REFLECTIONS / REFRACTIONS

University Lowbrow Astronomers

April 2010

Volume 34 Issue 4

Kitchen Timer Mini Equatorial Trackers

By Yasuharu Inugi

** Overview **

I have created utterly "lowbrow" Poncet type equatorial tracking platforms for small tabletop telescopes. They are small, light weight, and extremely low cost. They are powered mechanically by a kitchen timer and require no electricity.

And they do work.

Rough specifications are as follows:

<Specifications (for unit #2) >

Product: Poncet type equatorial tracking platform
Size: 10"x9"x4"
Weight: approximately 1.5 lbs
Duration: up to 60 minutes
Powered by: kitchen timer and elastic band
Estimated material cost: $15
Maximum tested load: 8 lbs
Latitude adjustment: 42+-3 degrees
Recommended use: Small tabletop telescope

** Concept **

For Dobsonian telescopes, many of us use "Poncet" tracking platforms. They are very useful, especially when observing with higher magnification. I own two of those for my 8" and 12.5" scopes.

Many Poncet platforms are commercially available today. But as far as I know, they are all made for medium to large aperture telescopes, and fairly expensive.

I own a 3” Celestron FirstScope, a $50 tiny tabletop reflector on a Dobsonian mount. It is a nice little scope for the money (see my article in June 2009 newsletter). I use it quite often for quick observing from my balcony. And despite the short focal length (300mm), I often use 100 to 150X magnification. For that kind of power, you'll start to want to have tracking.

But I didn't want to put my 3” scope on one of those large trackers. What I wanted was a tiny "letter size" tracker that's easy to carry around and set up, and would not cost much.

I searched around but I could not find such products, at least commercially.

So I decided to build one.

There were some specific goals I wanted to achieve for this project:

1) It must work reasonably well with a small tabletop telescope. Tracking should be fairly accurate so there is no significant problem when observing with 100~150X power range.
2) Easy to set up and use
3) Small and lightweight, therefore easy to carry around
4) Low cost
5) I should be able to build with the basic tools I have. (saw, drill, cutter, etc.)

Being a "lowbrow" astronomer, goal #4 was very important for me. But I had doubts about keeping the cost low in the beginning. If I had to use an electric drive like all the other Poncet trackers, that alone would cost over $50. Plus you would need to add a battery. All that would increase the cost, make the size larger, and add more steps for set-up.
I was wondering if I could possibly replace the electric drive with a mechanically powered one. I knew a tracking platform, even a large one, wouldn't consume much power. What I wanted was an inexpensive mechanical "motor" which would rotate slowly and steadily.
I looked for such a drive for a while before actually starting the project.
Then one day I walked into a dollar store, and viola! I found a kitchen timer for $1. It is a mechanically powered device which rotates with a slow steady rate of 360 degrees/hour. It is small, light, and cheap. After a 24 to 1 speed reduction, I could get the required 15 degrees/hour rate. It even "rings" at the end of the tracking. A perfect motor for the mini tracker!
It boosted my motivation, and I started to seriously work on this project.

** Design **
Many of you might already know how a Poncet tracker works, but I'll explain briefly anyway.
Pictures are better than words, so please also refer to Figure 1 for details.

