recorded).
4. The "referrer." This is best explained by example: Suppose you use the search engine google, and google provides a series of links including one link to a Lowbrow page. If you follow this link, www.google.com is recorded as the referring page.
5. The browser and operating system are recorded as a coded string of characters.

The lowbrow web site does not record people's names. The reason is simple, since the web server never asks for personal information (either directly from the user or from "cookies"), there is no personal information to record.

One a month I run a program that prints out information from the web server logs. The output of this program tells me various things about the web site. For one thing, I can tell which parts of the site are heavily used and which parts are not. In particular, people are more likely to visit pages with astronomy pictures than read through newsletter articles (this should not be too surprising). The most useful information to me is the list of unsuccessful requests. Most are due to a visitor who mistyped a URL, but occasionally an error is because I made a mistake with an internal link (that is a link from a lowbrow page to another lowbrow page). While I have procedures to prevent this, I cannot prevent all mistakes. When mistakes show up in the log the next month, at that point the problem can be identified and fixed.

I cannot tell the exact number of people who have visited the web site since people's names are not recorded, and no other information is available to get an accurate count. We received 76,582 hits during March (the most recent month I have data for). If all you have is a hit count, this could be one person who generated 76,582 hits, or 76,582 people generating one hit each. However I have other information to work with; I estimate between 3000 and 4000 people visited the site in March.

Not all of the hits are from people; there are automated processes that look for web pages. Of the 75,582 hits, 3026 were from the search engine Google. Google spends more time on our site than any other

search engine. In addition a scan of the log shows a few other search engines, but with fewer hits.

Some computer names recorded in the logs indicate a location. We generally get a few thousand hits from names ending in either ".ca" which indicates a location in Canada, ".uk" which indicates a location in Great Britain, or ".au" which indicates a location in Australia. There are typically a few hundred hits spread across a variety of other countries.

A handful of hits are from elementary or high schools. They generally end in ".k12.stateabbreviation.us", where stateabbreviation is one of the familiar two letter state codes, such as "MI" for Michigan.

E-Mail. One part of the webmaster's job is dealing with e-mail. The bulk of the messages are from club members. However a few messages each month come from the web site. These are people who visited the web site and noticed a sentence at the bottom of each page: "For comments about this page or more information about the Lowbrows, send e-mail to lowbrowinfo@umich.edu"

Amazingly, while there is an occasional spam message that arrives, the volume of junk mail sent to the lowbrowinfo@umich.edu address is very low. Most e-mails are in one of the following categories (placed in no particular order).

1. Link exchange requests (I explained these earlier).

2. "International appeals" - generally a group from another country asks for help. A typical request came a few years from the "Kuwaiti Scientific Club." They asked if we could teach them astronomy. In any event I felt there was a large gap between what they seemed to want and what we were able to provide. That seems to be true of most of these requests.

3. Every so often there is an e-mail from someone with no scientific training who nevertheless has a profound new scientific theory. Typically this "theory" proves some basic scientific idea is wrong. Albert Einstein was wrong, or the Uncertainty Principle is wrong or whatever. I hate being dogmatic, but I've never found any of these e-mails convincing. Even if one of them is correct, I am not qualified to evaluate them (they never make enough sense for me to evaluate them).

4. Some e-mails are astronomy questions. One example, a gentleman wondered why Mars didn't appear the same bright red color he remembered when he saw it 30 years ago (this was shortly after the last opposition). Unless there is some reason not to (see item 10 below), I generally try to answer them. In case you are wondering, color is detected by cones, and under poor light conditions, cones don't work very well. So it is hard to tell the color of astronomical objects, especially dim objects. When we get older, color sensitivity decreases and it becomes even harder.

5. Sometimes people ask for special access to the observatory, to celebrate a birthday or some other special occasion. We often have school groups, cub scouts, boy scouts or girl scouts come up to Peach Mountain, but we cannot honor all requests from individuals. For one thing, at least one club member would have to be present, and we don't have unlimited club members to handle these requests.

6. A few people point out problems with the web site.

7. More than once an e-mail has offered contributions, including photographs from an ultralight aircraft showing the old observatory in Stinchfield Woods (about a mile from our observatory), a set of aurora photographs taken by an amateur astronomer from Oregon and a variety of other things.

