

REFLECTIONS / REFRACTIONS

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University Lowbrow  
Astronomers

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## Why Astronomy Part II

By Mark S Deprest



If you are older than 30 you've been exposed to at least some of the what historians refer to as: "The Space Race". Some of us found inspiration in this and followed that to physics, engineering, computers, rocketry, and even astronomy. Now some of you chose to push yourselves and make your professions in these areas and some of you follow them as hobbies. Whatever the case, "the space race" and ensuing explorations of space have touch all of our lives in some way.

A number of our members credit this period of history as their stimulus toward astronomy, that spark that ignites the fire of desire, the desire to learn more. Norbert Vance of EMU found inspiration in the "space program" and that led him to a career in teaching astronomy. This is the second part of an on-going series of articles inspired by Norbert Vance's exercise, that he started at our July meeting; where he told his story and then passed out 3 x 5 cards and asked that the attendees write down what inspired them. These cards were then collected and handed over to me as

newsletter fodder. After a couple of months reading them over, I noted a pattern and I sorted them into groups. This article is group #2, The Space Program ... and the following are some of the comments of "Why Astronomy".

The Apollo program and moon landings were very exciting times and one of our rank wrote that John Glenn orbited the Earth on their birthday, and so they started to follow the space program, and especially all of the Apollo launches and ensuing missions. (*I don't want to burst their bubble but I doubt that John Glenn knew it was their birthday*).

David Shindell, found a certain inspiration while following the US space program starting with the Gemini missions and ending with the moon landings. His interest also include the classic instrument designs of antique telescopes.

Take a keen interest in the Apollo Program, follow it very carefully, add that to the multiple visits to the Abrams Planetarium in East Lansing, and Dave Snyder found that astronomy was a hobby that piqued and nurtured his mind.

As far back as memory will serve Doug Washow was interested in astronomy and space travel (*he thinks "maybe even before exiting the womb"*). As a 4 year old he saw "2001: A Space Odyssey" and realized that those monkeys weren't the same as the "flying monkeys" in the Wizard of Oz. He remembers watching Apollo 8 and Apollo 11, thinking some day I want to grow up and be an Astrophysicist ... we are still waiting ...

Jim Forrester found part of his inspiration while watching satellites on the beaches of Lake Huron late at night. As a younger version of himself he followed the the Mercury, Gemini & Apollo manned space flights and took note of the constellations during his cub scout days.

I am sure that many more of us can trace out interests in astronomy to "The Space Race" and many of us still feel a thrill at every launch, marvel at the technological breakthroughs that have come out of NASA, ESO, JPL, FKA & RKA, and find ourselves looking up at the night sky wishing we could travel there too!

Part III of "Why Astronomy" will deal with those who had some sort of formal education in the astronomical sciences, if you fit into this category drop me a breif description of that and I'll include it in the next part. Part IV will include those who got hooked on astronomy from some type of media, ie, books, TV or movies. Part V we'll see who got their kick from their first telescope and then I will conclude this series with two stories that defy categorization (these are very good ... just wait!). Thank you all who filled out those little 3 x 5s and thank you again Norbert for passing them along.

## ASTRO-IMAGING FOLLIES

By Brian Ottum

I wrote an article for the newsletter a few years ago entitled “Climbing the Imaging Mountain” in which I talked about all the factors that impact astronomical imaging. This article is simpler. I will just tell about how I learned how to take pretty pictures of the night sky – by screwing up and trying to learn from those mistakes.

The two most critical factors in taking a great image are FOCUS and TRACKING. These two will bedevil me forever, no matter how hard I work or how fancy my equipment gets.

### FOCUS MISTAKES

I’ve spent half an hour focusing the camera carefully, and then moved the scope to find the object. Days later (when I download the frames) I see that focus is messed up on one side of the frame. It’s because the camera was not totally flush up against the focuser, and the set screw not tight. The new “lean” just tipped it a bit and that’s enough to ruin a shot.