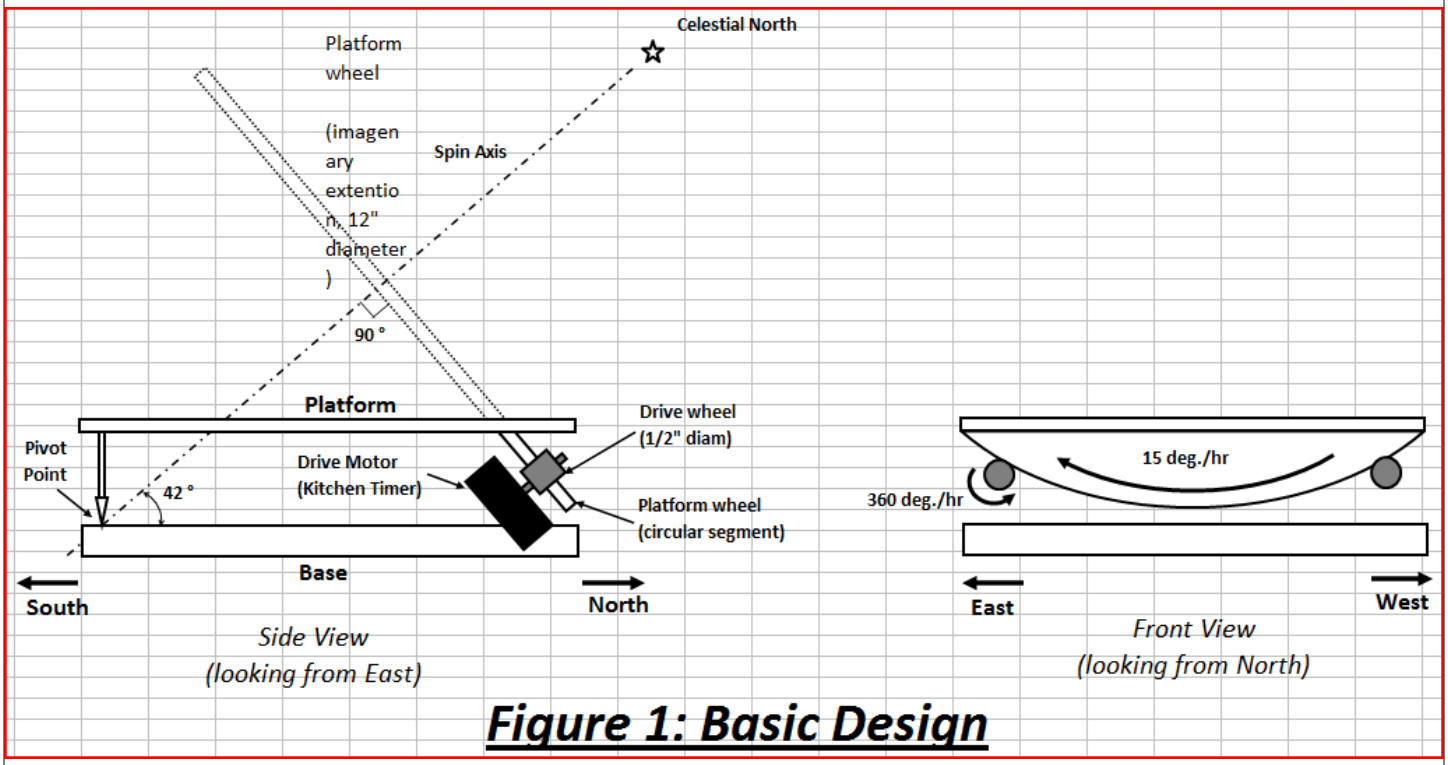


Figure 1: Basic Design

On a Poncet tracker, a telescope is placed on a horizontal plate (platform), which is designed to turn around an axis parallel to the Earth's rotation axis. The rotation of the tracker is designed to be exactly the opposite of the Earth's rotation, therefore cancelling the apparent movement of celestial objects.
A circular segment (I call this "platform wheel" in this article) is attached below the platform on the north side, at an angle equal to 90 degrees minus the latitude of the observing site. There is a pivot point on the south side below the platform, so that the platform can "swivel" around an axis parallel to the Earth's rotation axis. The rotational speed of the tracker must be 360 degrees/day, or 15 degrees/hour, going from east to west.
The latitude at Ann Arbor is about +42 degrees, so the platform wheel must be tilted 48 degrees from the platform.
I did some geometry calculation and found that for the desired "letter size" platform, the wheel must be about 12" in diameter. To reduce the kitchen timer's rotation rate of 360 deg/hr to 15 deg/hr, I needed a 24 to 1 gear reduction. This required the size of the wheel on the motor (I call this "drive wheel" in this article) to be about 1/2" in diameter.

