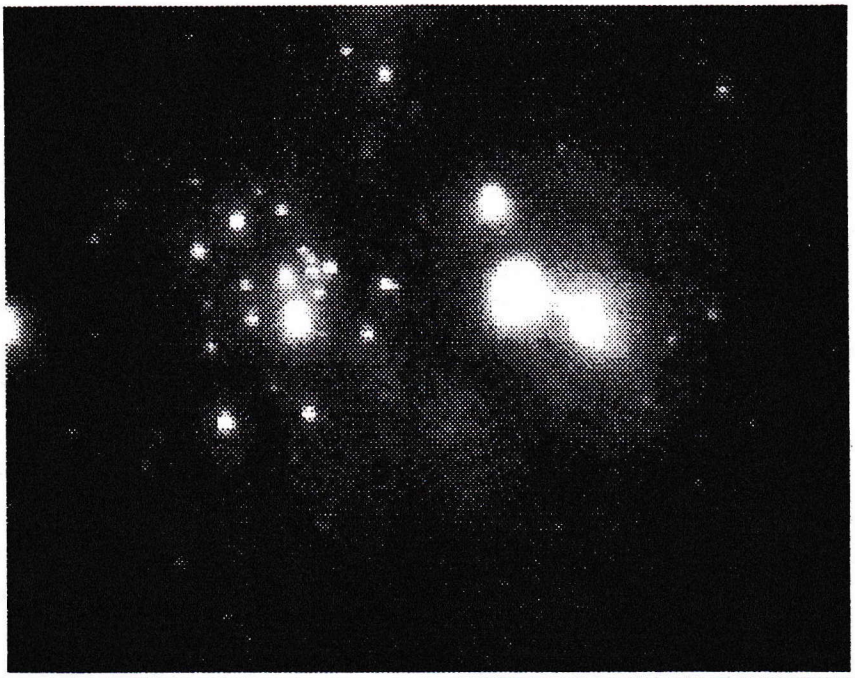
REFLECTIONS



REFLECTIONS

February , 1992

This image of the Lagoon Nebula (M8) was taken by R. Tanner and Rik Hill with a 320 mm f4 telephoto, the ST4 CCD camera, and an exposure of 60 seconds.

R. Tanner, ed.

University Lowbrow Astronomers

The University Lowbrow Astronomers is a club of astronomy enthusiasts which usually meets in the historic "Detroit Observatory" on the corner of Observatory and Ann Streets in Ann Arbor. The meetings start at 7:30 on the third Friday of each month and are open to the public. For further information, call Fred Schebor at 426-2363.

This Month:

February 21 - Meeting, at the **Detroit Observatory in Ann Arbor**. This meeting will be a demonstration of astro image processing on the PC by Roger Tanner. Doug Nelle will try to bring a LCD projection plate for the overhead projector so that a large image of the screen can be projected on the wall for all to see.

February 29 - (Leap Year Day !), The **Eastern Michigan University Astronomy Club** is holding a **Freezout**, a one day convention with talks by amateur and professional astronomers, telescope displays, and door prizes. Admission is $2.00. More information at right.

Next Month:

March 2 - Computer Subgroup Meeting at **Doug Nelle's house, 7:30 pm**, (a Monday). Stephen Musko will present a rought draft of the interface specification for the computer to be added to the 24" drive controller followed by a discussion of what the objectives of the controller would be. There will also be a demonstration of Deep Space 3D for any one that didn't get to see it the last time Doug demonstrated it.

March 7 - Club Observing Session, Peach Mountain Observatory.

March 20 - Meeting, at the **Detroit Observatory in Ann Arbor. Bill Durrant,** will present a slide show about the **LDEF** (Long Duration Exposure Facility) space probe which the shuttle launched in 1984 and unexpectedly spent 6 years in orbit.

EMU Astronomy Club is having a Freezout !

