REFLECTIONS
REFRACTIONS

of the University Lowbrow Astronomers

October 2002

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-Pinkney 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.

October 2002

- **Saturday October 12. (Starting at Sunset). Regular Open House at Peach Mountain.**

November 2002

- **Saturday November 2. (Starting at Sunset). Regular Open House at Peach Mountain.**
- **Saturday November 9. (Starting at Sunset). Regular Open House at Peach Mountain.**
- **Saturday November 30. (Starting at Sunset). Regular Open House at Peach Mountain.**

December 2002

- **Saturday December 7. (Starting at Sunset). Regular Open House at Peach Mountain.**

BFSP - Get to Know it Well

By Christopher Sarnecki

Imagine… - Imagine night skies darker than you have ever witnessed. Imagine being surrounded by 500 other astro observers in the middle of nowhere on an Appalachian mountaintop with summer nighttime temperatures. Imagine being given an opportunity to observe with some of your fellow Lowbrows for two nights in such a setting. Well, then you have imagined the Black Forest Star Party (BFSP) held recently on September 6-8, 2002 at Cherry Springs State Park in central Pennsylvania hosted by the Central Pennsylvania Observers. Lowbrows John Causland, Mark Deprest, Jim Forrester, Bob & Joni Gruszczynski, Doug Nelle, Gary Perrine & Cynthia Winzeler, Doug Scobel, Jim Wadsworth, and yours truly attended. A BIG thanks to Bob & Joni Gruszczynski for finding this annual Amateur Astronomy gathering.

For years a number of Lowbrows have attended Astrofest near Kankakee, Illinois. Well, maybe we were looking for something different, so this year we decided to try the BFSP. About 400 miles and eight hours later we found ourselves in the middle of the very scenic Appalachian Mountains and miles from cell phone towers. Was the drive worth it? Read on and see for yourself.

Amenities at the Cherry Springs State Park are pretty much limited to rustic camping (well water and porta-poties). The limited facilities were made more than tolerable by the incredibly dark night skies. Skies so photon filled that I'll have its memory burned in to my brain for some time to come. Not just stars down to the horizon, but the Milky Way from horizon-to-horizon. BFSP is located well away from city light pollution. In fact, no light dome of any kind was observed. I can only imagine that this is what the night sky looked like before the invention of electricity and the modern age.

Camp Lowbrow was set up in the middle of the observing field thanks to many of the Lowbrows who arrived a night before the official opening of the BFSP. This annual star party had 200 participants just two years ago, but in a short time word has gotten out that the dark skies here is the best possibly east of the Mississippi. The observing field is less than ten acres and salamander shaped. So getting here early is highly desirable. BFSP's claim to fame is observing served up with a side order in imaging. A portion of the observing field is set aside for astro imagers. While vendors, ATMers, and speakers are present, they are not considered the highlight of the weekend. Most come prepared to observe. A siz able number of sizable scopes were present. An 8-inch scope is a small scope here.

I arrived Friday afternoon to find many of the Lowbrows, who arrived Thursday, tired but bedazzle from the previous night's observing run. Most were already on astronomer's time; observing all night, followed by daytime snoozing. A quick tour of the field yielded evidence (18-to-22 inchers, Starmasters, Obsessions, Night Sky Scopes, a 10-inch refractor) that serious observers were in attendance.

The weather this week was in a word clear. One had the feeling that the whole weekend would be cloudless. Late Friday afternoon some upper altitude wispy clouds formed from the few jet contrails that found their way into our part of the state. At the start of nightfall the seeing was less than perfect, but soon the seeing did improved. Right away you knew these skies were different. The Milky Way was blazing. The M24, Cygnus, and North American star clouds jumped out at you. Limited magnitude naked-eye test yielded 6.0 in Ursa Minor. We looked at Kemble's Cascade sans binoculars. A naked eye Andromeda galaxy was an extended object!