** Key Elements **
Initially, I built a prototype with foam board and mostly scrap parts I had at home. I learned a great deal about the design and found some key areas that needed improvement. I changed the design and built one with wood board base. Then I tested and revised, tested again, etc., until it became reliable. So far, I have built two units: they are about the same size and have very similar design.
Here are some key design elements I would like to describe. Please also refer to Figure 2 for details:

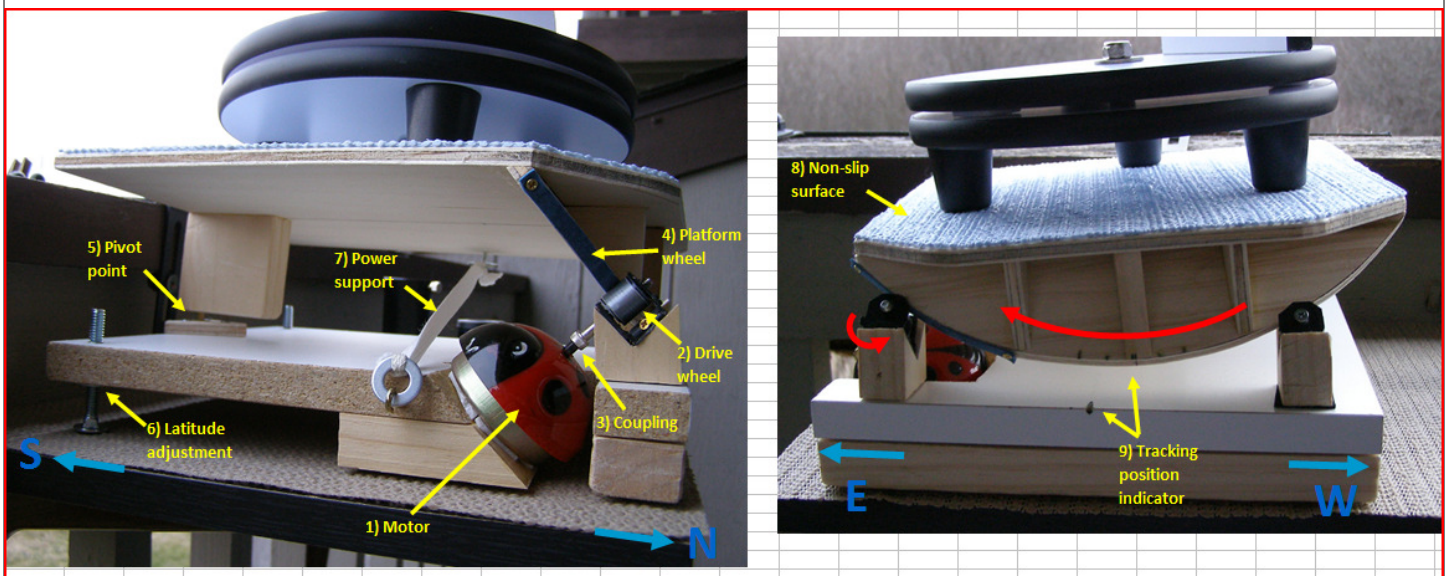
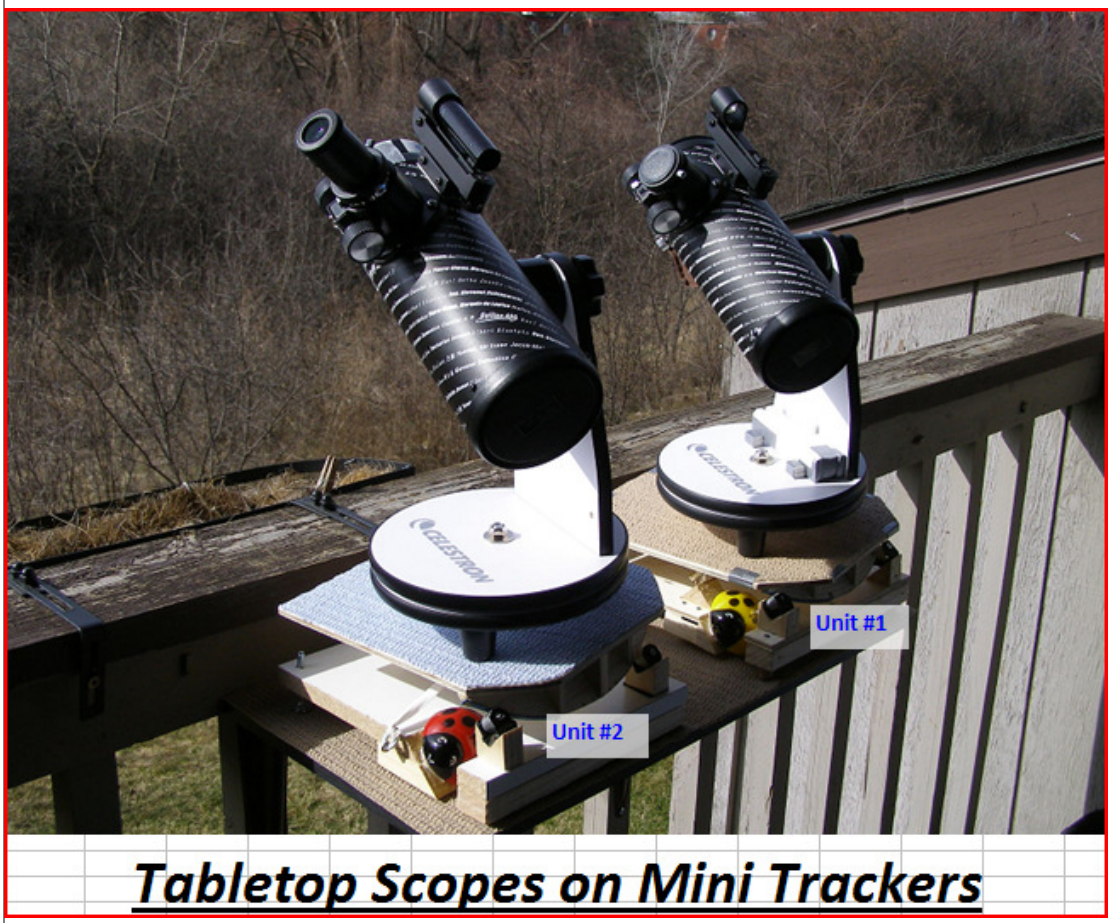