8. Occasionally someone wants to use material from the web site. Generally these requests have been honored.

9. Requests for the Lowbrows to help out with some charitable event. We generally honor these requests if we can.

10) Sometimes I get a question that is obviously from a take home exam or the topic of a term paper. The senders usually don't say they are a student nor do they explain the real reason for the question, but I can tell the difference between a take home exam question and a question asked by someone who has a sincere interest in astronomy. The students that send these e-mails are looking for the easy way out. I don't want to encourage that, so I might offer some hints, but I never write term papers or directly answer take home exam questions.

Club Member Contributions. The web site depends on club members making contributions. What sort of contributions? Photographs of club members, photographs of astronomical objects, the URL of interesting web sites are all welcome.

As I mentioned earlier, some club members have their own web sites. This isn't that hard to do. I will add a link to any club member who sets up an astronomy related web site. If you have contributions or comments let me know.

Telescope Topics
"Do You Foucault?"
by
Tom Ryan

Finding good optical tests has always been a problem for those who make optics. There are those who say, "If you can measure it, you can make it". The contrapositive is usually presumed, but is clearly not true. Galileo's lens makers had no way of testing lenses as they made them, but a recent interferogram of the (now broken) objective of Galileo's telescope showed that it was made to an accuracy of about a twentieth of a wave, without the benefit of testing equipment, a feat which would be the envy of Perkin-Elmer today. Galileo was able to possess such an instrument by buying a lot of objective lenses, and discarding all but one or two, which is also a method still in use today.

Most of us don't have the resources of Galileo or the Federal Government, so we must look for ways to make our optics right the first time. That usually means being able to test them with verifiable methods. There are many tests of astronomical optics used in the world today. The oldest test, the star test, was pioneered by Galileo himself. The star test, in capable hands, is a very good test of optics, not only because it tests the optic against the object that it will be used to see, but also because it permits the manufacture of essentially perfect optics. Under good seeing conditions, the test is "diffraction limited", which means it is limited only by the physical nature of light. The star test's only significant drawback is that it restricts testing to clear, steady nights, usually using the completed tube and mount to track the star being tested. While Astronomers have to work at night, Opticians usually prefer an 8 to 5 schedule.

The next important advance was made in 1859 by the Frenchman, Leon Foucault. He called his test the Knife-edge test, and it proved to be so incredibly sensitive that it was still the best test available when the 200" Hale telescope was figured. The Hale mirror was also tested by a method called the Hartmann test, but both tests have since been superseded by interferometric testing. The interference of light was known to Newton, but testing over distances greater than a couple of feet or so had to wait for the invention of the laser.

The Foucault test is one of the most sensitive tests of optics available. It is cheap and easy to do, which accounts for its almost universal use among amateur telescope makers. It basically consists of a light source, usually a small light bulb or LED, stopped down to a diameter near the mirror's diffraction limit by a pinhole, and a knife edge, which may be a razor blade, an opaque piece of paper, or even a credit card.

The light from the pinhole is directed onto the mirror, and the reflected image of the pinhole is actively "cut off" by the knife edge. The idea is that a perfectly spherical mirror will form an image of the pinhole at a single point. When the knife edge is positioned with its edge at this point, a little motion of the knife edge at right angles to the beam will either let all of the light pass the knife edge and proceed into the eye, or will block all of the light. The mirror will appear to go from a bright disk to a dark disk. However, if the mirror's surface is not entirely spherical, but rather has some "zones" whose slopes differ from those of the surrounding mirror, then light from these zones will not be returned precisely to that point. It may pass beyond the knife's edge when light from the rest of the mirror has been cut off, and its source zone will appear bright when the rest of the mirror is dark.

A parabola, which is of interest to astronomers, is not a sphere, but can still be tested by the Foucault test. The tester merely adds a micrometer to his setup, and then measures the positions where light from successively larger ring zones of the mirror are brought to focus. In other words, he finds the point where the light from the center area (which has generally the same curvature) focuses, then where the light from the next larger zone focuses, and so on, to the edge. These measured positions are then compared to the positions where a good parabola should focus the light. Sometimes zonal masks are used to better isolate the area on the mirror to be measured. All of this is a tedious process, but in the hands of a skilled worker, can produce excellent feedback to the mirror maker about the shape of the surface of the mirror.

The test works best if the pinhole source and the knife edge are very close to each other, since an axially symmetric mirror (like a sphere or parabola) will not produce a perfect reflected image away from its axis. This fact has caused many people to build "slitless testers". Construction details of these devices can be found in the literature.

