University Lowbrow Astronomers
Ann Arbor, Michigan

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University Lowbrow Astronomers

June 2006

Volume 30 Issue 6

What does this picture and astronomy have to do with each other?

Doug Scobel can tell you, read his article on page 2 and you'll know what he means!

Inside this issue:

Doug Scobel at Peach Mt.

Important Club Info

- June 2—3 Kensington Summer Star Gaze (Kensington Metro Park) 6pm to midnight
- June 16—University Lowbrow Astronomers' monthly meeting 7:30pm room 130 Dennison Bldg.
- June 17—Public Open House at Peach Mt. Observatory starts at dusk
- June 24— Public Open House at Peach Mt. Observatory starts at dusk (come on out & help us feed the bugs)
- **July 21— University Lowbrow Astronomers' monthly meeting 7:30pm at EMU's Sherzer Hall**
- July 22— Public Open House at Peach Mt. Observatory starts at dusk (come on out & help us feed the bugs)
- July 29— Public Open House at Peach Mt. Observatory starts at dusk (come on out & help us feed the bugs)
- **Lowbrow Members email address — <lowbrow-members@umich.edu> please use this for emails to all members only. For sub-group email addresses please refer to the "members only" website pages that deal with sub-groups. Also when replying to emails take the time to delete any non-pertinent text, that should help keep those email threads from getting to annoyingly long!**

Ya Know What I Mean?

by Doug Scobel

Most hobbies have their own lingo and buzzwords, and amateur astronomy is no different. But sometimes the terminology can get quite complicated, and words can sometimes be confused and interchanged, sometimes to the point that you need an interpreter to understand what the other person is talking about. OK, maybe it's not quite that bad, but it does help when everyone is on the same page so to speak. So, at the risk of being a little over the top on this (OK, I'll admit I can be sometimes), here's my attempt at clarifying a few commonly interchanged terms so that we can all understand each other better. I'm not mentioning the names of the people from whom I've heard these things, so there's no need to take offense. But if the shoe fits…

Collimation/Culmination

These are two different words that mean two different things.

Collimation (coll-i-MAY-shun) is the act of aligning the optical elements in a telescope, for the purpose of minimizing off-axis aberrations and realizing the best images the scope is capable of producing. This is most often done in reflectors with so-called Cheshire eyepieces and/or laser collimators. Owners of fast Newtonian reflectors are always fussing over their telescope's collimation, or at least they should be.

Culmination (cull-mi-NAY-shun), on the other hand, means the highest point in the sky that a celestial body reaches. For non-circumpolar objects, it occurs when the object reaches the north-south meridian, or in other words when it transits. Circumpolar objects, which transit twice in a 24-hour period, have two culminations, upper and lower. But generally one would mean the upper culmination, or its highest point.

Now at the 2005 Black Forest Star Party, at the door prize drawing someone won a laser culminator. Really. That's how they announced it, and more than once! I'm not sure how it would work, but I would like to get one myself. It would be really handy for observing those objects that are just rising and I don't want to wait for hours for them to get higher in the sky and out of the soup. Just point that baby at Mars and boom! – it's culminated!

Offset/Off-axis

Here are a couple terms that sound similar but really mean two different things.

Offset is often used when describing an offset mask, as is sometimes done with large Dobsonian reflectors when atmospheric steadiness is really bad. The mask covers the upper tube opening, but has a circular aperture that lines up in the opening between the secondary mirror and the edge of the primary mirror, and between two spider vanes. It results in an unobstructed light path, and can aesthetically clean up the image, although the aperture is greatly reduced. Some folks call these masks off-axis, but they are offset, not off-axis. The light path (as long as the scope is collimated) can still be on-axis; it's just that the aperture is offset from the optical centerline.