On February 29 th, the EMU Astronomy Club is having a Freezout in the Strong Hall Auditorium. The admission is $2.00 and donuts and coffee will be provided. There will be a series of talks starting at 9:30 and going until about 5:00. After a break for dinner, the Sherzer Observatory with its brand new 10" Astrophysics refractor will be open for observing if the weather permits. There will be telescope displays by City Camera and the EMU Astronomy Club. Some of the topics for the talks are; The New Sherzer Observatory, PC Controlled Telescopes, Star Scapes and Relativistic Speed, and, Arecibo Radio Astronomy. There will be door prizes given out and this event is open to the public.

Club News

Update on the 24" Renovation.

Another heavy duty work party at the observatory on Sunday the 16th has moved the renovation along another major step. D.C. Moons has cleaned, stripped, and painted the Declination gear. D.C. and a team of clubmembers have installed the Dec gear. The bearings for the Dec gear have been cleaned and relubed. The clutch plate was installed on the RA gear. The Dec. circle and index plate have been cleaned and installed. The only thing left to go on the Dec axis is the Dec counterweight. There was several small parts for the Dec axis drive system which were cleaned, relubed, and installed on the scope.

D.C. estimates that there needs to be 2 more work parties to get the next major step done. The first will get the scope assembly finished. The major parts are to assemble the Dec counter weight, the lead surrogate mirror, and the rest of the small parts to the drive systems. Then the observatory will be cleaned and the floor painted. The next major work session will assemble the drive motors and electronics into the observatory. After the final testing, the observatory will be cleaned again, and the optics installed.

D.C. also requests that people stay out of the observatory until the restoration is completed because the parts that are assembled are not balanced yet, and if someone tries to move the scope around, it would swing around and probably hurt them. Several more work parties are being set up for the coming weeks, see D.C. at the meeting for the times and dates.

REFIGURING A LARGE COMMERCIAL TELESCOPE MIRROR

by Doug Scobel

In 1984 I got bit by the Dobsonian telescope bug. Large aperture was finally affordable and portable, and *I JUST HAD TO HAVE ONE!* Having made a couple of six inch telescopes before (an f9 and an f4.5), including the primary mirrors, I decided to make a thirteen inch. I purchased the optics commercially from Coulter Optical Company (who market the Odyssey line of Dobsonian telescopes). Once I received the mirror set and finished the scope, I was blown away by the light gathering power as compared to my six inch scopes. However, once I set the magnification above 100x, I noticed that stars were starting to look a little fuzzy. Over 200x and they were hopeless blobs. Planetary images were horrible. But, I was happy with low power images and the light gathering power, and I could not expect much in terms of resolving power from an f4.5 design and the typical Michigan seeing conditions (or so I thought). Also, I was not too eager to send back a mirror for which I had to wait nine months. I decided to keep and use it.

Afterwards, for the great Mars oppositions of 1986 and 1988, I made an eight inch f8, including the mirror. This scope really performs well providing great planetary images when seeing permits it. It was in making this mirror that I learned how to figure a good mirror, including advanced Foucault (pronounced **foo-CO**) testing and star testing.

I then used these testing techniques on my thirteen inch mirror. Tests confirmed what I suspected - the mirror was poorly figured. It had a nice smooth figure, but was quite overcorrected - with a wavefront error over one wave! (one quarter wave is considered good.) I decided to refigure it. Knowing that the degree of difficulty of figuring mirrors rises with the square or cube of the diameter, I knew that it would not be easy, but I did not think I could make it worse than it already was.

I had the coating removed for ten dollars (but found out later that there is a solution you can buy at Radio Shack that will remove the aluminum without harming the glass). I then proceeded with the refiguring work, using sub-diameter laps exclusively. It took me about two months (in my spare time) to finish the work. Once I got the figure within tolerances, I was able to test it (uncoated) in the telescope. Under the star test it shows slight undercorrection, but focused star images are much improved. The Airy disk is actually visible! I was also able to use about 420 power on the moon and fine details were still visible. The mirror is by no means perfect, as it has some roughness in the outer zones and a nick in it where I accidentally dropped one of my pressing weights on it. But it does give much better images than it did originally, and that is what I set out to accomplish. It is now in the hands of P.A.P. Coating Services to receive a fresh enhanced aluminum coating.