Telescope tubes contract when the evening gets colder. This moves the focus up and outward. For years, I have not thought of this. Being inherently lazy, I just focus at the beginning of the evening and call it done. I’ve recently noticed that the shots taken at the end of the night often have blobby, unfocused stars (especially if the night is cooling fast). Oops.

### TRACKING MISTAKES

I used to balance my scope so that the tube & camera were exactly the same weight as the counterweight. Dumb. The rotary worm gear would bump the drive gear teeth periodically, and the scope would move a few arc seconds (the RA “backlash”). All the stars would have periodic lines. Some frames would be great, others have lines. I scratched my head for weeks on that one. Finally, I found out that whatever is on the east side of the mount (either the tube or the counterweight) needs to be just a pound or two heavier so there’s no more “bumping.”

One night I got everything set up but just could not find the faint NGC galaxy I wanted. Gave up and went inside. A couple weeks later (when it was clear again) I went through the same setup procedure. I realized that I was aligning the scope on the WRONG STAR! [Idiot me]

One night I hit the “lunar rate” button so the scope changed its tracking rate from the normal sidereal rate. Everything was messed up.

I got an autoguider to help the tracking. Works great. But I wasted a night fighting with it, later to realize that the software needs me to do a completely new calibration once the object switches from the eastern to the western sky.

### OTHER HUMOROUS MISTAKES

A couple years ago I left my winter coat in my dome, to use it on the cool September nights. I was excited to image NGC 4565, the great edge on galaxy. Everything was set up and running, taking 90 minutes’ worth of frames. Shortly into it, I got cold and picked up the coat. After putting it on, I got the feeling that someone was making multiple PAINFUL injections into my neck. I hopped around frantically, trying to get the coat off. Finally I did and was able to brush the wasp off my neck. The next day, I see that there were no frames after the first few. In my jumping around, I had unplugged the scope.

Two weeks ago, I identified a new NGC nebula that I had never imaged. So I set up finder charts and spent 3 hours getting images. The next day I realized that I had imaged the object just a week earlier! Yes, I am getting senile.

One time I accidentally deleted all the frames off of the memory card before downloading them to my computer.

### NOT EVERYTHING HAS BEEN BAD

My son recently put some of my best shots on my website. I call it "Space's Greatest Hits." He found some programming that helps do nice zooms of each shot. I encourage you to check it out and get back to me with comments.



<http://www.ottumresearch.com/astrogallery/index.html>

### COMING ATTRACTIONS

I'm wrapping up a MONSTER mosaic of all 110 Messier objects, in a format that's a bit more artistic than the boring grid pattern. That will be a future article and zoomable web page.

## The Clear-Sky Blues—By John Manney

The sky is clear and black, and the Moon is out of sight. I am far away from the city lights. There are no mosquitoes, and it isn't cold yet. The telescope isn't broken. Best of all, I don't have to get up for work tomorrow. It is a perfect night to go out and enjoy the sky.

*However, I am enjoying the skies already. I am in my overstuffed chair with my new book of Hubble images. Plus, I am a bit tired. And, it can be a big deal to set up the scope. It weighs 5 pounds, and the tripod legs will probably hit the doorway. This can be stressful. Besides, the go-to drive may decide not to go anywhere.*

A little voice is scolding me: This is a good night to go out and observe. It may be a long time before we have another one. You're just a wimp! What would Herschel say about this? Is this the way Galileo worked? What about the Arabian and Chinese astronomers of long ago? Would they see it your way?

*OK, so what if I am a wimp. I'm not under any obligation to go out, just because it is clear, dark, warm, mosquito-free, and Moon-free.*

But the memory of this lost opportunity will haunt me in February, March, and April. Worst of all, I will have to keep an awkward silence the next time we're whining about the cloudy skies of Southern Michigan.

*In short, I am in turmoil because this is a perfect night. If it were cloudy, cold, Moonlit, or mosquito-infested, I wouldn't feel bad about anything. Astronomy is supposed to be fun, not a Greek tragedy.*

I have an idea. I have a compromise. I have to take the trash out, anyway. I'll just look at the sky for a couple of minutes. I'll be able to say it was a great night to look at the stars, and I took advantage of the opportunity. Maybe, I will find that it is cloudy after all.