I made a slitless tester many years ago, and it made a tremendous improvement to what I could see on the mirror. Zones that were very faint or did not exist, when the light source and knife edge were an inch apart, suddenly became very obvious when tested using a slitless tester. A mirror buyer should be very suspicious of the quality of a commercial mirror if the manufacturer's web site shows them using a Foucault tester with a separated source and slit. They may

be able to judge overall correction, but shallow zones just will not be seen. You can easily verify this for yourself by retesting your mirror with the source and knife edge separated. As an example, the tester sold by University Optics has the problem of a widely separated pinhole and knife edge.

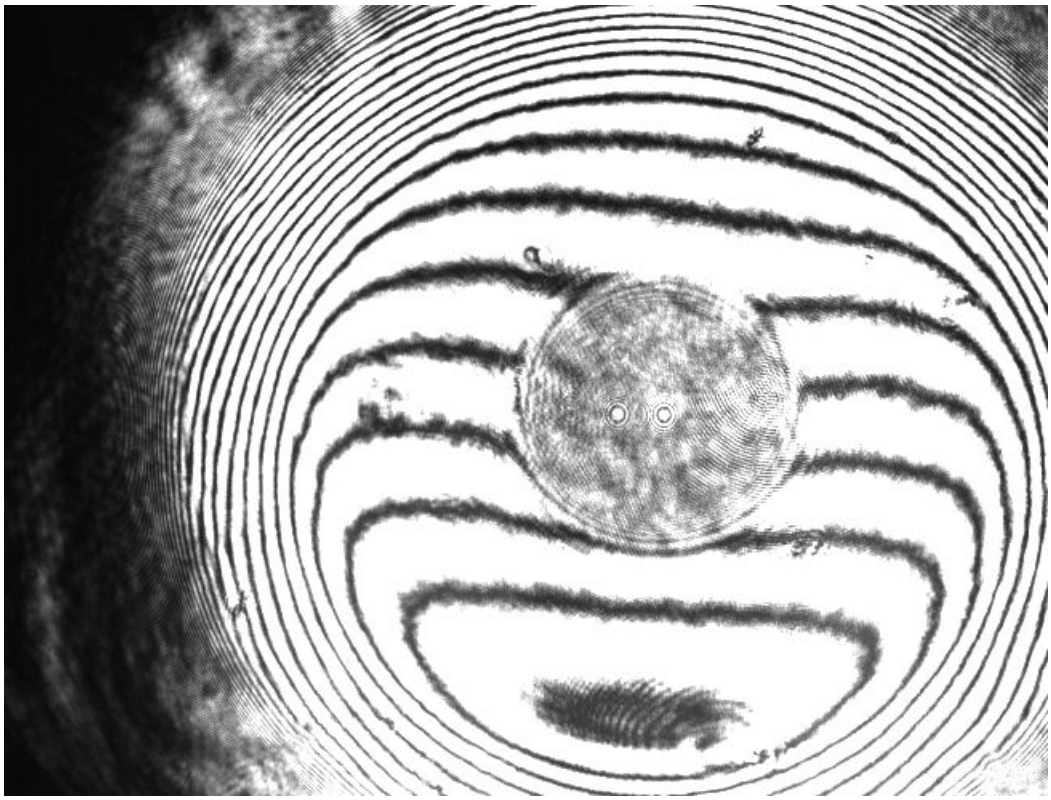
The Foucault test can be very sensitive in a qualitative sense, but it is much harder to get data from it in a quantitative sense. The main problem I have had with this test is, if I could see an error on the mirror, how could I really tell how big the error was? The slope-step-slope-step method of judging a mirror's overall correction seems loaded with opportunities to make errors. Where, really, is the 95% zone, where the mirror's radius of curvature is changing so quickly and critically? Are the shadow intensities on either side of the mirror, either at the pins or in the mask cutouts, of equal intensity? Am I sure? Bouncing off of a good, well characterized aluminized flat would help here, and would turn Foucault zonal measurements into null testing for parabolic mirrors, but if there are zones in the mirror, however faint, there remains the problem of judging their size. And a double bounce off the unaluminized mirror's surface means that the light source needs to be pretty bright, but can't be a laser, because it is not advantageous to use coherent light for Foucault testing. (I used a very bright Zirconium arc lamp for a while. It solved the brightness problem, but not the measurement problem.) The Foucault test also will not easily show astigmatism, when and if it is present, unless you specifically test for it. Even then, it is not easily detected.