Off-axis refers to incident light rays that are not parallel to the optical axis of the telescope. If the scope is properly collimated, then the light from any object that is centered in the field of view is on-axis, and the light from any object not in the center of the field of view is off-axis. Off-axis light rays can cause all kinds of aberrations, such as astigmatism, distortion, and coma. And the farther the light rays are from the center of the field the worse the aberrations. This is particularly true in telescopes with fast focal ratios, where off-axis light rays from near the edge of the field of view arrive at the focal plane at steeper angles compared to slower focal ratios. They also cause many an eyepiece designer sleepless nights, since the correction of any one aberration will usually increase another. Which helps explain why eyepieces that are well corrected to the edge of the field in fast scopes also tend to be quite pricy.

Magnitude/Order of magnitude

Here's a case where the same word is used singly or in phrases, but means two different things depending on the context.

When used alone, *magnitude* means the total amount of light being received from a celestial object. In other words, it's a measure of how bright something is. In the magnitude scale we use for indicating star brightness, each number represents a gain in brightness about 2.5 times over the previous number.

Order of magnitude is a phrase that means a change by a factor of ten. Each "order of magnitude" can be calculated by taking the number ten to the order'th power.

For example, when comparing a 1st magnitude star against one of 4th magnitude, a gain of three magnitudes, the brightness increase is about 15.6 times. But three orders of magnitude means a change by a factor of ten to the third power, or 1000. Not exactly the

same thing, huh?

Minutes of Arc/Minutes of Right Ascension

Here's another case where the same words are used singly or in phrases, but mean two different things.

A *minute of arc*, or *arc minute*, is a constant angular measure, and is always $1/60^{th}$ of a degree. It doesn't matter where in the sky you measure it, it's always the same angle.

A *minute of right ascension* is also an angular measure, but the actual angle depends on the declination where it is measured. Right ascension is the way astronomers measure the angle around the earth's rotational axis, with a full circle being split into 24 hours. Each hour of RA is further split into 60 minutes. Because the hour circles get smaller and smaller, each minute of RA subtends a smaller and smaller angle as you move from the equator to the poles. For example, at the equator each minute of RA is 15 arc minutes. But at plus or minus 60 degrees declination, where each hour circle has half the diameter as that at the equator, each minute of RA is only 7.5 arc minutes.

I mention this because I have a double star booklet where the author used minutes of arc instead of minutes of RA and misdirected the reader from star to star while star-hopping. I was having a devil of a time trying to star-hop to some stars using his directions until I discovered what was going on.

Seeing/Seeing

Here's a case where the same word is used to mean two different things.

The most common usage is when describing how steady the atmosphere is when observing, also known as *steadiness*. Good atmospheric seeing, or probably more accurately good atmospheric steadiness, is important when using high magnifications to split close double stars or examine fine lunar and planetary detail.

But sometimes I've heard folks use the term seeing to describe a good, clear, night, in other words good *transparency*. Transparency is independent of how steady the air is, but more a measure of the amount of water vapor or other aerosols in the air, and the amount of light pollution present. In other words, transparency refers to how dark the sky background is.

More often than not, good transparency comes at the expense of steadiness, and vice-versa. If you want to be clear (pun not intended!) in what you're describing, it's probably best to use the word steadiness or transparency, rather than seeing.

Contrast/Contrast

Here's another case where the same word is used to mean two different things. Some use it to describe the amount of scattered light in the eyepiece's field of view. Others use it to describe the amount of detail that can be seen, for example in a planetary image. But they're not the same thing, nor are they affected by the same factors. I would describe the former as *field darkness*, and the latter as *sharpness*.

Loss of field darkness is generally due to light being scattered more or less evenly throughout the entire field of view. The less scattered light, the more contrast there is between the sky background and the object being viewed. Factors that affect it are diffraction of light around the edges of things in the light path, like spider vanes or the secondary mirror in a Newtonian reflector. Dirty optical surfaces can scatter light. Internal reflections in the telescope and/or eyepiece also decrease field darkness. And of course, so does light pollution. But these do little to affect the amount of detail that you can see, say, in a planetary image. But if you're trying to pick out a really faint galaxy on the edge of visibility then you need as dark a sky background as possible.

