REFLECTIONS / REFRACTIONS

University Lowbrow Astronomers

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Volume 32 Issue 6

Observat'n Resolution '08 - Follow up Report, Part Une

By Christopher Sarnecki

In the February Newsletter I proposed an observing challenge list dubbed Observat'n Resolution '08. Since the first half of the list favored the winter/spring constellations of Canis Major, Leo, and Virgo, I thought its time to report progress (or lack of...) on my efforts so far. I have to admit that I was a little apprehensive in starting this list. Could I find and actually see these objects? Staring with Sirius B, let's find out.

Name/Cat No. Mag Size Coordinates - RA/Dec Constellation

Sirius B 8 - 06h45m/-16d43' Canis Major

As indicated this 8th mag white dwarf is the companion to the brightest star in the sky, the -1.4 mag Sirius. This year the separation begins at 8.2" and ends the year at 8.6". Remember that last separation. I attempted splitting this famous pair with the 8-inch, f6. I also experimented with a hexagonal shaped mask (as mentioned in the *Sky & Telescope's* February issue) and an off-set clear aperture mask. The hexagon shaped mask really just created more diffraction spikes to the four crated by the 4-vanned spider. I used high power, but unfortunately, I waited till Sirius was past highest culmination in the southern sky. Poor seeing didn't help, and sadly I didn't split this one. Something tells me I am going to pay with some late night (early morning actually) cold weather observing late in the year if I am going to bag this one this year when it comes around again.

Davy Crater Chain 45 Km. 11.S lat. 7W long. Moon

A string of 2 dozen, 1 - 2 Km wide craterletts just north and east of the famous crater Alphonsus. This was the first object I bagged on the observing list, and did it with the 8-inch, f6 at medium power.

Look for this object 1-day past a first quarter Moon. Not as easily observable as I expected. Three of the larger craterletts were seen on a long whitish streak at the predicted location. Wouldn't mind seeing this object in a larger scope.

Leo I 10 10' 10h08m/12d18' Leo

The dwarf galaxy Leo I's low surface brightness is famous and proved to be a challenge. I used a chart off the Skyhound's March web site: (http://www.skyhound.com/sh/skyhound.html) for referencing the star field just north of the bright star Regulus. Keeping Regulus outside the FOV, and using the faint stars as a reference for locating Leo I, I was able to 'see' this galaxy. Not a faint smudge, but viewed only as a slight brightening of the background sky, this 'nothing' galaxy is much less apparent than the other local dwarf, Barnard's Galaxy.

Intermission - Just in time for Summer, three fine IPAs...

High Seas IPA, Michigan Brewery Company, Webberville, Mi. - Hoppyness at arm's length, fruity nose, and a nice dry aftertaste. Mummmm!

Snake Dog IPA, Flying Dog Brewery, Denver, Co. - Tasty sweet hoppy goodness with a nice warm ending.

Double Crooked Tree IPA, Dark Horse Brewery Company, Marshall, Mi. - Defiantly the scariest looking beer I have ever drank due to the 1/2-inch of dead yeasties in the bottom of the bottle. Thick fruity nose on this one. One intriguing and complex brew. Not for the faint hearted.

3C273 11.7 - 13.2 12H26M/02^19' Virgo

Many of us have heard that it is possible to observe this the brightest Quasar. At a whopping almost 2 billion light years away, sighting quasar 3C 273 has been on my to do list for some time. The map in *Sky & Telescope's* May 2005, (page 83) provided to be an excellent tool for locating this faint star. While I used the 18-inch, f4.5 to see this, I know it is observable in smaller scopes. I intent to try this one in the 8-inch. If I don't see the quasar, at least I'll get the satisfaction of locating the star field. I encourage Lowbrows to attempt this object in medium size scopes. May 25th, just after a small front pasted through, I nailed this quasar in the 8-inch! Must be at 12 mag instead of 13 mag as I was unable to see a 13.5 mag star right next to the quasar (well it is only an 8-inch).