*So out I go. Wow...the Milky Way is thick tonight...Polaris beckons from the north...My right eye catches the Seven Sisters. Capella is rising in the northeast. In the west, Arcturus is fading away. In the south, Jupiter almost hurts my eyes.*

I had better set up the scope, before we get clouds, or some other problem.

*[No clear nights were used in preparing this article]*

## The Eye of the Observer

by Doug Scobel

Well, it happened again. Remember Gracie and her bear, about whom I wrote a few months back? Check out the August 2010 edition of Reflections if you missed it. In the article I relate an encounter with an apparent amateur-astronomer-to-be while observing up north. Well, it happened again at our last open house (you know, the one where Mark [Low]brow-beat us into attending). This time the encounter was with a remarkable third-grader named Allison.

Do you remember November 6? If Mark's cajoling didn't, then the cloudless, pure azure late afternoon skies surely convinced many of us into attending what could have been our last open house of the year, yours truly included. It looked like it was going to be one of those perfect nights. But alas, around sunset, a last-minute cloud bank made its appearance and never totally relinquished its grip on the skies over Peach Mountain. A group of cub scouts made their presence known early, but the clouds, while thin, didn't afford us any targets for the boys and their families. It didn't take long for them to get tired of waiting and they ended up leaving. Too bad they left when they did, because it wasn't long after that when the cloud bank started to thin and a few objects started to become visible. The first was Jupiter, and it wasn't long before most scopes were pointed in his direction. About that time a group of several families arrived. The first scope in line from the pavement was Mark's big and beautiful Blondie, but when I saw the number of people lining up at his scope I suggested that some could come look through mine as well. By now Jupiter was winking in and out, in concert with the small gaps between the clouds as they slowly passed overhead. I had to encourage our guests to stay at the eyepiece for a while lest they miss a gap in the clouds where Jupiter would look really good. There were a few boys, their apparent parents, and one young girl taking turns at the eyepiece. Now this girl was a little different in how she approached her viewing. Most of the others would take a quick look and say "Cool", and then move on to another scope. But she actually took her time. She was actively studying what she was seeing, not just looking.



I would ask "Do you see the bands across the planet?" "Yes I do" she said. "Those are Jupiter's clouds. Do you see those bright stars to the right of the planet? Those are some of Jupiter's moons". "Yes, I see them" she replied while still glued to the eyepiece. Then came the unexpected. Some questions. Really serious questions. Not how far away is it, or how big is it, but more along the lines "What are the clouds made of? Do the moons ever crash into each other?" Not an unreasonable question, since they're all in a row and, hmmm, maybe they *could* run into each other. So I tried to explain to a young child the clouds are made of methane and other gasses, and how each moon is in its own circle going around the planet, and they stay in their circles so they never run into each other. She nodded as

if she understood – whether she truly did understand I don't know. But while she nodded I could see the gears going inside her head, so she was definitely listening and processing and internalizing to the best of her ability.

By now the clouds were thinning more and more, with the gaps becoming larger and larger, so there were more targets available to our scopes. Soon Lyra was smack in the middle of a large open area, so naturally I went to M57, the Ring Nebula. A number of folks took turns looking, with the usual reactions, some saying "Wow!" while others I had to ask if they saw it. It wasn't long before that same girl was at the eyepiece. "Do you see the smoke ring?" "Oh, yes, I see it." I was pleased, because sometimes it can be a challenge for kids that age to make out the fainter, fuzzier objects. But what came next caught me off guard. "It kind of looks like a planet." "Say what?" I thought to myself. "It kind of looks like Jupiter" she added. How astute. I told her how these kind of objects are called "planetary" nebulas because they, well, resemble planets. I then complimented her on her observing



skills, and she nodded in appreciation. But she wasn't done yet. "It's darker on top". She was obviously noticing that the ring isn't equally bright all the way around. So of course I had to compliment her again. Again I received the same nod and a very polite "Thank you" in return. We looked at a few other targets, like the E.T. cluster, the Double Cluster, and others, before the clouds closed in for the night. The same girl never strayed far, and always took her time at the eyepiece, and always came up with some really good questions. And I always got that same knowing nod in reply to my attempts at answering them the best I could, and the same polite "Thank you" every time.