Spooning for Dwarf Galaxies - Most of the BFSP participants come prepared with an observing list and I had a list of faint fuzzes that I have been saving up. In the August *Reflections* I listed an observing challenge. **NGC 6822, Bernard's Galaxy**, is an 11th mag dwarf galaxy in northeast Sagittarius. This is a large 10 x 20 arcmins galaxy with low surface brightness. I indicated you might want to save this one for your summertime dark site. Well, I did manage to see a suggestion of this object at Peach Mountain, but at BFSP it was a much more defined galaxy. It is nice to contemplate this little world as a satellite to our own Milky Way. Just in time for BFSP the October Sky *& Telescope* had an article titled Observing Faint Nearby Galaxies by J. Freeman. Listed was a few more dwarf galaxy challenges. **NGC 147 and 185** are dwarf galactic satellites of M31. You would never know it from their location about seven degrees north of M31 near the border with Cassiopeia. Both are 9th mag objects approximately the same size as Bernard's Galaxy and with a higher surface brightness and were easy objects by comparison. Doug Scobel and I attempted to locate another nearby dwarf called **Maffei 1**, an 11th mag, 10 arcmins satellite. The article has photograph that enabled us to pin point the exact location. At first Doug didn't claim it. After looking in my scope and I think I convinced him that we were seeing it. Perhaps our imaginary vision was working overtime.

Seeing Dark - Lord knows I have tried to see dark nebula from Peach Mtn. I have read up on the darkest and biggest of these objects to prepare my

self to observe them, but I have always managed to come up empty at the scope. Dark nebulas are essentially clouds of non-luminous dust and gas that block out stars behind them. At BFSP, viewing dark nebula is a piece of cake. **Barnard 86** (B86) is an island of dark in a sea of stellar jewels three degrees north of the Sagittarius teapot spout. I can testify that this object looks just like the photographs. It's DARK man! The surrounding stars fade to the background, as the dark nebula seems to float in the foreground. As added bonus to viewing B86, locate the embedded open cluster **NGC 6520** on B86's eastern border. This smallish 6 arcmin, 7th mag cluster has a very noticeable perfect circle of stars in it. Perhaps this will help locate the dark nebula when observing in more light polluted skies. **B92** and **B93** are two dark nebula on the northern edge of M24, the Sagittarius Star Cloud. Sometimes looking at a difficult object at a dark sight helps one to find the same object in a less than dark site such as Peach Mtn. All of these dark objects are easy to locate and now that I know what to look for when I check 'em out again back at home.

The **Horsehead** nebula is probably on everyone's observing list, yet most of us are honest enough to believe we will never see it unless we travel to the southwest. Well, we spotted it in an 18 incher with a hydrogen-beta filter. It was superimposed on a gray field as a 'notch' with a noticeable horsehead shape.

Looking large - Many of us started looking at galaxies. Not faint fuzzies, but photon busting behemoths. **NGC 891** is a 10th mag, 13 x 3 arcmin object that John Causland has indicated "was put here to frustrate amateur astronomers". I have seen a whisper of this galaxy in John's 18-incher from his dark backyard. If you think that an 18-inch scope can sweep this edge-on object easily, you would be mistaken. Low surface brightness is the cause for our frustration when viewing NGC 891. From BFSP a central dust lane centered in a bright nebula was obvious. Sweeping up this galaxy in the scope was child's play. **NGC 253, the Sculptor Galaxy**, is 7th+ mag elongated 26 x 6 arcmin island universe that doesn't present much to see from average skies due to its southern location. From our mid-Penn mountaintop, it was big and bright. **M31** had two huge dark lanes in it. You've read about it. You've seen it in long exposure photographs. At BFSP, observing it took your breath away. I caught Doug Nelle scooping up M31 globulars with his 17 1/2 using and map from an old ATM magazine. Impressive.

Alien skies - At one point during Friday night, a few of us were discussing an e-mail received by Dave Snyder on a sighting of what was thought to be three high altitude military aircraft in the sky over Hastings, MI. It turned out to be one of the **NOSS (Naval Observation Satellite System)** satellite constellations. Right on clue this 4th mag triple satellite grouping, in a perfect equilateral triangle formation, appeared overhead moving south to north. An hour later we saw two paired satellites following a similar path. As we continued to follow them the third satellite winked in just before all three became victims of atmospheric extinction. Wow, in one night we managed to see two NOSS fly overs!