Wolf 359 13.7 - 10h54m/07^19' Leo

Wolf 359 is a Red Dwarf and the third closest known star (after the Alpha Centauri system and Bernard's star) at 7.75 LY distant. As indicated in my previous article, this red dwarf is one of the smallest stars known, at about 10% the mass of the Sun and about the size of Jupiter according to Burnham's Celestial Handbook. I used a 1959 hand drawn map from Burnham's Celestial Handbook to help find this faint star. Wolf 359 has a large proper motion of almost 5 arc-seconds per year in Position Angle of 225, so I had to make some adjustments to the map to locate the right spot. So how do I know I saw it? Good question. I did see the star where the modified map indicated it should be, and didn't see a star where it was drawn in 1959. Wouldn't it be nice if all these objects in space had tags on them like they do on our star atlases and maps?

Still on the original observing list are extra-galactic globular clusters NGC 1049, in the Fornax galaxy; and, Abell 39, the spherical globular cluster in Hercules. Challenge objects remaining are Polarissima Borealis, the diminutive 13 mag galaxy within one degree of Polaris; extra-galactic globular clusters G1 in the Andromeda galaxy; and M87's relativistic plasma jet (OK, I'm dreaming on this last one). Still have to split that pesky Sirius B. I'll defiantly report back later in the year on how well I fared on the second half of this Obervat'n list.

Chris Sarnecki

Seen here trying to hide those glassy eyes after too many glasses of those IPA's.

Chris has been a long time member of the University Lowbrow Astronomers and a highly accomplished observer in his own right.

When not sampling strange brews, Chris likes to push his observing skills and scopes to their limits. If you see Chris out observing ... wander on by, he always has something interesting to see and generally a lot of info about the object.

Titan, Dark Matter and Black Holes
By Dave Snyder

Now that spring has arrived, there are more opportunities to observe. Among other observing targets is Saturn. I lost track how times I've seen Saturn through a telescope, but I never get tired of looking at it. After I've soaked in the image of Saturn's disk and the rings, I start looking at the moons. The number of visible moons varies, but you can almost always see the largest of Saturn's moons, Titan.

I bring this up because of a talk I attended this March: "*The Methane Hydrological Cycle on Titan,"* by Jonathan Lunine (Planetary Science and Physics at the University of Arizona). Also attending were Fred Adams (Physics, U-M) and Sushil Atreya (Atmospheric, Oceanic, and Space Sciences, U-M). I first met Dr. Atreya while I was an AOSS grad student. Some of you may remember that one of Dr. Atreya's students give a talk at the February 2005 club meeting "Titan, as seen through the eyes of Cassini-Huygens." Both talks discussed the Cassini-Huygens mission and what we have learned about Titan. Titan is not just a point of light, it is a strange world; like Earth in some respects but very different in other respects.

Before I talk about Titan, I should go over some basic atmospheric chemistry. The Earth's atmosphere is mainly nitrogen and oxygen with smaller amounts of other materials including water vapor. The atmosphere is divided into "spheres," for our purposes only two are important. The troposphere is the part of the atmosphere closest to the Earth. The stratosphere is farther out. In the Earth's atmosphere very little water vapor escapes the troposphere into the stratosphere. This is important because materials in the stratosphere are often broken down by solar radiation. Water vapor is not affected in this way, but oxygen is (the later is converted to ozone). The Earth's atmosphere has only very small amounts of hydrocarbons (these are compounds composed of carbon and hydrogen, for our purposes only two are important, namely methane and ethane).

Titan is one of only four solid bodies in our solar system with a significant atmosphere (the others are Venus, Earth and Mars). It is permanently covered in an orange haze, this haze made observations of the surface impossible until relatively recently. Our understanding of Titan has increased as a result of data collected by the Cassini-Huygens space mission. Cassini-Huygens has established that Titan's atmosphere is mainly nitrogen and methane, and there is evidence for small amounts of ethane. Methane and ethane are normally colorless gases, though both gases will condense out as clouds in Titan's atmosphere. Titan is cold, though somewhat warmer than you might expect due to the methane.

Cassini-Huygens has produced visible light photographs and radar images of Titan's surface. The resulting images have given us a lot of information. The northern polar region looks similar to the Thousand Lakes region of northern Minnesota. There are many black areas, one about the size of Lake Michigan. These black areas resemble lakes. For these structures to appear black in the radar images, they must be flat. The most likely possibility: these are lakes of methane or a mixture of methane and ethane. Water ice has been ruled out as possibility. There are no lakes in the equatorial region, and only one lake in the south. Near the equator, there are "dunes" suggestive of sand dunes; they are probably made of water ice. Unlike Earth, there are no "oceans" (at least no visible oceans….) There are structures that resemble rivers, they suggest that periodic rainstorms result in rivers of methane. Even though the rivers dry up, you can still see the river channel.