In all fairness to Coulter Optical Company, I got my mirror when the Dobsonian craze was in full stride. Everyone was making them, and Coulter was by far the cheapest place from which to get large optics (why else do you think I bought the mirrors from them?). They must have been really cranking them out, even with half-year to a year's delay in delivery. I can see where some poor mirrors could have gotten out. Also, I have looked through Roger Tanner's and Doug Nelle's 17.5 inchers, both with Coulter optics, and they each look pretty good. I may have just gotten the odd bad mirror. But, if I knew then what I know now, I would have returned it for a new mirror. Regardless of price, you are entitled to better than one wave surface accuracy!

If you are interested in making or testing your own mirror, I recommend a couple of resources (over and above the books available on the subject) that proved invaluable to me. The first is an article in Telescope Making #32 by Dick Suiter on mirror testing. In it he re-explains and expands on mirror testing and data analysis as described in Jean Texereau's **"How to Make a Telescope"**. It also contains a listing of a computer program for analyzing your test data. This is the clearest and most useful piece I have seen on the subject. For large mirrors (say, twelve inches and up) there is a series of articles in Telescope Making #s 12, 13, and 16 by Bob Kestner on grinding and polishing large thin mirrors. He has a lot of experience in this area and tells you things you won't find anywhere else. Additionally, many thanks to Tom Ryan (also a Lowbrow member) who helped with lots of tips and advice.

So, there you have it (or at least I will when it comes back from P.A.P.). If you have any questions or need advice on a mirror project feel free to call or look for me at a club meeting. But if you have trouble finding me, it may be because I am out in my back yard or on Peach Mountain using my "new" telescope.

HOW NOT TO MAKE A MIRROR

by Doug Nelle

There are so many good books and articles on how to make a mirror that rather than rehash a lot that has already been written, I would like to relate a few things not to do that I have learned while working on an 8 inch mirror.

Select a time when you know you will be able to complete a major portion of the work. Don't start rough grinding in your small apartment only to realize later on that you weren't willing to give up enough space for the required time. Then you'll pack everything up and take it out later--only to find that you forgot which grit you left off at. Then you're moving, so you pack it all up again. After you're settled in at the new digs you unpack everthing and have at it. At which point you promptly get engaged. After you're married, your spouse has moved in and you've settled the furniture problem (does that ever really get solved?), you find where you misplaced everthing and begin the final assault. At which point you decide to buy a new house. A year and some later (no need to go into details I hope) you finally get around to doing the rest of the work. My sugestion is that if you can't do all the work at once, try to do all the rough grinding in one period, the polishing in another and the figuring in a third.

Next you learn that you don't believe anyone who says they know the "shortcuts" that will save you a ton of time. Simply put, they won't. And don't think you can be anything other than spotlessly clean. It will come back to haunt you.

On my 8 inch mirror I had to do some extra polishing due to sleeks caused by dirt getting into the pitchlap. And speaking of pitchlaps, I have found that the cleanest way to make one is to make a dike around the tool (as described in many books), pour in the melted pitch, let it cool a little, and press in the mirror. Then I resoften the lap by putting it in a bucket of very hot tap water and press out the channels with a straight edge. You will still have to do some cutting and pressing, but this seems to work best for me. While polishing, don't think that a certain number of hours written in a book will get the job done. You must inspect the surface at the edge to confirm that every last pit is gone.