Conversely, it's optical defects that adversely affect the diffraction pattern that reduce sharpness. Poorly figured optics do it by putting too much light in the outer rings, and not enough in the Airy disk. A too-large central obstruction can do the same thing. Poor atmospheric seeing affects it by blurring the pattern. Mis-collimation affects it by introducing astigmatism or coma. All of these things will reduce the amount of detail you can see, but they will do little to brighten the sky background.

So when you're describing a view in a telescope, do you mean contrast, or do you mean contrast? The terms field darkness and sharpness are probably more descriptive.

Vega/Vega

Here's a case where the words look the same, but how they're pronounced determines their meaning.

Vega (VEE-guh) is the brightest star in the constellation Lyra. In fact, it is one of the most brilliant stars in the entire sky.

The *Vega (VAY-guh)* was a small, lousy car built by Chevrolet a few decades ago. In fact, it was one of the dullest cars ever built.

Please don't insult the star by mispronouncing its name!

Betelgeuse/Beetlejuice

Here's a case where both spelling and pronunciation come into play.

Betelgeuse (BET-el-joos) is the bright red giant in the constellation Orion.

Beetlejuice (BEET-ul-joos) is a creepy, fictional movie character.

Enough said.

Guard Rail/Guide Rail

Strictly speaking this has little to do with astronomy, but since it comes up during our annual pilgrimage to the Black Forest Star Party in Pennsylvania I thought I'd mention it.

In most states, where it would be hazardous to leave the roadway, roads have what they call guard rails along the edge of the road-bed. Their purpose is to prevent any would-be errant vehicle going somewhere it ought not go, like into a bridge abutment, over a bridge, or down a ravine. They *guard* you from such hazards. But not in Pennsylvania. There they don't have guard rails, but instead have *guide* rails. Their purpose seems to be to *guide* you on your way. Fortunately, the Pennsylvania department of transportation tells you when they're not present. In many places along the twisty roads around Cherry Springs State Park you'll see signs that read "No Guide Rail". My best guess is that you're supposed to drive along with the side of your car scraping along the rail, so that it guides you along the way and keeps you on the road. But keep your eyes open for the "No Guide Rail" signs, lest you find yourself careening down the side of a mountain and into a tree!

Other Silliness

I've also seen lots of goofy spellings in my travels perusing the Astromart Forums. One of the most common ones is where folks spell aperture as aperature, which isn't even a word. C'mon, people, it has a spell checker now so there's no excuse! I've also seen people discuss the thickness of their spider veins (ugh!) instead of their spider's vanes, and talk about armature astronomy (which is astronomy as it relates to electric motors I guess) rather than amateur astronomy.

Now that I've gotten all this off my chest, I feel much better now. And I hope you've taken a few "minutes" to read this and are now "seeing" the "contrast" between correct and incorrect terminology, at least in astronomical circles. And as far as me being a bit over the top on the subject, well as I said earlier, if the shoe fits…

Ya know what I mean?

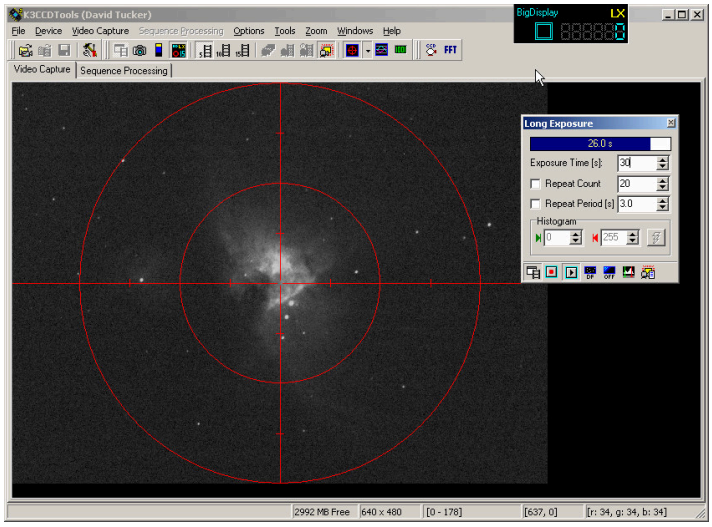
Astronomy Day 2006 activities at Peach Mt. Observatory. Pictured from left to right Sharon MacKellar, Norb Vance, Angelika Cardew, Otto Cardew, Yumi Inugi, Yasu Inugi, and Dave Snyder. Pictures by John Landino