On Earth, water goes from vapor to liquid water ("rain") and back to vapor ("evaporation"). Something similar seems to happen on Titan, only with methane/ethane instead of water. The analogy isn't perfect; for one thing methane mixes into the stratosphere where solar energy almost certainly breaks apart. The end result: methane is converted into ethane and hydrogen; the later escaping Titan's gravity. This process is fast by astronomical standards and is one way; ethane cannot be converted back to methane. We expect all the methane to be converted to ethane in ten million years or so.

This prompts an obvious question, since Titan is over 4 billion years old, why is there is still methane in Titan's atmosphere? While we do not have the data to be sure, it is possible that the atmospheric methane is replenished from underground reservoirs (similar to the aquifers of water under the Earth's surface). Another possibility: methane could be produced underground. While it is too cold for liquid water on the surface, it is possible for liquid water mixed with ammonia to exist underground (the ammonia would act as an antifreeze). Some researchers have speculated that there could be large underground oceans of ammonia water. This could undergo chemical reactions to form methane and it might occasionally erupt; Titan's version of a volcano. There is evidence that such volcanism may have occurred in the past.

Since Titan receives very little energy from the sun, there isn't much energy to power a hydrological cycle. If Titan were like Earth, we should have seen many methane rainstorms. We haven't; it is believed that they occur but infrequently and we haven't been observing long enough to see any so far. It is unknown if a Titan equivalent of a thunderstorm is possi-

ble; none have been observed so far. There are winds on Titan, but they are weak (if the winds were stronger, the lakes should have waves and this has not been observed).

While it might seem far-fetched, some researchers have suggested life might be possible on Titan. If there is life, it could be responsible for the methane in Titan's atmosphere. The evidence to date suggests there is no life on Titan, however it hasn't been completely ruled out.

While I don't want to go into much detail, I attended a number of other talks.

Jonathan Lunine gave a second talk later in the day "Exploring the Outer Solar System: Present and Future." He discussed objectives in possible future space missions: Pluto, three moons of Jupiter (Io, Europa and Callisto) and two moons of Saturn (Titan and Enceladus). Titan is our best model of the early Earth (Titan's atmosphere best approximates what we think the atmosphere of Earth was four billion years ago). Enceladus is one thousandth the size of Titan, it has geysers and it sheds matter forms the E-ring of Saturn. All would be interesting targets for space missions, however it seems unlikely there will be enough funding to allow space missions to each of these targets.

Margaret Geller (Smithsonian Astrophysical Observatory) gave a talk on dark matter. Among her many accomplishments, Dr. Geller produced a documentary "So many galaxies, so little time." We may need to consider that as the club motto. She began her talk by saying that we don't know what dark matter is, but are now know ***where*** it is. Dr. Geller's work has involved mapping the location of dark matter. She presented her findings to the audience, which included the most detailed maps of the kind I have seen.

Saul Teukolsky (Physics, Cornell) gave a talk on gravitational waves and black holes. In brief he is exploring the following problem: Gravitational waves are predicted from the theory of General Relativity. However detecting such waves is very difficult. If we have some idea of what the signal of a real gravitational waves would look like, it might be possible to optimize our equipment to make the detection easier.

Following this logic, Dr. Teukolsky built a computer simulation of a binary black hole (BBH for short). It seems likely that BBHs would produce the best examples of gravitational waves. (Gravitational waves require a moving gravitational field. BBHs contain two moving fields, one for each black hole, and black holes produce the strongest gravitational fields known). The simulation was written in C++ (while it has taken a while, FORTRAN is no longer the only language used for such projects). The simulation takes thousands of CPU hours to run.

(Some of you will recognize the name; Saul Teukolsky is one of the co-authors of the "Numerical Recipes" books).

References

Sushil K Atreya. May 2007. "The Mystery of Methane on Mars & Titan." *Scientific American.* Volume 296, No. 5, pp. 43-51.

Margaret Geller. April 2, 2008. The Eighth Annual Ford Motor Company Distinguished Lecture in Physics (the University of Michigan): "Newton Meets Einstein: Mapping Dark Matter in the Universe."

Jonathan I. Lunine. March 27, 2008a. Michigan Center for Theoretical Physics Lecture (the University of Michigan): "The Methane Hydrological Cycle on Titan."