Nature's light pollution (if you can call it that) - As Saturday evening turned in to night, the prospect for a night of perfect darkness seemed to be all but guaranteed. All day the skies were absent of any hints of clouds. As the twilight gave up its last grip on the western sky, the northern horizon appeared like a major metropolis was parked beyond. Soon it became obvious that a full-blown **aurora** was in the making. Just when we thought it couldn't get any better it did. Thin green auroral streamers would grow towards the sky, then grow wider. After a while red streamers appeared. Every time a streamer would reach for the sky, a roar when out across the assembled masses. The Lowbrows soon gave up the scopes for comfort of lawn chairs. At one point the auroral activity reached up to the zenith. After a while I was wondering if the night's observing sessions was going to be cancelled due to nature's light pollution. That was not to be. The aurora decided to shrink back in to the northern horizon and we were back to the scopes.

Seeing double - Never without another double to view, Mark Deprest and I decided to prepare ourselves for Sky & Telescope's resident double star writer, Sissy Haas's presentation Saturday on double stars. We selected Sissy's favorite double **Gamma Ceti**, a 3.6 mag Yellow primary with it 6.6 mag blue companion 2.9" away. If you think this is an easy split, you would be wrong. While it is not difficult, it is a challenge. This double is also a beautiful sight to see the smaller star sitting on the first diffraction ring of the brighter star. In the middle of Saturday night's observing run, I had an opportunity to share naked eye doubles Alpha Capricornus, Omicron 1 Cygni, the Pleiades pair of *Atlas* & *Pleione*, Theta Tauri, Epsilon Lyra, and Delta Lyra with Doug Scobel. Yes, he split them all I am happy to say.

BFSP was this observer's dream come true. I was able to enjoy extremely dark skies that I thought were only available in the southwestern states, and I got to share all the magnificent sights with my fellow Lowbrows. If you count yourself a dedicated observer, then you owe it to yourself to get to the BFSP.

Roger Tanner Comes Home

By David Snyder

On July 26, 2002 we had a special meeting of the Lowbrows. Roger Tanner was the guest speaker. Until a few years ago, Roger was an engineer at Ford and an active member of the Lowbrows. That is, until he decided to devote more time to astronomy. He moved to Arizona with the goal of turning a hobby into a full time job. Since that time he has worked on several unmanned space missions. Roger comes back to Ann Arbor every so often, and this time he brought a prototype of a Mars Camera.

Roger had been given the assignment of designing a camera that may be part of a mission to Mars. I say "may be" because this is one of several possible missions, only one of which will be selected. If it is selected, a spacecraft will be launched in 2007 that will carry a group of identical landers. Each lander will be about the size of a coffee can and will be sent to landing sites evenly distributed across the Martian surface. Each lander will contain, among things, one of Roger's cameras. These cameras will produce images of everything visible within a 360-degree radius. A single circular image will show everything on the ground and in the sky. The purpose of the camera is to detect changes in the atmosphere over a period of several years.

Roger discussed a number of issues involved with sending a spacecraft to Mars. First of all the equipment must be able to withstand the acceleration of launch. It then must deal with radiation, large temperature changes and the deceleration of the landing. The craft also needs to deal with dust. Martian dust is everywhere, and is a continual problem facing anyone involved with Mars exploration. The dust potentially can get into anything that lands on the Martian surface and possible damage it.

Many of these issues can be tested on the ground, including how equipment reacts to temperature changes and exposure to radiation. However it is hard to test how some pieces of equipment will react to the dust. We know the dust has the form of a very fine-grained powder. It is probably made of iron oxides along with some other material, but the exact composition is not known. The dust can potentially stick to the surfaces of camera lenses, which could distort the images. Since the camera is supposed to function for several years, accumulated dust could be a problem. The cameras aboard the Viking Landers rotated in a "jerky" fashion that probably helped dislodge any accumulated dust. This will not help Roger's proposed camera, since it has no moving parts. The lens of the camera is made of conductive material and is contact with the metal skin of the craft. It is hoped that this will electrically ground the lens and prevent it from accumulating a static charge that could attract dust. Even if some dust sticks to the lens, he felt that the dust is likely to accumulate in a random fashion and probably would not affect the data collection process.