Figure 2: Mini Tracker Key Elements

1) Motor
A kitchen timer, or the "motor", is attached to the base at an angle parallel to the inclined platform wheel.
2) Drive wheel and speed adjustment
I picked up a 1/2 inch "nylon spacer" from a hardware store for the drive wheel.
I then wrapped a small strap of duct tape several times to adjust the speed (the more tape you add, the faster the tracker goes.) It was a trial and error process but after several tests I was able to adjust the speed fairly accurately.
3) Coupling of Motor
I initially mounted the drive wheel directly on the motor, but the weight of the telescope gave too much stress to the motor. So I changed the design to "couple" the motor to the drive wheel so that most of the weight of the load would be absorbed by the wheel support, but not by the motor. For unit #1, I used a screw driver head and a bolt for coupling. This worked, but it had a large amount of "play" that tended to cause problems. On unit #2, I changed the coupling to a cut hex nut and a bolt (thanks to a suggestion by Mike Radwick) for much less play.
4) Platform wheel
To prevent slipping, I glued a piece of rubber band (used to bind broccoli) on the left bottom of the platform wheel where it contacts the drive wheel.
5) Pivot point
I placed a cut bamboo skewer stick below the south end of the platform. Then the stick is placed in a small hole on the base. This enables the platform to swivel.
6) Latitude adjustment
I placed T-nuts and bolts at the south ends of the base for latitude adjustment.
7) Power support
Kitchen timer's power was limited and initially I often had a problem of premature stopping. To prevent this, I added a piece of elastic band (the same kind used for your underwear) to pull the platform in the driving direction. This power support enables the tracker to work without stopping, up to about 8 pounds of load.
8) Platform surface
To prevent slipping, I glued a non-slip sheet (for kitchen cabinet) on the surface of the platform.

9) Tracking position indicator
To indicate the tracking position in the dark, I drew lines and applied glow in the dark paint on the front side of the platform wheel and the base.