Shooting M42: Part 2 (continued from May 2006)

An Introduction to Digital Deep-Sky Photography By David P Tucker

Software:

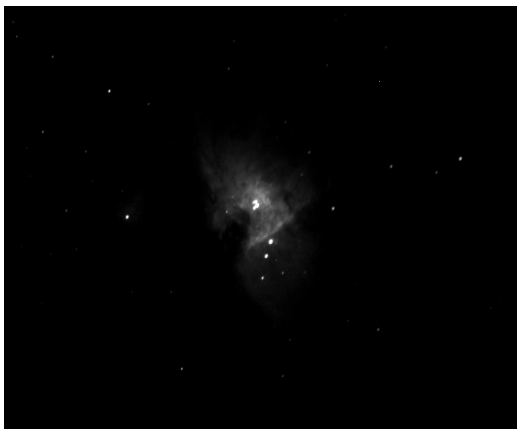
I do my image acquisition and most of my image processing using a program called K3CCD (from http://www.pk3.org/), written by Peter Katreniak. It's reliable, easy to use, and I got a free copy with my camera. The software basically has two modes, called "Video Capture" and "Sequence Processing". later. "Video Capture" mode is used for controlling the camera and saving images taken onto an avi file (basically a digital movie), and that's the topic of this section. This is a typical screen shot while taking a series of long exposure images:

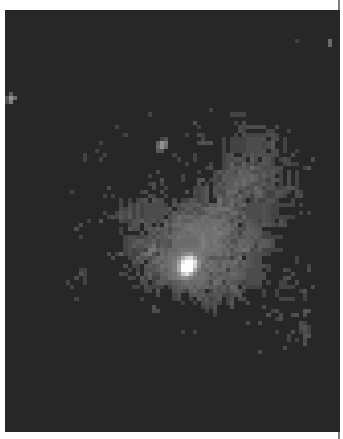


The "Long Exposure" Dialog allows me to enter the desired exposure length, number of frames to be taken. The program continuously updates the screen as images are "acquired" from the camera, and begins saving images to an AVI file as soon as the "record" button is clicked. Not shown is the "Amp Gain" control (accessed through "Device" on the main menu bar) which controls the gain on the cameras internal amplifier, which also can have a critical impact on the final image (discussed in the next section).

Signal and Noise:

You may be wondering why I normally take long sequences of frames, rather then just one. Here is a single frame of M42, shown in its original form on the left, and "Gamma Adjusted" on the right to bring out dimmer pixels ("Gamma adjustment" is available in most photo-editing programs.) Here I adjusted "Gamma" from its default value of 1.0 up to 2.5:



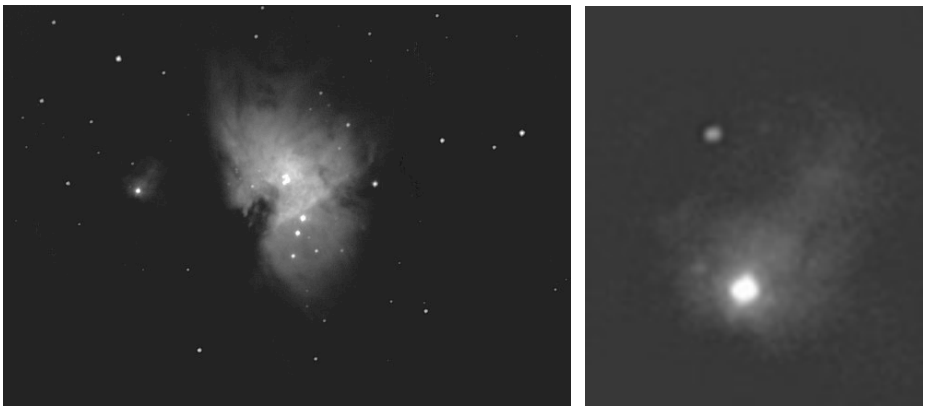


Here is a detail of the image on the right:

Not that great, is it? What were seeing here is mainly something referred to as "Quantum Noise" : The rules of physics dictate there will always be inherent inaccuracies when measuring subatomic particles like photons (the fundamental particles of light), but this inaccuracy drops as the quantity if photons measured increases. The most obvious way to increase the number of photons counted is to lengthen the exposure time, but there are limits here: No Equatorial Platform tracks perfectly (unless some sort of guiding setup is

used), brighter features may saturate (overexpose), and then there's that infernal "Dark Noise": Infrared photons emitted by warm surfaces in the camera slowly clouding the image (remember, the camera is sensitive to IR as well as visible light - this problem can be partially dealt with by subtracting a "Dark Frame" taken with the lens cap on from the raw image, but I did not have to use this technique for this image, so I'm not going to go into it).

Digital technology offers us another option: we can take large numbers of moderate length frames (say, 30 seconds), and then have our Astro-Imaging software (K3CCD in this case) "Stack and Align" the images, then add corresponding pixels values on all of the frames together to give (Say) a virtual one hour exposure. The alignment part of the process usually consists in have the user select a distinctive feature that appears in al of the frames (usually a star), the software will then automatically shift each image slightly (if necessary) to make up for minor equatorial tracking errors. I ended up taking around 180 odd 30 second exposures for this particular image, and this is the result (gamma adjusted):



Monochrome ("Luminance") image of M42

Beautiful! Again, here is a detail:

Its worth noting that by taking shorter sub frames we reduce the required polar tracking accuracy somewhat, but your not going to get a good picture if the object actually drifts out of the frame as you "film" it!

Finally, notice that my 180-frame image still has large area of black background, although in reality the whole region in suffused in dim nebulosity. To "fill in" the background, I either need to further extend exposure time/frame count, or increase the gain of the camera's internal amplifier. I chose the later alternative, and cranked the gain up to 40% for a second run of images (in the first set the gain was set to zero). Here is the result

:

Wow! here's all the dim nebulosity missing from the first image, but the bright trapezium area is completely overexposed. But that's ok, because I can use photo editing software (specifically, Registar) to paste the trapezium region from the first image onto the background of the second (I'll get back to that)

Ideally the individual sub frames should be exposed for as long as possible (several minutes or more) when imaging really dim objects, but its often possible to get very good results using large "stacks" of 20 to 60 second frames. If frames are too short, there may be no image at all in darker parts of the image. To some extent we can correct this by increasing amp gain (as I did here), but that can significantly increase noise, especially as gain goes over about 50%. I often get everything set up, then take some test shots to find the largest practical sub frame length before I start to get star trailing due to tracking issues.

Color Imaging, Again:

I stated earlier that we basically take color images through monochrome cameras by taking separate exposures (or "Stacks" of exposures) through Red, Green and Blue filters, then combine them using the "RGB Combine" functionality provided by most photo processing programs. But we can actually do better then this. By placing a color filter in front of the camera we are limiting the amount of light hitting the camera (e.g. a Red filter will block Blue and Green light), so the image will never be quite as good as a black-and-white image (unless the subject is particularly bright, like Jupiter maybe). So we introduce a fourth step into the process in which we combine the RGB image obtained by the RGB combine operation with a long exposure black-and-white image, called the "Luminance" image. This combine operation can be done using standard photo editing programs, like Photoshop or JASC Paintshop, by bring in the RGB image as one "layer" of a single image and the monochrome image as another, manually aligning them, and then merging the layers specifying "color" as the blend mode for the RGB image and "Luminance" for the monochrome. Typically I take many more monochrome frames the color frames, and almost all image processing (sharpening, etc.) is done to the luminance frame only before combining.