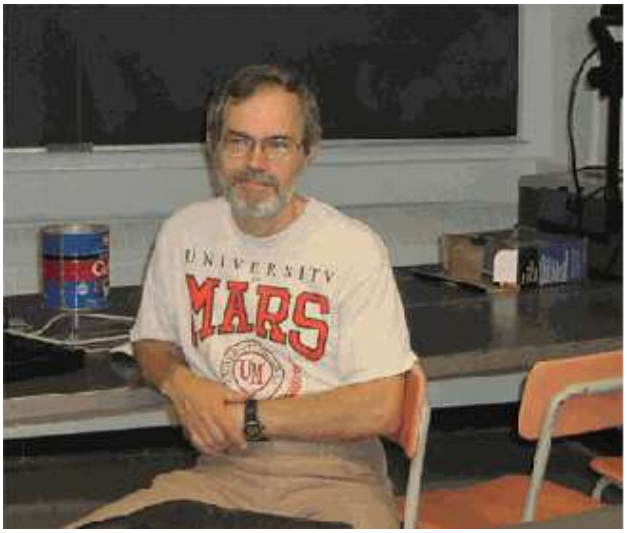
Because budgets for space missions are tight, weight must be kept to an absolute minimum (each pound dramatically increases the cost of a mission). Using careful design, the electronics were simple and used minimal power. This resulted in a lighter spacecraft. The camera fits onto a single chip surface mounted onto a circular circuit board. Other types of cameras would have given more resolution, but would have required more circuitry. The computer and the camera use the same voltage supply, which reduces weight. The computer was designed to wake up periodically, ask the camera to take a picture, record the image and go back to sleep. Periodically it uploads

data to the orbiting spacecraft that in turn forwards it to earth. It had an ephemeris to determine the best time to transmit. This minimizes transmission time (which is big power drain). If the lander cannot talk to the orbiter, it will continue to save data until it can. Even if an orbiter completely failed, the lander will keep saving data until a new orbiter could take its place.

There was also a brief discussion of manned Mars missions. Roger felt such a mission was still years into the future. However recent indications of water ice on Mars would make a Mars mission much easier (astronauts would not have to bring as much water with them, water would add to the weight and the cost of a possible manned mission). It also means that a supply of oxygen is available (it is easy to produce oxygen if you have a plentiful source of water). Oxygen would be used for breathing and as an oxidizer; the rocket that would send the astronauts back to earth needs oxidizers of one form or another.

Roger's talk was two months ago, so I asked Roger for an update, he sent me the following e-mail:

"I am writing up the project report. We are not doing any more work at present. We are waiting for the next round of selections to be announced in December. If we make it into the final 4 there, we will do more work on all the proposals we are on. Just wait and see. I have some other small projects to do for some research that the boss is doing. Other than that it's pretty slow."



FOOLING AROUND WITH FILTERS

By Gary Perrine

Every month I receive this e-mail from Mark Deprest and it says, Pleeeese!!! Send me some articles for the newsletter. Anything will do. Come on I'm really hurting this time. Something about your new scope. Maybe something about an eyepiece. A picture of your dog or cat wearing a Captain Nemo hat and goggles. I'll put it in the newsletter. I swear.

Well I can't take it anymore. I've been a member of this wonderful organization for around three years now and have never written an article on anything. So I'm feeling guilty about it. So I say to myself, Gary, get a little ambitious. Go upstairs to the computer, get out your one and only typing finger, and do something to cheer Mark up a little. He sounds like he needs it. And he deserves it. He does a great job on our newsletter every month. So here goes.

I thought I'd submit a short article about using color filters for visual planetary viewing. The reason I picked this topic is because I don't really remember reading very much about them in our newsletter since I've been receiving it. It doesn't seem to me like many people use them much or maybe they just don't talk about using them very often. I use them quite a bit because I like planetary viewing.