Now comes the part that it's all about. Figuring

Don't think it will all fall into place. It won't. The various parabolizing and correcting strokes shown in texts are good guidelines, but every person is different. Your stroke is slightly different from everyone else's. It takes a few work sessions to see how your pattern wears the glass. For this reason, keep a log book of all work done during figuring and its results. Be very specific about the type of stroke and length of time spent on the mirror. And don't begin any work session without warm pressing the lap and tool. If you fail to do this, the results will be horrific. (Trust me on this one.)

Now we're ready to screw up the testing. Don't rely on one type of test or one iteration of a test. You must star test your mirror after all other tests say you have a good figure. Which means that you have to build the rest of the scope. This is where I am at now. To illustrate the point about testing, one test I have done says that I have a 1/30th wave mirror and am probably the grestest mirror maker of all time, while another says I have no business writing this article. In future articles I hope to give a report on just how good (or bad) the mirror really is, and tell about building the rest of the scope.

To conclude, I hope I haven't scared anyone off. If I can make it past all of the "don'ts" I've outlined here then you can too. One thing to remember is that most manufacturers will guarantee their mirrors only to 1/4 wave. And you can make a much better mirror than that. So start soon.

Subgroup Reports

Computers in Astronomy Subgroup

The twelfth meeting of the Computers in Astronomy Subgroup was held at Stuart Cohen's house with a turnout of 4 members.

The meeting started with Stuart demonstrating some programs he had written for his Commodore C-64 computer. His machine has 32K of free memory after Basic is loaded. He adapted the programs from ones listed in the Astronomical Computing section of Sky and Telescope. One of the advantages of adapting a program from another computer is that you are forced to learn how it works. Additionally, when memory and computing speed are limited, you are forced to think about the algorithm and only calculate what is necessary to get the results you want. For instance, in his interacting N bodies program, Stuart realized that when you calculate the gravitational force of body 1 on body 2, you don't need to calculate the force of body 2 on body 1, they are the same. This symmetry reduces the number of calculations in half.

Stuart started with a demonstration of his interacting galaxies program - GC3D8.0 (Galaxies Collide in Three D Version 8.0). This program starts with a spiral galaxy modeled with several rings of point bodies. The intruding galaxy is represented by a point mass. The galaxies can be started with any relative position and velocity, Stuart chose to start the interacting galaxy below the center of the spiral with no velocity. The program plots the point masses on the screen in both a side and top view. The program then calculates the force of each mass on all the rest and calculates the movement resulting from that force. After several time steps, the center masses in the spiral galaxy were pulled down toward the intruder galaxy and the intruder was pulled up toward the spiral.

Stuart says he starts these simulations up and goes to do something else and comes back later and saves the results to disc. After a few more time steps, the intruder galaxy shot thru the center of the spiral galaxy and the central mass of the spiral was ejected out the bottom of the screen. The center part of the galaxy was twisted down to toward the original position of the intruder galaxy. The program looks like it would be very interesting to experiment with.

The next program Stuart demonstrated was a simulation of the dynamics of a open star cluster. The program would allow the stars to be placed in any position in the simulation space and individual velocities assigned to each star. Stuart used the default of having the computer assign random positions and initial velocities. In developing the program, Stuart decided that the dots representing the individual stars were too hard to see, so he outlined them with colored squares. Stuart also had the computer beep when the two stars came so close that they would have hit in the simulation space. When that happens, Stuart zeros out their velocities, and then they continue to move based on the gravitational attraction from the rest of the stars. As Stuart discussed the way the program worked, the simulation showed some interesting dynamics for the star cluster, 2 of the 9 stars in the cluster were thrown out in opposite directions by near interactions with various members of the cluster. The discussion turned to the difficulty of trying to "design" a stable 3 body system.

Stuart then showed two programs he wrote for his Sharp EL5500 programmable calculator which uses Basic. The programs calculate the sun rise and set times for any date and position on the Earth. He said that this simple sounding calculation uses just about all of the calculations you can do in astronomy. He got the algorithms from Astronomical Formulae for Calculators by Jean Meeus which he recommends highly. Again he mentioned that there was a lot of understanding to be gained in doing the programming your self.