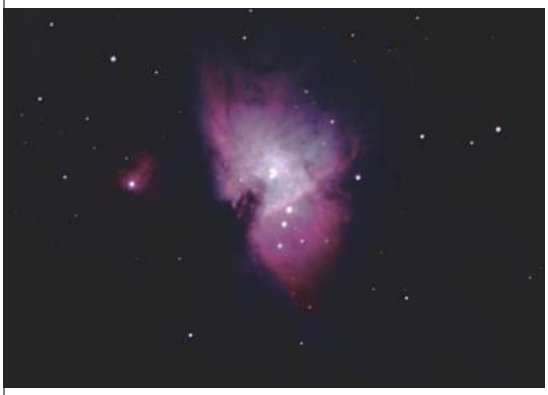
Finally, how this image was built:

First I built an image of the bright core region, shooting about 150 30 second frames of "Luminance" (monochrome) data, then about 15 frames each through Red, Green, and Blue filters. From these I built four separate images representing the nebula in Red, Blue, Green and White light, doing the sub frame stacking in K3CCD.

Images of M42 in Red, Green, and Blue light (see also "Luminance" Frame above)

I then used "Registar" to Combine the Red, Green, and Blue images into an RGB image, then finally used JASC Paintshop to merge in the Luminance data. This gave me the image below, on the left side.

Then, I did the whole thing all over again, this time with the Amp gain set at 40% to get the image below on the right. Finally I used "Registar" again to combine these two, to get the final image at the top of the article.



Conclusion, and where to Get More Information:

This is by far the most elaborate image I have ever taken – most of my images are monochrome, and I have never tried to combine images taken at multiple amplifier gain levels/exposure times before (and frankly, it will be a while before I do again!).

You can get more information on K3CCD from Peter Katreniak's site http://www.pk3.org/Astro/index.htm , in particular see Carsten Arnholm's tutorial at http://arnholm.org/astro/software/K3CCDTools/tut1/ (also available in Spanish!). There are too many good sources of imaging information on the web to possibly list, but one I particularly like the new Yahoo Small-Aperture-CCD group at http://groups.yahoo.com/group/small_aperture_ccd/?yguid=205602942 .

As far as books go, Ron Wodaski's "The New CCD Astronomy" is about as close as you'll come to a CCD imaging bible, and much of the technical information in this article came from that book. Or e-mail me (david.tucker@autodesk.com), maybe I'll base my next newsletter article on the questions I get about this one.

My future plans include imaging some objects that don't require recording and combining 6 separate stacks of images, getting some sleep, and seeing If I can run a coffeewarmer off the batterypack for my mounting.

New Lowbrow Members

Tally by Kathy Hillig

Club members are doing a great job recruiting new members. I keep getting dues from people who want to join. It sure helps the treasury. These are the new members who've joined in the last year. If you see them around at meetings or Open Houses, please say hello and welcome to the club!

2005	
May	Gerald Reardon
July	Manolo Galia
	Eric D'herde
August	Robert Johnson
	Georgia & Brent Marvin
	Lea Blander
September	Shelby & Christa Newhouse (Insel House)
	Donald Deman
	Cris Kurtz
October	Paul Davignon
	Hyon Cheol Kim
	Aaron Thero
November	Matthew Adams
December	Dorian Jurgle
2006	
January	Michael Elliott
March	James & Trisha Deneen
April	Robert Wade
May	John Landino
	Ty Rodrigues
	Mark Whitney

Of course, there are also those who've not renewed, so our total still hovers around 100. It's currently at 99 unless those 4 people whose memberships expired May 1st pay up!

As Newsletter Editor, I too want to welcome you the this wonderful club. I have no doubt that we can expect a few wonderful articles from all of you.

Remember this newsletter is for the Lowbrows, about the Lowbrows and most importantly by the Lowbrows!

Send articles and pictures to: msdeprest@comcast.net

Thank you and Welcome to the Lowbrows!

Our very own Astro-Poet, Anna Scott sent me another bit of poetry inspired by her love of the night sky and while doing a little web surfing of my own I came across a couple of comet influenced poets. I hope you will enjoy these as much as I do!