I remember when I first got into this hobby, when Hale-Bop came through and I bought my first telescope, a Celestron 80mm WA, not the best setup for looking at planets. I'd read how color filters could enhance the detail on planets that you couldn't see very well when looking through an unfiltered eyepiece. OK, I thought, here's the magic fix for this little 3 in. scope that I can barley see some faint lines in Jupiter and Saturn with. And they're fairly cheap too compared to buying a bigger scope, only about 40 bucks for a starter set of four. Can't wait till the mailman drops these babies off. I've been wanting to see if that ice on Europa and those volcanoes on Ganymede look the same as they do in Sky and Telescope.

Well Orion did their job as expected and promptly shipped my filters. The post office did their job and delivered them to me via a dapperly clad official US

Postal Employee. My first night under the stars with them I did my job of threading the dark blue one into an eyepiece without cross threading it TOO MUCH.

Hey, what's the deal? Instead of Jupiter looking like a round thing with faint fuzzy lines in it, it had now taken on the appearance of a round blue thing with faint fuzzy lines in it. Well, at least it's still round. Think I'll just find a cozy out of the way place in the accessory case for these for a while.

It wasn't until I got my dose of aperture fever and bought a larger scope and tried the filters through it that I realized, these little things do kind of work like they're supposed to. You just need to use optics that you can see the detail on the planets reasonably well to begin with. The way these little colorful do-hickeys work is they help reduce irradiation, which is the distortion between the boundaries of the lighter areas and darker areas of the Moon's or a planets surface caused by turbulence in the atmosphere that we are looking through. They also help to increase contrast by blocking out some of one color while enhancing another color of two adjoining areas of the Moon or planets such as the bands of Jupiter, or the Cassini division in Saturn's rings.

Since my original purchase of the starter set of filters which consisted of a # 25 red, a # 58 green, a #15 yellow, and a # 80A blue, all darker shaded filters, I've bought two more, a # 8 light yellow, and a # 82A light blue. I've been pretty happy with the results I've had with the #15 deep yellow filter while observing Saturn and Jupiter. This filter really seems to help me be able to see more detail on both these planets. The #8 light yellow is ok too but doesn't seem to help out as much as the darker one while only using yellow as a filter. The # 80A dark blue has given some good results too but I still prefer the Yellow.

While in Pennsylvania I bought the #82A light blue one. I think I like this one the best so far. It seemed to work great by itself on Jupiter. Then I thought to myself, I wonder what will happen if I couple this together with the light yellow one? It seemed to enhance contrast and detail better than any of the other filters that I have. I'll probably use this combination quite a bit.

I don't really get to much use out of the red and green filters. The red just seems too weird when I look at anything through it. The dark green one is supposed to be good to use on Mars, but I've never had a whole lot of luck observing that planet no matter what I'm looking at it with. I thought I saw the polar caps once but it may have just been a dirty eyepiece lens. I'm just not a real Mars kind of guy I guess. Although I am tempted to put it in while looking at the Moon sometime and telling some youngster, see it really is made of green cheese, now always believe everything your parents tell you.

I guess the bottom line on the subject of color filters for me is, if you can buy a couple of these things at 12 to 15 bucks a pop, and they can help to pull out detail a little, or quite a bit as I've found to be the case with a couple of mine, they're well worth the considerably small cost compared to some of the other accessories we're willing to shell out our hard earned bucks for.

Well, that's the end of my first article. Actually that was kind of fun. Think I'll try another one some time.
Oh, two words of caution I should mention before ending this.
#1- In case someone new to this astronomy hobby is reading this, never use a color filter to look at the Sun with. Use only an approved solar filter.
#2- Don't get any silly ideas about buying two of the red filters and taping them onto your eyes and using a nice bright white light to read your sky maps with. It'll just tick everybody off.

Doug's Deep Sky Challenge

by Doug Scobel

Three Obscure Planetary Nebulae in Aquila

While at the Black Forest Star Party this past September, John Causland challenged me to track down some relatively obscure planetary nebulae that you may wish to check out for yourself. They are NGCs 6803, 6804, and 6807, all within a few degrees of one another in Aquila. Now. I know that it's early fall, and Aquila (the Eagle) is normally thought of as a summer constellation, but it's still more than high enough in the sky in October or even in November to try to hunt these guys down. They're all magnitude 12.0 (visual) or brighter, and all three appear on chart 16 of Sky Atlas 2000, so you don't need more sky atlas than that. But I suspect that you may find at least two of them quite a challenge to find, regardless of the size of your telescope.