Jonathan I. Lunine. March 27, 2008b. Michigan Center for Theoretical Physics Lecture (the University of Michigan): "Exploring the Outer Solar System: Present and Future."

Jonathan I. Lunine and Sushil K. Atreya. March 2008. "The methane cycle on Titan." Nature Geoscience 1, 159-164 (2008). [Published online: February 17, 2008].

Dave Snyder. January, 2006. *Reflections of the University Lowbrow Astronomers.* "Gravity, Part 1: What Einstein Did For Astronomy."

Dave Snyder. October, 2006. *Reflections of the University Lowbrow Astronomers.* "Gravity, Part 4: Globular Clusters & Galaxies."

Saul Teukolsky. April 3, 2008. Michigan Center for Theoretical Physics Colloquia (University of Michigan): "Black Holes and Gravitational Waves."

A beginning Amateur Astronomer Part 3

By George W. Ferrier

After reaching a high membership of 14 members we have dropped to 6 or 8 people that do observing. This is mostly due to warmer and longer days and also due to not being satisfied with just Binocular Observing and were not interested in what was being viewed but wanting to experience what is seen in magazines and pictures, but those still with us are Energetic, Enthusiastic and Willing to Observe anything that is in the night Sky. Some of Our Observing:

January 4, 2008:

Orion, Mars which was between Betelgeuse and Aldebaran, NC22444 the Rosette Nebula which looked like a bright star surrounded by a gray fuzzy glow, we were using 10 x 50 Binoculars.

January 19, 2008:

We were tracking Mars movement using its close proximity to the moon. We observed it for One hour and 37 minutes.

February 20, 2008:

We Observed the Moon and Saturn and watched the full Eclipse; at the end we noticed a blue glow from the moon.

March 20, 2008:

EMU Saturn, Gemini; the double of Castor, Orion Nebula, Perseus; Double Cluster NGC 869 & 884

April 15, 2008:

I had Four Members meet me at EMU for some observing. We used a 6" Dobsonian and a Mononocular on a tripod. We observed using the Dobsonian M51, M81 & M82, Saturn and 2 of its Moons and the Trapezium in the Orion Nebula and thru the Mononocular we observed The Pleiades, Hyades, Mizar & Alcor and the Andromeda Galaxy, which looked like a small gray cotton ball.

April 26, 2008:

Took 3 Members to Peach Mt. we viewed Regulus, Saturn, Polaris, Sirius, The Whirlpool Galaxy ,M3, M85, Rhea & Titan we also observed a satellite pass North to South above Ursa Major and also a meteor passed above Arcturus.

May 10, 2008:

About 1 hour after sunset we were able to observe both Mars and Mercury which was about 25 Degrees below and left of Mars.

May 22, 2008:

I had 2 of my members with me at EMU and we watched the ISS pass at about 9:30 PM in the South and it was a -2.5 Brightness and we observed it again after 11 PM but it was not as Bright. We also watched Mars in the Beehive Cluster, M13; the Hercules Cluster, Saturn and Titan, Arcturus, Vega and we watched two artificial satellites passing overhead.

May 24, 2008:

Peach Mountain Observed M3 Regulus, 2 passes of the ISS.

Ken Cook gave me a 4" Orion Saturn scope we can borrow. He helped me with the set up and we viewed Regulus which when we first viewed looked like a Sapphire Ring surrendered by Diamonds, but when focused it was a BEAUTIFUL Blue Object hanging in the night sky, then he put it on Saturn and we could see the separation of the rings and also 1 or 2 moons. He then left me to use another scope. I had great difficulty in sighting in on objects to observe but was eventually was successful and Observed Castor & Pollux and then Mars. While Observing Mars I seen a Meteor or Artificial Satellite pass below it. We also observed several Satellites pass overhead. We have also went and done observations when the Shuttle, ISS and also several satellites like Cosmos, Evisat, Genesis 1 & 2 and we were able early in the Morning we were able to view the Hubble pass but it was about a 3 in brightness. On the nights we did no observing I had my group make a Model of Orion to show how the Constellation looks like when we view it and what it looks like in space. We also talked about our Universe and what's in it, and one day we made an Astrolabe to measure Degrees. I am trying to get used to using the scope and how to find objects more easily and I need to align the spotter scope according to Mr. Cook.