Once the clouds dictated that we were done with observing, I spent some time in conversation with her parents and her. I found out that her name is Allison, and she's in the third grade. I also found out that the family owns a telescope, I think an Orion Starblast. She said that she has a "lot of questions", so she has a natural curiosity about astronomy that doesn't come along very often. We discussed various books that are good for beginners, I recommended "365 Starry Nights" because that was the only one I could think of off the top of my head. [Perhaps if one of her family members reads this they can go to our beginner's book list at <http://www.umich.edu/~lowbrows/biblio/youth.html>]

I complimented her again, telling her what a good observer she was. And I meant it. Very few novices notice much if any of the subtle details in the things we show them, but not this little girl. She's got the eye of the observer, and as many of you reading this know, it's not just the eye. Just as it was with Gracie a few months earlier, she was engaging her mind, processing what she was perceiving with her senses, in this case sight, to form an understanding of something beyond her immediate self. Not that common in most of our guests, but even more remarkable considering she's only a third grader. Very remarkable indeed. I sure hope she and her family make it out to Peach Mountain again.

My current work and volunteering schedule limits my ability to get to open houses, but you can bet that I will make a more concerted effort to do so. I don't want to miss out on meeting another Allison. You never know when you might encounter another youngster that has the eye of the observer.

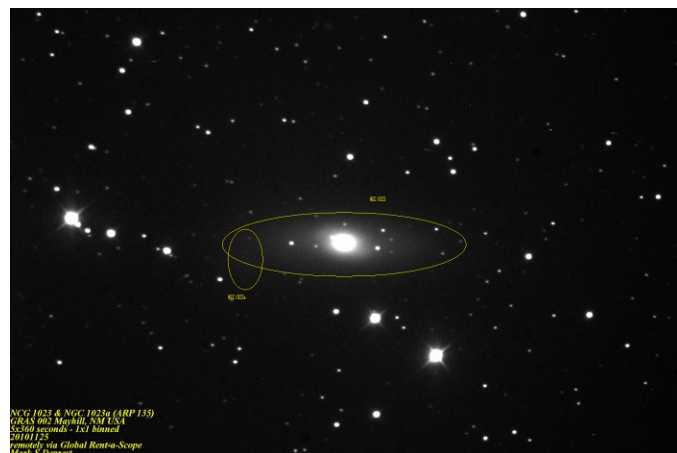
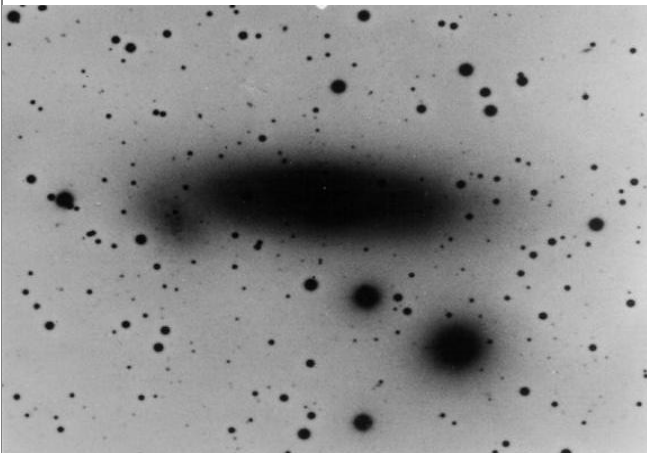
## Observer's Challenge

By Mark S Deprest

Yes, I know that its usually someone else that throws out these observer's challenges, but I thought I might give you all one of my own. Everyone knows my observational passion is first and foremost COMETS, however any one who has observed with me recently, knows that I am working my way thru the Dr. Halton Arp's Catalog of Peculiar Galaxies also that I love to observe the unusual and often overlooked objects. I would like to present three of my favorites for this time of year. The first two objects are from the Arp catalog and the third object got me twice, more on that story later ...