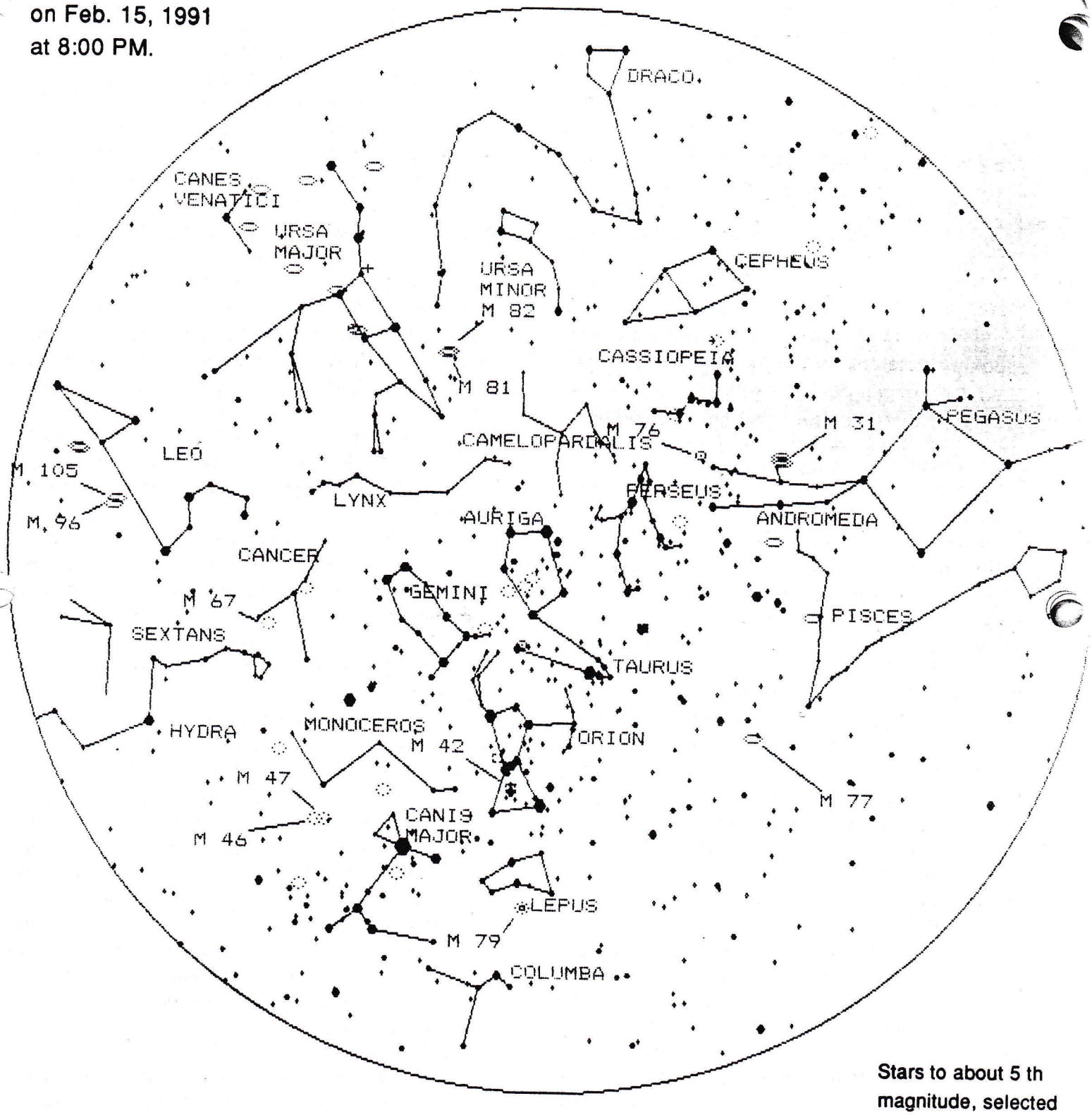
Next the group crowded into a small back room where Stuart works on the drive controller for the 24". The drive controller is wired up on a steel panel, and is composed of several breadboards for each function. The drive motors, hand paddle, and limit switches were wired up for testing. Stuart demonstrated the drive operating in several modes such as; tracking the sky, guiding for photography, and slewing to center an object. The RA high speed slew is not designed or built yet so the slow slew for RA was demonstrated. This slew is plenty fast for centering an object but would be too slow for moving the telescope across the sky.