NGC 6804 is the easiest to spot, at magnitude 12.0 and a diameter around 31 arc seconds. You'll find it about 20 minutes of right ascension (about 4.5 degrees) nearly due west of Altair, the brightest star in Aquila. In my 13", it's small, not very bright, and featureless. The central star is listed at magnitude 14.4, and so it should be visible in larger scopes. But I did not note seeing the central star in my log entry dated July 1993 from Peach Mountain, nor did I record what difference any filters made. I guess I'll have to try observing NGC 6804 a *third* time.

NGC 6803 is only about a degree almost due north of NGC 6804. It is a little brighter, at magnitude 11.4, but much smaller, only six arc seconds in diameter. Also, I did not know it at the time, but according to The Deep Sky Field Guide to Uranometria 2000, it has a "smooth disk with a brighter central region", so it appears smaller visually. While scanning the area in my 13" at low power, I saw nothing that looked like a planetary nebula - just a lot of faint stars. So, I tried my OIII filter, passing it in and out between my eye and eyepiece. After carefully comparing the view with and without the filter, one of those little faint stars did not dim when the filter was present. Sure enough, there it was! Not much to see, though. I tried switching to higher power to see if I could see any detail, but even at about 300x, all it looked like was a slightly out of focus, greenish star.

John had challenged me with spotting NGCs 6804 and 6803, but I noticed NGC 6807 on the chart, about 3.5 degrees SSE of NGC 6804. So, I thought as long as I'm in the neighborhood, I'd check it out. Just as with NGC 6803, as I scanned the field at low power, I saw nothing that looked like a planetary. So again, I tried to "blink" it in using the OIII filter, which revealed its hiding place. Gotcha! Just like NGC 6803, NGC 6807 is tiny, star-like, and free of detail, even at high power. I found out later that it is magnitude 12.0, with an angular diameter of only two arc seconds. Now that's small!

So, if you own a moderately large scope, and a narrowband light pollution reduction filter, and don't mind getting off the beaten track, then you may wish to take a few minutes to hunt down these three planetaries. They're not impressive visually, but they're an accomplishment to find just the same. If you do manage to locate them, try putting higher power on them - I'd be interested in hearing what you see.

Doug Scobel and Chris Sarnecki at the 2002 Black Forest Star Party in Cherry Springs, PA, discussing how to dispose of John Causland's body after they kill him for ruining their dark adapted eyes with his flash.
Photo by "the Late- John Causland"

Telescope Topics
Rapid Prototyping
by Tom Ryan

One of the more interesting things that I've run across recently concerned a method of rapid prototyping. Rapid prototyping, if you're not already familiar with the term, is the practice of quickly developing products, so they can be evaluated as soon as possible. As anyone who has gone through the development process for a product already knows, the earlier in the development cycle that the product can be fine-tuned to the customer's tastes, the less expensive that product will be. That is, mistakes caught on the drafting board can be fixed for much less money that if that mistake is found on the manufacturing floor, or (Heaven forbid) in the customer's hands. (Many companies have done very well just by providing software that simulates the product before it is actually built. Our efficiency here may be our last bastion of defense against products made by dollar-a-day labor.)

In practice, catching mistakes early does save money. But teams that successfully design product after product do more than that. They don't try for the "Great Leap Forward". Instead, they progressively innovate. They do this by making many incremental changes to a product, and they do it quickly. Bad ideas are quickly killed, and good ones quickly adopted. This kind of innovation, in my experience, requires the presence of a particular type of person on the team. (Kathy Kolbe would say these people have a high degree of "Quick Start" to their character.) Their rapid ideas usually need to be complemented by someone who is better at following through, or foreseeing trouble and heading it off, but a team without a rapid prototyper will take too long to develop yesterday's products. Take my word for it; developing yesterday's products is just about the most expensive thing you can do.

I am not a rapid developer by nature, but I know some people who are, and I pay close attention to the methods that they use.