This, and other difficulties that I have had while testing mirrors by the Foucault method, caused me to move to a laser interferometer and Offner null optics. A laser interferometer shows deviations from perfection in half wave (or quarter wave, on double bounce) increments, with the option for estimating to an honest tenth or twentieth wave. When the Offner null lenses are added, accuracy is extended to testing conics other than parabolas. Laser interferometers have problems of their own, but they are all about the cost of entry, and not about the uncertainty of measured results.

There are some companies producing optics for amateurs today that say that interferometric testing is unnecessary, and they can get better results by using Ronchi, Foucault, and star tests. Their argument seems to be that interferometric testing is difficult to do properly, and interpreting the results is beyond the scope of the average buyer. I disagree with this, both for the reasons stated above, and because I have always considered the Ronchi test to be merely an out-of-focus Foucault test. Star testing, of course, is a perfectly valid and sensitive test, but is not practical for shop testing and is not capable of providing fast and, more importantly, detailed feedback when figuring the mirror.

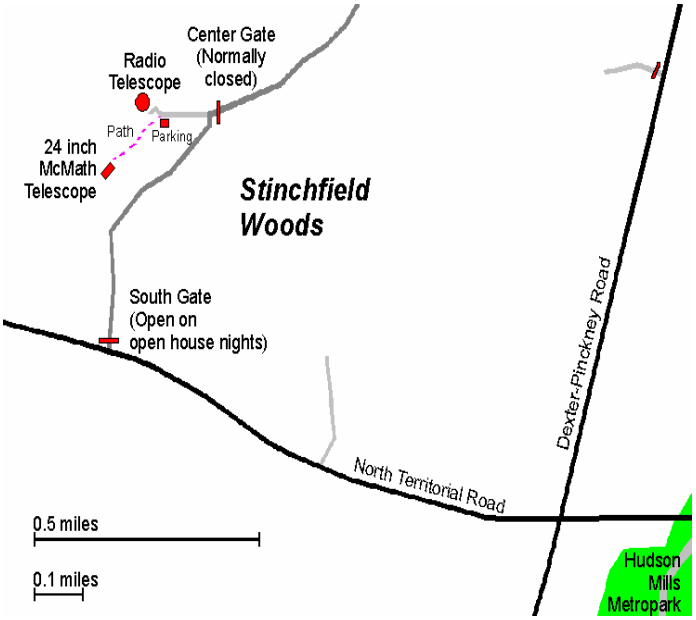
In a future article, we'll look at some of the strengths and weaknesses of interferometric testing.

"Wow, man! I guess I shouldn't have duct taped the edge of my mirror to that plywood cell."



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 480-4514 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 Charlie Nielsen at the monthly meeting or by mail at this address:

6655 Jackson Road #415
Ann Arbor, MI 48103

Magazines

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

Sky and Telescope: $29.95 / 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.

Telephone Numbers

President:	Charlie Nielsen	(734) 747-6585
Vice Presidents:	Jim Forrester	(734) 663-1638
	Bernard Friberg	(734) 761-1875
	Jim Wadsworth	
	Doug Warshow	(734) 998-1158
Treasurer:	Mike Garrahan	(734) 973-6859
Observatory Director:	Mike Radwick	(734) 453-3066
Newsletter Editor:	John Ryan	(734) 662-4188
Keyholders:	Bernard Friberg	(734) 761-1875
	Charlie Nielsen	(734) 747-6585
	Mike Radwick	(734) 453- 3066
	Fred Schebor	(734) 426-2363

Lowbrow's Home Page

Photo by John Ryan

The bylaws committee poses for a photograph after club approval of the by-laws.

Left to right: Bernard Friberg, D. C. Moons, Kurt Hillig, Kathy Hillig, Dave Snyder, Charlie Nielsen, Jim Wadsworth, Jim Forrester and John Causland. Each committee member is holding the "star" they received earlier, except for Kathy, who is holding a copy of the by-laws

UNIVERSITY LOWBROW
ASTRONOMERS
7676 Grand Street
Dexter, Michigan 48130

Lowbrow's WWW Home Page:
www.umich.edu/~lowbrows/

Check your membership expiration date on the mailing label.