NGC 1023 & NGC 1023a – a.k.a. ARP 135

NGC 1023 is an easy target that almost any size scope will be able to show. At 10.5 magnitude and 8.1 x 3.4 arc minutes in size. This galaxy is a pretty bright, large, very elongated S0 type with a very bright central core. 200X brings out the companion galaxy NGC 1023a on the eastern tip. Using averted vision this duo shows considerably more in both size and detail. NGC 1023a is the challenge object, a 10" scope under transparent conditions should be able to pick it up. This duo is about 4.5 degrees west of rho Perseus on the Perseus / Andromeda border and at this time of year it rises at about 4:00pm so, by evening astronomical twilight they are 45 degrees above the northeastern horizon. The finder chart and images below should help you with both where and what to look for.





### NGC 772 & NGC 770 – a.k.a. ARP 78

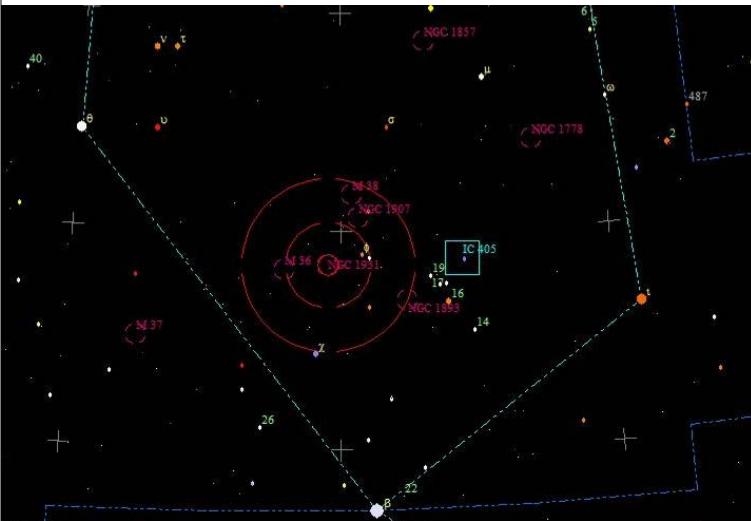
NGC 772 is also an easy Sb type galaxy to observe in almost any size scope as its magnitude is listed at 11.1 and it too is similarly large at 7.5 x 4.3 arc minutes. Listed as bright, large, slightly elongated, with one bright arm, bright elongated central core and averted vision causes this beauty to grow by 150%. An extremely faint extension seems to connect to the much fainter NGC 770 listed as a type E 13.9 magnitude galaxy. NGC 770 and the connecting bridge are the challenges, you should be able to see hints of the bridge under very transparent and rural dark skies in scopes as small as 12 inches. This one requires patience and very contrasty conditions. NGC 770 is much smaller and pretty much round in shape with its dimensions listed as 1.1 x 0.8 arc minutes and located about 3.7 arc minutes south-southwest of the core of NGC 772, both can be found 2 degrees southeast of beta Aries, see the finder chart and images below.



### NGC 1931 (not a Comet!!!)

Okay, here is the last of the challenge objects and the challenge is to not be fooled into thinking its a comet ... it got me twice! Let me explain, this small open cluster with a diffused nebula involved looks like a comet in low powers and it is located in a star rich area of the winter milky way between M38 and M36. When I was sweeping with my 8 inch scope from M38 over to M36 using my 32mm MK-80 eyepiece it slid thru a corner of my FOV and let me tell you I got a very big scare. I knew that there weren't any reported comets anywhere near Auriga so, if this was actually an unreported comet I was going to be famous! Now, fast forward 2 years and using my 18 inch scope and the same low power eyepiece and sweeping once again from M38 to M36, I got the second scare ... which really ticked me off. Because as the saying goes ... fool me once, shame on you; fool me twice, shame on me! Now, in my defence even one of the best observer in the country today, Steve Coe of the Saguaro Astronomy Club writes his description of this object as: "Bright, pretty large, somewhat elongated. Looks like a small comet at very low powers." This is a cool object and not really

challenge to seen in almost any size scope the real challenge is to not be fooled! The finder chart and image below should help you find this comet imposter!