Up North Observing – Part II

By John Causland

Yasu and Yumi (the intrepid anytime camper astronomers) and I decided rather spontaneously, and certainly serendipitously to drive up north for the Memorial Day weekend. We were running on pure intuition. The moon was to rise around 1 a.m., but the sky conditions were predicted to be great

It's the first trip of the year, no time to plan, and I can't find my tent! But Yumi and Yasu must have extras of everything. It's the crazy Memorial Day weekend and was not leaving until 3:45 pm with the need to combine all our gear together in the Aztek. "Lightnin', Mike Radwick, calls about 2:30 to say he really wanted to come, but couldn't convince himself to do it, what with Memorial Day traffic. I do must my best to guilt him out of his fear. But he also does encourage us to drive up 127 and avoid the Zilwaukee bridge construction. This did add at least 60 miles, and it took us 5 hours with no dinner break, but it made for a leisurely, no stress trip.

Several months ago, Lowbrows received an open invite to Beth Kingsley's cabin south of Atlanta right on M65, and given our late start, Yasu and I agree, (as we most always do!), to skip Tomahawk tonight and go straight to Beth's, a shorter ride by 30 miles. This was also fortuitous, as we found the next day that our favorite Tomahawk site was filled with several cars. We surprised Beth at 8:45 p.m. as her friend and kids made somemores on the bonfire. We walked back a half block on a 2 track between hay fields as the sky dimmed. An ungrown hay field was back just far enough to get us away a little from the lights of M65. We quickly realized that the cross road, Beaver Lake Pond Rd. brought headlights pointing straight at us across the field, so we parked the trailer across the 2 track to block them. But, over the hours, the lights and roar of passing trucks never ceased.

But, the sky was DARK. 21.75-21.79 on the Sky Quality Meter! This compares to 21.65 at Black Forest and 21.8 in the U.P. The structure in M101 and M51 was incredible! What a site. Better than any photo to an observer's eye. The moon rose at 12:30, but it didn't matter with Dark and Dry. We put the Denkmeier binocular viewer in and looked at a slew of globulars. They didn't seem to dim at all with the rising moon. By 2:45, we were in our sleeping bags listening to the passing trucks, all packed up and ready to go in the a.m. We'd had some incredible views, but the ambiance at Tomahawk is better.

As we headed to Tomahawk, our hungry stomachs forced us to stop in Atlanta's 2 block long downtown at DeJay's for breakfast. As we left, walking across the street, I felt impelled to suggest that we wander over to the "cookout" in front of a realty company celebrating their becoming a Cabela's Trophy Properties agency, and, just for fun, tell them that we'd long been considering finding land to buy to do astronomy. We surprise a realtor out front with our tongue in cheek story, telling him we were looking for land nobody else would want, small cabin, no land, but surrounded by fields, no trees, and no water.

The realtors were all quickly taken with our story of how dark the skies were as we showed them

Kingfish's dark sky topo map of Michigan and the Eastern seaboard. The agency head, Mike, intently absorbed our story of search for dark sky, and within minutes, he and his partner, Diane, joined heads and suggested we come to their place that night to set up camp! What a total surprise. Mike drove us out to their place, 7 miles west and there we found ourselves coming up on rolling hills, their house as others on land previously farmed, no trees, and all good horizon.

In wonder at our good fortune, we wander around the house, outbuildings and pasture, but notice the mercury vapor lamps on nearby houses. The closest neighbor wasn't home, so we decided to set up in a closed in area that would block off the light offenders. A very odd location indeed. Half surrounded by low farm buildings and a sheep pen! But our intuitions said "do it"! This was an opportunity not to be missed. And Mike insisted we could stay in the house! They had a big bunk room with several beds. On the way back, we find a real camaraderie with Mike on several levels. He was not one to miss an opportunity that the universe would provide him. Incredible. And he even suggested we come back later for dinner.

With hours yet left in the afternoon, Yumi and I drop Yasu off at the Atlanta beach side park to nap, while we drive 15 miles north to Tomahawk, with no good reason really, since we were committed to Mike and Diane's. But, we did find that our special Tomahawk site was taken, as with all other sites on nearby site circles. So, Yumi and I drove to the other 4 big site areas at Tomahawk and discovered that not quite all sites were taken. But the big discovery was that one area had another big open field that would be fine for numerous scopes and the sites were open! Yasu must not have explored this one earlier!!! So, now we had 2 possible Tomahawk locations!