** Field Test **
I have done tests and made improvements repeatedly, but here are the latest test results I have.
Tests were mostly done on the balcony of my apartment. I used a Celestron FirstScope 76mm mini Dob (f=300mm) with a 6mm Orion Expanse eyepiece (66 degrees of FOV) and a 2x barlow on the tracker. This gave me a 100X magnification, with a FOV of 0.66 degrees. I tracked a star near the celestial equator, mostly either Rigel or Sirius. I set a star in the center of FOV and watch how it drifted out.
The tracking was not dead accurate and the star slowly drifted. But the speed and direction of the drift were pretty steady for the most part, and after adjusting the latitude and the speed, I was able to keep the drifting down to a very low level.
When properly adjusted, Sirius stayed in the FOV for the entire tracking period of 60 minutes. This means the drifting was kept under 0.33 degrees/hour (Without tracking, it drifted out in about 80 seconds.)
I also noticed the stars "jiggle" slightly in the FOV. It was noticeable but not uncomfortable for visual observing. (I've seen similar kind of jiggling with larger trackers.) I suspect the cause of this jiggling is either imperfection (rough surface) of the wheels, or possibly from the oscillations of the kitchen timer. I also noticed that when someone was walking around or when it was windy in the star could bounce around. This I believe is mostly because the table on my balcony is not sturdy, but also the light weight of the tracker could be a factor.
I believe placing the tracker on a sturdier table, or directly on the ground, will reduce the jiggling and bouncing, but I have not tested yet. Building the tracker with heavier material could also reduce jiggling and vibration.



** Final Remarks **
Are these mini trackers useful after all? Yes, well, at least for me. Even for a small 3" scope, I found the tracker to be useful, especially for planetary and detail lunar observations where I spend longer time to look for details. Since the mini trackers are so easy to use and carry around, I almost always use one whenever I use the 3" scope. Also tracking is nice to have when you are showing an object to other people. I have never used a camera on the mini tracker, but I would like to try one someday, to take long exposure photos.

I have enjoyed making these trackers and learned a great deal about Poncet platforms. It was a good winter spent, and now it's spring again! But these trackers are no way near perfect and I'm still making improvements here and there.

You Might Be a Lowbrow If…

By Doug Scobel

I'm sure you're all familiar with Jeff Foxworthy, the famous comedian who makes fun of himself and others who happen to be rednecks. You know his shtick. "If you think the last words to The Star Spangled Banner are 'Gentlemen, start your engines', then you might be a redneck". Or, "If the Jack-O-Lantern on your front porch has more teeth than you do, then you might be a redneck". Or one of my favorites, "If your idea of fast food is hitting a 'possum at 65 miles per hour, then you might be a redneck". Hilarious stuff, in my opinion at least. That got me to thinking. Just like rednecks, there are certain characteristics and behaviors of Lowbrows that make us unique. And in my opinion, some of them are quite funny – or at least they would be if they weren't partly if not entirely true. So here's my list – maybe you can come up with some of your own.

If you've ever said "Wow, it's really warm out tonight" when observing under 20°F temperatures in January, then you might be a Lowbrow.

If you have ever seriously considered selling all your astronomical equipment to take up stamp collecting because you just can't face yet another solid month of cloudy skies, then you might be a Lowbrow.

If you keep insect repellant in your eyepiece case, then you might be a Lowbrow.

If your definition of observing in the winter is looking at pictures on the Astronomy Picture of the Day web site, then you might be a Lowbrow.

If your telescope has ever gotten so wet from dew that if you didn't know better you'd say it was caught in a thundershower, then you might be a Lowbrow.

If you have only four hours of true darkness from twilight to twilight on the summer solstice, then you might be a Lowbrow.

If your checklist for what to take with you to your favorite observing site includes a snow shovel, then you might be a Lowbrow.

If you know what the Michigan Nebula is, then you might be a Lowbrow.

If you have ever observed where there were so many mosquitoes that they created diffraction spikes around bright stars, then you might be a Lowbrow.

If you've ever bragged about observing in temperatures below zero – and I mean Fahrenheit, not Celsius - then you might be a Lowbrow.