One method that I have seen is to build prototype structures with glass. Ordinary window glass has about the same strength, weight, and stiffness as aluminum, but is cheaper, easier to cut, thermally more stable, and easier to join together. The glass can be cut to order, or cut on the spot by someone who is moderately skilled. The resulting sharp edges can be sanded down with a sanding block. If the bonds between pieces are done by hot melt glue or silicone sealant, they are not nearly as strong as a bolted or welded joint in aluminum, but they are a whole lot faster. Somewhat stronger are lap joints made with optical stickum.

Optical stickum, otherwise known as medium hard optical cement, is a tremendously useful adhesive. I was introduced to it by Karl Mueller, although it's mentioned in Twyman's "Optical Glassworking". It's made by mixing 4 parts Rosin with 1 part Beeswax (both available from Universal Photonics). It melts at boiling water temperatures, flows onto surfaces well, and grips like a drowning man. Parts can be separated by heating the parts back to boiling water temperatures, by freezing the parts and then giving them a gentle bump, or by dissolving the cement in acetone.

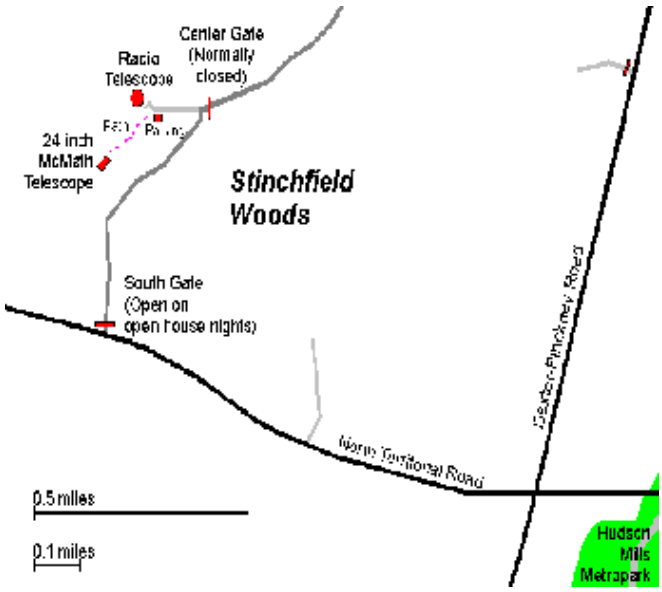
I mix the rosin and beeswax in an aluminum foil boat that is placed on a hotplate that is set to 180 degrees. The boat is about 1" by 5" long. After thorough stirring, I let the mixture cool to room temperature, where it hardens into a solid. When I need to glue something together, I heat the object up to about 150 or 200 degrees, peel back the aluminum foil, and push the block against the object until it coats it with a thick (or thin) film. Then I push the object against the part to which it is to be glued, and let the whole thing cool.

I use the stuff all the time. The cement creates very low levels of stress in the parts it joins. I've glued lenses onto aluminum plates in order to grind their edges, cover glasses onto windows to minimize chipping when coring through, ball bearing feet onto spherometer rings, and glass bridging plates to hold together pieces of glass that were being cut apart.

Karl used it to bond together an entire inspection station to measure lens runout. He did it in about ten minutes, using ball bearings as locating points and existing indicator stands to support the Interapid indicators, and then he disassembled the whole thing in a similar amount of time when he was done with it. Compared to building the station out of aluminum, that's rapid prototyping.

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 E-mail to Newsletter Editors at:
Mark S Deprest (734)223-0262 msdeprest@comcast.net
Bernard Friberg (743)761-1875 Bfriberg@aol.com to discuss length and format. Announcements and articles are due by the first Friday of each month.

Telephone Numbers:

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Vice Presidents:	Dave Snyder	(734)747-6537
	John Causland	(734)747-8437
	Doug Warshow	(734)998-1158
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Lowbrow's Home Page:

http://www.umich.edu/~lowbrows/
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Bernard and D.C. working together along with many others to maintain the 24" McMath Cassegrain telescope during the recent resurfacing of both the primary and secondary mirrors.
The front page shows D.C. getting deep into his work and later Jim Garrahan trying to figure out how to get D.C. back out of there.
The Lowbrows want to thank everyone involved in this project for their time , effort and patience. It's those dedicated people who keep your club going!
Photos provided by Kathy Hillig.

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