"Gift of the Stars"

Serenity of the stars....a gift, to EVERYONE,

Wafting freely.....across the skies.

We breathe the sweetness....deep into our being.....

And the Star-glow.....sparkles in our eyes.

Anna Scott – 2006

"Comet Observer"

I attract comets for my eyes

And then I throw them

Back to the universe.

Emanuela Ignatoia Sora—2006

Comet Haiku

The comet cried again

Rending immensity

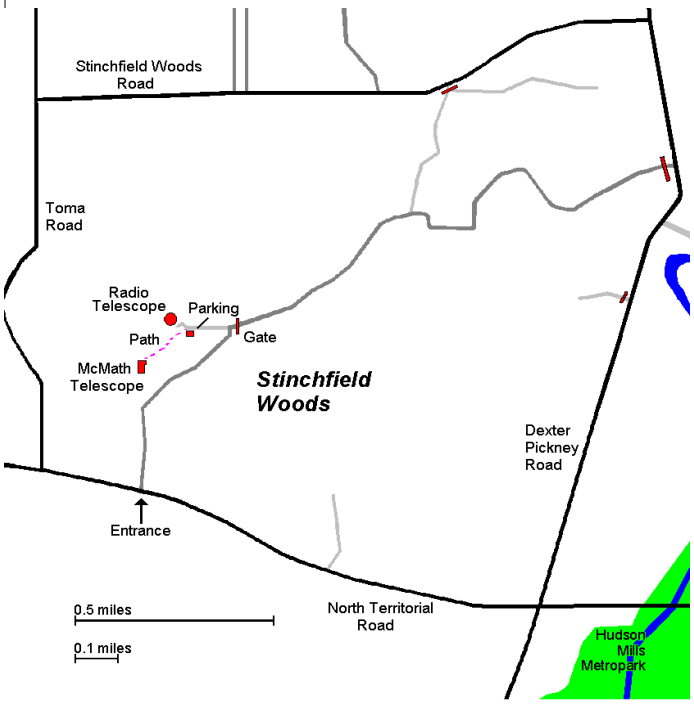
With divine sparks

Sergui Dobos—2006

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 Astronomer c/o Kathy Hillig

7654 W. Ellsworth Road
Ann Arbor, MI 48103

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.

Telephone Numbers

President:	Charlie Nielsen	(734) 747-6585
Vice Presidents:	Jim Forrester	(734) 663-1638
	Nathan Murphy	(734) 395-1043
	Kurt Hillig	(734) 663-8699
	Bob Grusczynski	(734) 461-1257
Treasurer:	Kathy Hillig	(734) 663-8699
Observatory Director:	D. C. Moons	(586) 254-9439
Newsletter Editor:	Mark S Deprest	(734) 223-0262
Key-holders:	Bernard Friberg	(734) 761-1875
	Fred Schebor	(734) 426-2363
	Charlie Nielsen	(734) 747-6585
	Mike Radwick	(734) 453-3066
	Paul Walkowski	(734) 662-0145
Webmaster	Dave Snyder	(734) 747-6537

Lowbrow's Home Page

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

Email at:

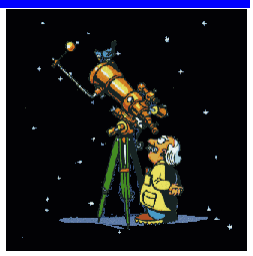
Lowbrow-members@umich.edu

University Lowbrow Astronomers

Kathy Hillig
7654 W. Ellsworth Road
Ann Arbor, MI 48103

Phone: 734-663-8699
E-mail: hilligk@hotmail.com

Reflections & Refractions



Website
www.umich.edu/~lowbrows/

One of our newest members was kind enough to send me some images he took at Peach Mt. Observatory on Astronomy Day 2006 (that was May 6th for those of you who missed it). Some of the Lowbrows set up telescopes in front of the Radio Dish and John Landino snapped off a few shots. Thanks, John for sharing!

University Lowbrow Astronomers
7654 W. Ellsworth Road
Ann Arbor, MI 48103

Check your membership expiration date on the mailing label