Next Meeting

The next meeting will be at Doug Nelle's house at 7:30 on Monday the 2nd of March. Stephen Musko will present the rough draft of the specification for the computer to drive controller interface for the Peach Mountain 24" telescope. The group will then discuss the objective of the computer system. Your input is desired. Additionally, Doug Nelle will demonstrate Deep Space 3D for anyone who hasn't seen it yet.

Sky Map

Peach Mountain
on Feb. 15, 1991
at 8:00 PM.



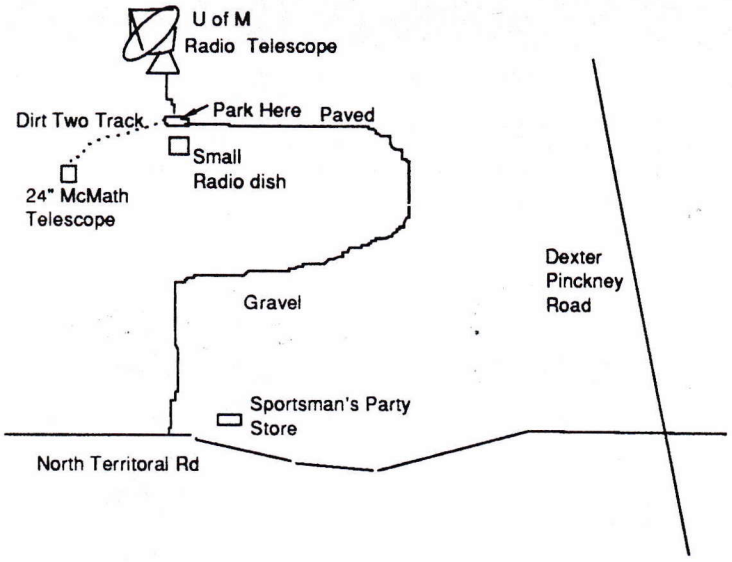
Stars to about 5 th magnitude, selected objects to about 9 th magnitude.

The Observing List was omitted for February, it will return next month. I didn't have time to put togather a new one and there were too many articles (can you believe it!) to squeeze it in.

☞ Places:

The *Detroit Observatory* is at the corner of Observatory and Ann Streets in Ann Arbor, across from the old U of M Main Hospital. The Detroit Observatory is an Historic Building which houses a 19th century 12-inch refractor and a 6-inch transit instrument.

The *Peach Mountain Observatory* is the home of the U of M radio telescope and the 24-inch McMath telescope used by the Lowbrows. This observatory is located northwest of Dexter, off North Territoral Road, West of Dexter-Pinckney Road. The entrance is just west of Sportsman's party store and is marked by a small maize and blue university sign. Go through the gate and follow the gravel road. Once parked at the observatory parking lot, follow the path away from the radio telescope and around the fenced in compound to the telescope, see map below.



☞ Times:

The monthly meetings are held on the 3rd Friday of each month at 7:30 pm. Meetings are either at the "Detroit Observatory" in Ann Arbor or at the Peach Mountain Observatory. Meetings held at Peach Mountain are cancelled if the sky is not clear at sunset.