If you've ever observed Messier objects – however briefly - through holes in the clouds under a 95% cloudy sky, then you might be a Lowbrow.

If you have ever even considered hanging an astronomical calendar on your neighbor's garage door across the street, so that you can at least observe *something* with your telescope, then you might be a Lowbrow.

If you know that Peach Mountain isn't really a mountain, then you might be a Lowbrow.

If you spend more time buying and selling equipment on AstroMart then you spend actually using that equipment under the stars, then you might be a Lowbrow.

If you have duct tape anywhere on your scope, then you might be a Lowbrow.

If you are willing to drive more than a thousand miles – each way – to get to truly dark skies, then you might be a Lowbrow.

If you know what a "Guide Rail" is, then you might be a Lowbrow.

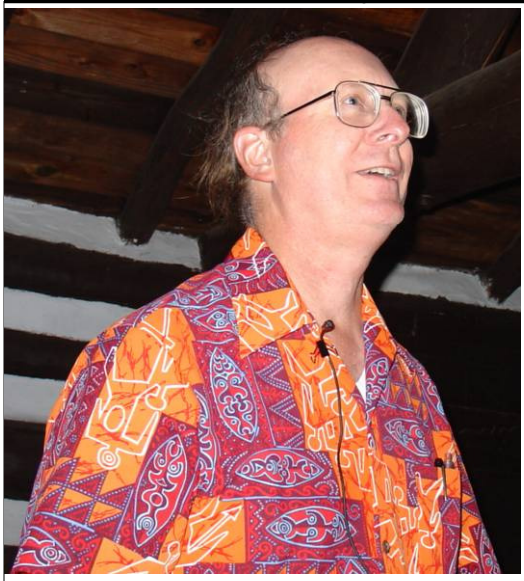
If the know the meaning of the word Scopehenge, then you might be a Lowbrow.

If you know what "Atta boy, Jim!" is from, and who says it, then you might be a Lowbrow.

If you know someone who brings a portable planetarium to star parties "just in case", then you might be a Lowbrow.

So, how can you be certain that you are truly a Lowbrow? Well, if one or more of these jokes make you cry rather than laugh, then you could very well be one. But that's okay, being a Lowbrow is a good thing. It's a lot better than being a redneck.

[My apologies to any of you who consider yourselves rednecks and take offense – Doug]



For Don

The night I was informed of Don Machholz's newest comet discovery I felt deep inside a great excitement rising up through the labyrinthine pathways of my unvanquished curiosity. It was the childhood wonder of a discovery of something previously unknown. A comet advancing wither shins through the purple pre-dawn sky, unseen by anyone ever before, suddenly comes within the ken of one man. For three nights that man battles cloudy climes to bring a new comet to the attention of the world. In the end his discovery is confirmed and the world has new knowledge of a very old comet.

However this is no simple discovery using automated telescopes and software to do all the work. It is a visual discovery done through a manually controlled telescope and has taken many hundreds of hours of searching. In fact Mr. Machholz has adamantly searched for many thousands of hours through the eyepiece to discover a total of eleven comets. This indefatigable hero of the night has inspired many like me, who have looked up into a clear star filled sky in awe, to wonder what mysteries lie within its unfathomable depths. Reflecting on his happy discovery I am inspired to take a stroll down the path of my Milky Way memory and recall a few events from my life long love of the stars.

Each childhood day I waited impatiently for the night to come, ever checking the Western skies for those importune clouds which might sweep in during twilight to destroy the nightly observing session which always bought new wonders and promises of new sights to be seen each night for a lifetime of observing.