NGC 1931 (not a comet)  
20x30sec 2x2binned  
20100320  
MyTelescope - New Mexico  
Mark S Deprest



## How Much Does A Lens Cost:

### Why We Are Going To Be Broke For the Rest Of Our Lives

By Tom Ryan

"You know what you've got there? You've got a \$10,000 hammer."

I looked at the quotes that had come back from the optics shops for the little lens assembly we were building for the military, and replied "No, I think it's more like a \$32,000 hammer, with \$2700 of NRE charges. But that makes it only \$17,000 per hammer, because we're buying two."

"A bargain, then", said my boss. "Too bad we couldn't find this lens on the shelf. It would have cost just a couple hundred dollars."

"Yeah. Mass production is nice. I think the combination of spectral range and f-number is what got us. I couldn't find this as a COTS lens in the States, and the military is probably not going to buy an ITAR item from Japan or China."

"You know what worries me?" he continued. "We're going with the low bidder. All the other bidders came in at about the same price, and that price was a lot higher than this. How good can this company be, if their bid is so low?"

"Well, they've got a good reputation, or did. Let me check into it. Maybe I can find out if they have any strikes against them."

"You do that. And let me know before we sign off on the purchase order." He turned and walked out of the spare office I was occupying, and I spent a minute thinking about what to do next.

I picked up the phone and made a couple of calls to two friends of mine in California. One had sent out a considerable number of requests for quotes to optics companies, and the other worked for a defense contractor. I figured that one of these guys might know if our prospective vendor was still doing good work. Both of them were out when I called, but I left call-back messages. Then I started checking the web for bad news about our lowest bidder's reputation.

It really was too bad that this lens wasn't available off the shelf. It was small enough to fit in the palm of your hand. Including design, predictive analysis, overhead costs and paper clips, this little lens assembly cost more than ten times what the biggest and best Astro-Physics refractor cost, which is probably what prompted my boss' comment about \$10,000 hammers. Still, it was not available off-the-shelf.

The lens was part of an upgrade to a hardware device called a hyperspectral scanner. This is an instrument that flies over areas and takes spectra of the ground. You might think that this sounds boring and pointless, and if you do, that makes two of us, but you're not thinking like a scientist. Back in the dim, distant past, researchers at the misleadingly renamed Environmental Research Institute of Michigan (formerly Willow Run Labs) spent countless hours running samples of dirt and leaves through a Carey-14 spectrograph, recording the spectral signatures of all kinds of rocks and plants. We now know the reflectivity of tourmaline at 1034 nanometers. And a lot of other stuff. Enough so that this instrument's predecessor had discovered approximately one trillion dollars worth of minerals during overflights of Afghanistan. Not a bad return on its investment, assuming that any of that money found its way back

to U.S. taxpayers. Now, this instrument was being outfitted with better detector technology and optics custom tuned to the detectors. Which were also non-standard and not available off-the-shelf.

I designed the optics. I made them as cheap as they could be and still do the job. They still cost a fortune.

The lenses would have cost practically nothing if we had gotten bids from China. Yes, we might have had to have bought six or ten of them before we got one that worked, but the overall cost would still have been less. But the U.S. Military does not outsource its stuff to most other countries, and it takes a dim view of U.S. companies that leak its technology to other countries. It invests heavily, it invests constantly, it takes care of its own, and the result is the envy of the world.

I've often wondered why more businesses don't copy the practices of the U.S. military. Businesses today seem all too ready to give up market share tomorrow to make a buck today. They will cut employees at the drop of a hat, as if those employees cost nothing to train and integrate into the company. They will send factories overseas if they think they can get their products made cheaper, rather than investing in better production methods which might keep jobs here and prevent the devastation of communities. They behave as if profit today is all that matters. They will cut the grass right down to the ground, and act surprised when it doesn't come up the next year.