We returned to pick up Yasu and tell him the news that his site was taken, but we'd found another one for future use, and head back to Mike's, at the corner of Secrist and Maneer. (Check Google maps.) I go jogging and their little Yorkie follows me for a half mile. As she wouldn't turn back with me, I pick her up and, for the first time in my life, I jog for 3 blocks back with a dog cradled under one arm…

Mike, a former butcher, makes us a steak dinner - just like being part of the family! As we set up, Mike says the mosquitoes just yesterday hatched en masse. He spray fogs the perimeter of our area and we're not bothered the rest of the night. But the grass here is very short, mowed down by the sheep. The previous night's horde of mosquitoes had even filled up our car, and they were had to get rid of the next a.m.! Here, no such problem. That's hay vs. sheep chewed stubble for ya. Who'd a thunk sheep would be an advantage for observing.

Soon after dark, quite a group of folks had arrived for a spontaneous star party of 30. These folks all loved this opportunity! And the dark sky objects surprised even us! The enthusiasm here may even one up Peach Mtn! The Sky Quality Meter again hits 21.77!

By midnight, most are gone and we leisurely chat and observe with Diane and a friend or two. Mike has to be up at 5 a.m. to serve breakfast at the Hunt Club! He's quite a cook. One of Mike's realty associates, Dorothy, in the afternoon,

spoke of getting us onto the "hunt club" (20,000 acres!) site for a star party sometime. That night, she was sure of it. What opportunities were opening up for all us Lowbrows!

The sky had begun to fill with streaks of clouds and we packed up again this night at 2 a.m. Thankfully to sleep in a bed! In the a.m., Diane makes us a big farm breakfast of fresh eggs from the coop and her step father, Roger, joins us. Roger remembers a star party going on years ago. We quiz him about it, and it was SMURFs, only 10 miles east on Pleasant Valley Rd. owned by a guy who since passed on.

On the way back, we look at a house or two for sale, hopeless cases. And we visit Camp Michiluca, Brian Ottum's vacation getaway. A Lutheran camp. It's practically deserted and we drive all it's circles and talk to the care taker and note that it's 2 possible observing fields have somewhat limited horizons but could be pretty good anyway. But Mike and Diane's is clearly the best find! And at the moment at least, we have a standing invitation to come back anytime. Ready to go?

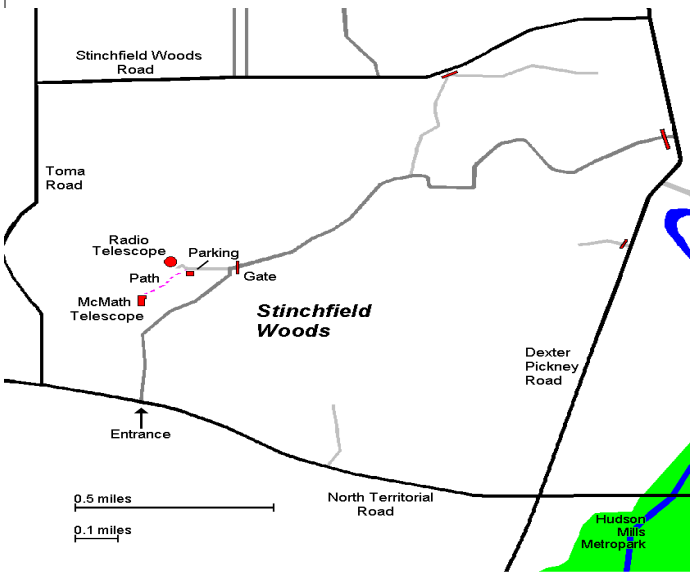
Yes, there will be a Part III installment to this Up North Observing adventure!

All Images by John Causland

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 Yasuharu Inugi

2918 W Clark Rd #203
Ypsilanti, MI 48197

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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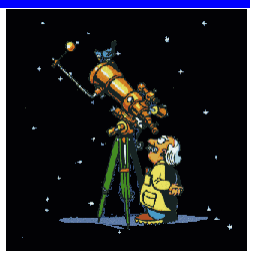
Reflections & Refractions



Website
www.umich.edu/~lowbrows/

Remember "shooting stars" can be very dangerous, so keep moving and remember to "duck!"

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Check your membership expiration date on the mailing label