I would live for the night of perfect seeing in order to push my telescope to its utmost limits. Every night would bring a new thrill: the craters of the moon and crescent phase of Venus at age 10 in a 50mm refractor; the passage of the moon in front of the Pleiades on a cold winter's night and a ruddy lunar eclipse through my grandpa's 8X40 mm binoculars at age 12; the first views at age 14 of Saturn and Jupiter in a 4 ¼" Edmund Reflecting telescope; the sighting of Pluto on two consecutive nights at age 16 through a Criterion 8" telescope; the colors and filaments of the Orion nebula and the beauty of many galaxies like NGC 4565 at age 33 through an 13.1" Odyssey I telescope from Coulter Optical and at age 45 the discovery of Comet/C/1998/H1 through another Coulter telescope this time an Odyssey II 17.5"; the viewing of thousands of galaxies and globular clusters through my home made 25" reflector at age 46; and now at age 56 the imaging of many galaxies and nebula and comets and asteroids through a 12"RCX400 using a modified Cannon xti camera which produces images equal to those taken at Palomar when I was a boy. I cannot recount here ALL the millions of celestial objects seen over the past 5 decades but each aurora and meteor and star field and comet and asteroid and planet and nebula and galaxy and star cluster and satellite (including Sputnik) has it's special moment in my mind and each arouses my curiosity for what else could be out there, yet unknown by any mind, like this Comet Machholz 2010 was just a few weeks ago.

Each night or morning people like Don Machholz and you are strongly drawn out of their abodes to stare in wonder, using their eyes or cameras or binoculars or telescopes ever searching for the magic of the unknown, ever curious about wonders within our view and those beyond our ken. Each month we await impatiently our Sky &Telescope or Astronomy magazine to devour its wondrous information in words and pictures. Each season we await the familiar celestial friends and yet undiscovered treasures found in those constellations culminating during that season. Each year we reflect on all the sights we have seen and look forward to the empyreal machinations of the future as the Heavens themselves seem to plot against our completely knowing them by ever revealing new complexities within subtleties. Still, we are never put off by these puzzles but swell with eudemonic pride as we explain and theorize and search for satisfactory paradigms to make, in our nonplussed minds, logical sense of sometimes impossible astronomical scenarios. At the end of it all people like Don Machholz make new discoveries and ever new ones and we realize with delight, the hope from our youth, that there is no end to discoveries to be made out there. There are only more mysteries to be uncovered and understood, an infinite supply of celestial food to feed our ever ravenous curiosities.

Patrick Stonehouse 3-24-2010

Current Astronomy Events in Southeast Michigan (April 2010-December 2010)

The following lists events hosted by the University Lowbrow Astronomers, plus a few selected events hosted by other organizations. All events are hosted by the Lowbrows unless otherwise indicated. Events hosted by the Lowbrows (with the exception of monthly club meetings) may be cancelled if conditions are unusually cold or if it is cloudy. If in doubt, call (734) 332-9132 after 4PM the day of the event to determine the status.

Follow the links for more information about each event. Events listed below are free of charge (unless indicated otherwise).