The only explanation I can see is that the financial sector has taken over the economy, and men are being reduced to the status of potatoes. If potatoes are cheaper overseas, then that's where businesses will go.

In the military, things are different. If a man is wounded, a unit will do whatever it takes to retrieve him, even at the cost of other men's lives. In the military, men are not potatoes.

What is interesting to me is the fact that the military doesn't try to set up trade barriers to prevent foreign technology from getting in, and it seriously protects its own technology (Are you listening, IBM?). It doesn't try to keep from its ranks people of one or another nationality (speak Farsi? The Army wants You!). It wins by investing and by taking care of its people.

The financial sector works by asset-stripping America. They can get a safer, more secure income by putting people into debt than by investing in new businesses. Look around. There isn't less stuff. There is just less stuff owned by the average American. Finance took over the poker game in the 1920's, and when they got all the chips and everyone else was in debt down to their shoes, the game stopped for the duration of the Depression. Roosevelt broke the financiers then, but they gradually bought favorable laws through campaign contributions and returned in the 2010's, loaning newly printed money against assets, and when everyone was in debt to them again, the economy crashed again. Bush gave them enough money to cover their bad loans, but didn't change the way they do business, so now we are in a long, slow motion recession again, and will be until the influence of finance is either broken again or the debt-serfdom of the Middle Ages is re-instituted. But right now, the grass is still cut down to the nubbin, the financiers are off selling the hay, and next year's crop is not looking good because they sold the seed, too.

The phone rang. I picked it up. "Tom here".

"Hey, Tom. This is Steve. I got your message. Haven't heard from you in a while. How are you doing?"

"Good, good. There are no jobs in industry right now, but medical is still paying, and the military is looking good."

"Yeah, we've doubled in the last year. I'm not sure we're making any money, but we've added a lot of people. Management here just bought two phase-stabilized interferometers to test the products. They're spending as fast as we make it, but I think they see it as an investment, and when the economy picks up, they'll be ready."

"I hope you're right about the economy picking up. I don't see it happening any time soon. But what about that company I mentioned? Have you heard anything about them?"

"I haven't heard anything about them, specifically, but every time I've ever gotten back an RFQ that was significantly lower than the other bids, it always turned out later that the company just needed cash to keep the machines running for a week or two. I'll bet, if you try to buy hundreds of these lens assemblies, the price will go way up."

"That makes sense. It's possible to lose money on one job and come out ahead of no job at all, but it's not possible to make up a loss on volume. Fortunately, we're only buying two. Thanks. Hey, on another topic, how's your wife doing and what was the name of that winery you and I visited?"

When I got off the phone, I continued to search the web for information on the company, but all I could find was the fact that it was owned by its founder. Since a founder is unlikely to strip mine a company's assets, and probably takes a long view toward profits, I called my boss and told him he could go ahead and sign the papers.

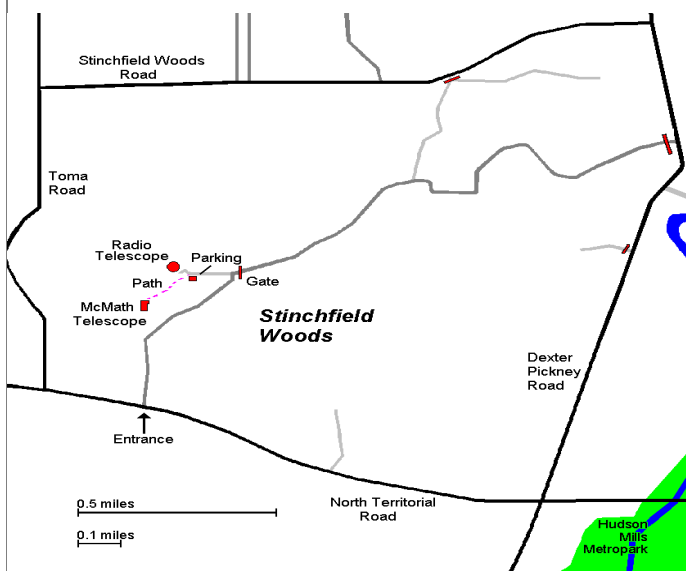




## Places & Times

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 3<sup>rd</sup> 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](mailto:msdeprest@comcast.net)** to discuss length and format. Announcements, articles and images are due by the 1<sup>st</sup> day of the month as publication is the 7<sup>th</sup>.