- **Friday, April 16, 2010.** (7:30PM). Monthly Club Meeting.
- **Saturday, April 17, 2010.** *May be cancelled if it's cloudy or too cold.* (Starting at Sunset). Open House at Peach Mountain.
- **Saturday, May 8, 2010.** *May be cancelled if it's cloudy.* (Starting at Sunset). Open House at Peach Mountain.
- **Saturday, May 15, 2010.** *May be cancelled if it's cloudy.* (Starting at Sunset). Open House at Peach Mountain.
- **Friday, May 21, 2010.** (7:30PM). Monthly Club Meeting.
- **Saturday, June 5, 2010.** *May be cancelled if it's cloudy.* (Starting at Sunset). Open House at Peach Mountain.
- **Saturday, June 12, 2010.** *May be cancelled if it's cloudy.* (Starting at Sunset). Open House at Peach Mountain.
- **Friday, June 18, 2010.** (7:30PM). Monthly Club Meeting.
- NEW **Saturday, July 10, 2010.** *May be cancelled if it's cloudy.* (Starting at Sunset). Open House at Peach Mountain.
- **Friday, July 16, 2010.** (7:30PM). Monthly Club Meeting.
- NEW **Saturday, July 17, 2010.** *May be cancelled if it's cloudy.* (Starting at Sunset). Open House at Peach Mountain.
- NEW **Saturday, August 7, 2010.** *May be cancelled if it's cloudy.* (Starting at Sunset). Open House at Peach Mountain.
- NEW **Saturday, August 14, 2010.** *May be cancelled if it's cloudy.* (Starting at Sunset). Open House at Peach Mountain.
- **Friday, August 20, 2010.** (7:30PM). Monthly Club Meeting.
- NEW **Saturday, September 4, 2010.** *May be cancelled if it's cloudy.* (Starting at Sunset). Open House at Peach Mountain.
- NEW **Saturday, September 11, 2010.** *May be cancelled if it's cloudy.* (Starting at Sunset). Open House at Peach Mountain.
- **Friday, September 17, 2010.** (7:30PM). Monthly Club Meeting.
- NEW **Saturday, October 2, 2010.** *May be cancelled if it's cloudy.* (Starting at Sunset). Open House at Peach Mountain.
- NEW **Saturday, October 9, 2010.** *May be cancelled if it's cloudy.* (Starting at Sunset). Open House at Peach Mountain.
- **Friday, October 15, 2010.** (7:30PM). Monthly Club Meeting.
- NEW **Saturday, October 30, 2010.** *May be cancelled if it's cloudy.* (Starting at Sunset). Open House at Peach Mountain.
- NEW **Saturday, November 6, 2010.** *May be cancelled if it's cloudy or too cold.* (Starting at Sunset). Open House at Peach Mountain.
- **Friday, November 19, 2010.** (7:30PM). Monthly Club Meeting.
- NEW **Saturday, December 4, 2010.** *May be cancelled if it's cloudy or too cold.* (Starting at Sunset). Open House at Peach Mountain.
- NEW **Saturday, December 11, 2010.** *May be cancelled if it's cloudy or too cold.* (Starting at Sunset). Open House at Peach Mountain.
- **Friday, December 17, 2010.** (7:30PM). Monthly Club Meeting.

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The Members of the University Lowbrow Astronomers

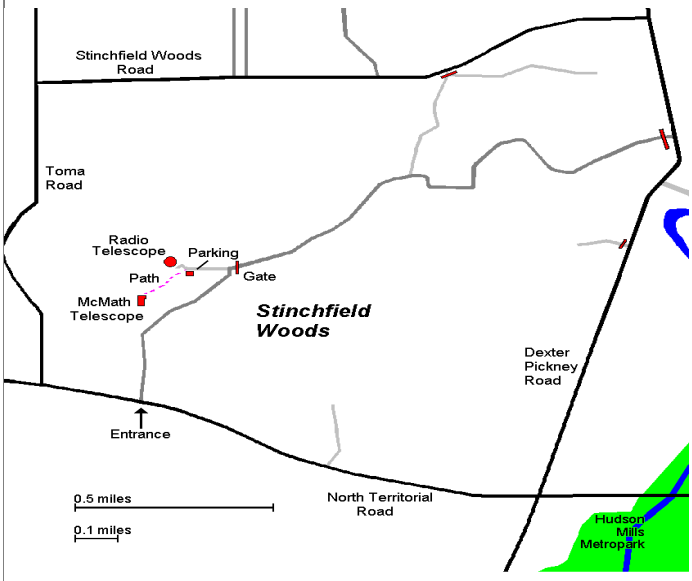
Out of pure laziness they failed to provide their newsletter with their thoughts or images!

Please don't let this happen again … remember what your Newsletter Editor says, "only you can prevent blank pages!"

Places & Times

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

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



Public Open House / Star Parties

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

Membership

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

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

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

The University Lowbrow Astronomers

c/o Liz Calhoun

P.O. 4465

Ann Arbor, MI 48106

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

Sky & Telescope - $32.95 / year

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

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

Newsletter Contributions

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

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

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Vice Presidents:	Jim Forrester	(734) 663-1638
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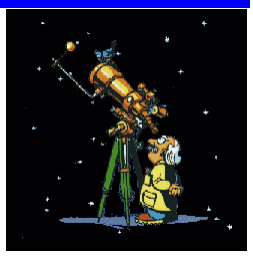
Reflections & Refractions



Website
www.umich.edu/~lowbrows/

William Stegath snapped this lovely photo of Mercury and Venus on 4/3/10.

University Lowbrow Astronomers
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Check your membership expiration date on the mailing label