## Telephone Numbers

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	Jason Maguran	
	Paul Walkowski	
	Belinda Lee	(313)600-9210
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Observatory Director:	Mike Radwick	
Newsletter Editor:	Mark S Deprest	(734) 223-0262
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	Fred Schebor	(734) 426-2363
	Charlie Nielsen	(734) 747-6585
Webmaster	Dave Snyder	(734) 747-6537

## Lowbrow's Home Page

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

## Email at:

[Lowbrow-members@umich.edu](mailto:Lowbrow-members@umich.edu)



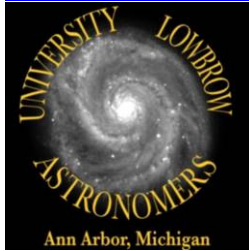


## University Lowbrow Astronomers

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c/o Liz Calhoun  
P.O. Box 4465  
Ann Arbor, MI 48106

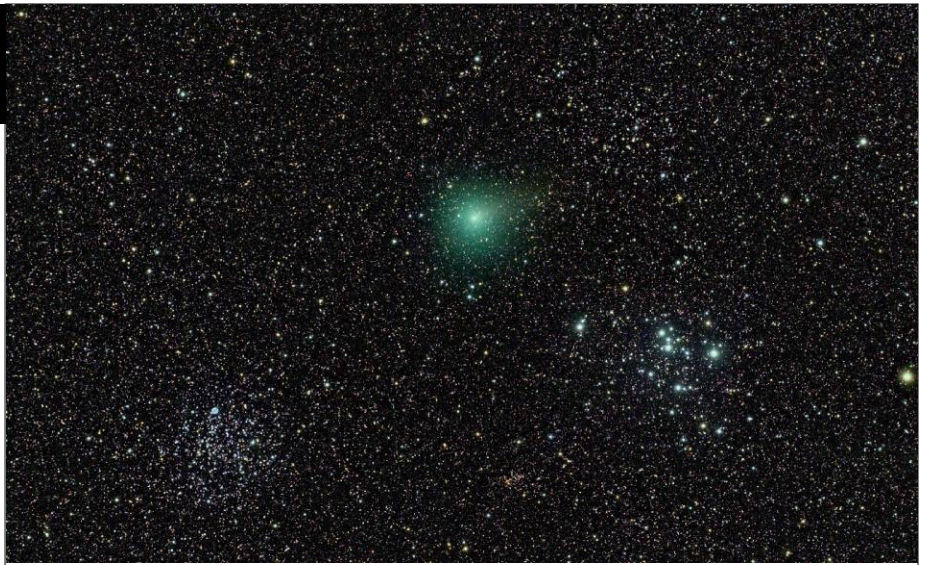
[lizcal@umich.edu](mailto:lizcal@umich.edu)

### Reflections & Refractions



### Website

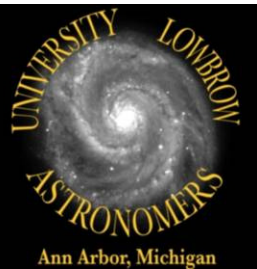
[www.umich.edu/~lowbrows/](http://www.umich.edu/~lowbrows/)



*Comet 103P Hartley 2 is still putting quite a show for those of us in the know ... here is a great image from 11/27/10 at 05:00 , as it passes between M46 and M47 .*

*This image was taken remotely via Global Rent-a-Scope, New Mexico, USA.*

*Credit—Rolando Ligustri (cropped and use by permission)*



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