Public Star parties (Open Houses) are held on the Saturdays before and after the new moon at the Peach Mountain Observatory. Star parties are cancelled if the sky is not clear at sunset. Many members will bring their own telescopes. Your scope is welcome. Wear warm clothes for the season and bring insect repellent. The next scheduled Open Houses are listed on the front page.

☞ Dues:

Membership in the Lowbrow Astronomy Club is $20 per year for individuals or families, and $12 per y for students. Among other things. this entitles you to use the club telescope after some training. See Dick Sider at the meeting or send your dues to his address below.

☞ Magazines:

The Lowbrow Astronomy Club offers discount subscriptions to popular astronomy magazines:

Sky and Telescope : $18/yr.
Astronomy : $16/yr., 12 issues.
Odyssey : $10/yr., 12 issues.

Contact Dick Sider (663-3968) for more information or write to him at the address below:

Dick Sider
902 Pauline Blvd.
Ann Arbor, Mich. 48103

❒ Sky Map:

The *Sky Map* section in this issue of *REFLECTIONS* is produced by Doug Nelle using the program D Space 3D.

☞ Newsletter Contributions:

Please send any information, short articles, or drawings to the address below. The closing date is 7 days before the meeting.

University Lowbrow Astronomers Reflections
1770 Walnut Ridge Circle
Canton, Mich. 48187

☎ Important Numbers:

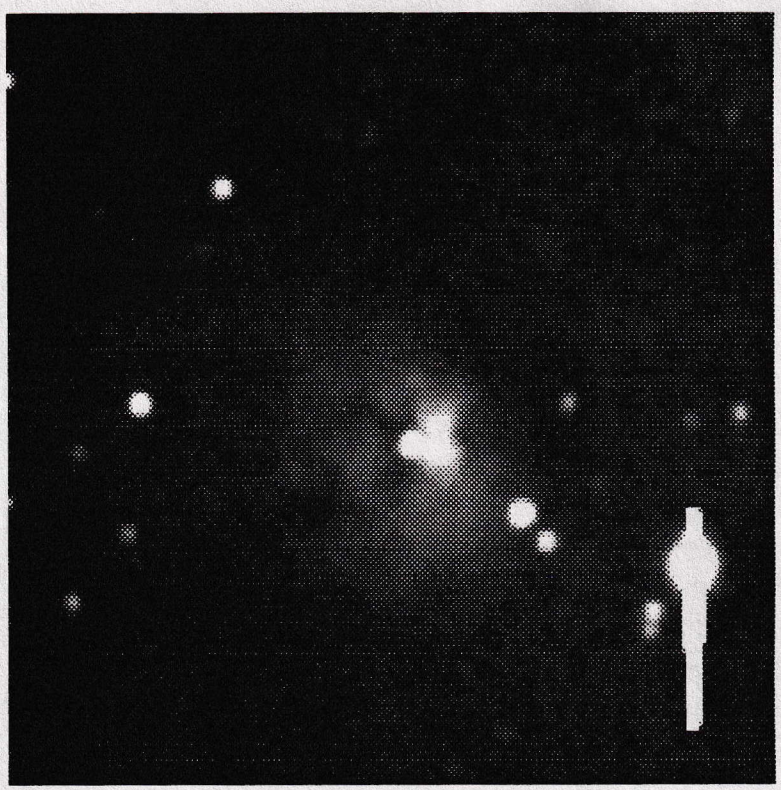
President: Fred Schebor 426-2363
VicePres: Stuart Cohen 665-0131
Doug Nelle 996-8784
Paul Etzler 426-2244
Treasurer: Richard Sider 663-3968
Observatory: D.C. Moons 254-9439
Newsletter:Roger Tanner 981-0134
Membership: Ron Avers 426-037

Peach Mountain Keyholder:
Fred Schebor 426-2363

Monthly Meeting:

Astro Image Processing on the PC

At the
Detroit Observatory in
Ann Arbor



This CCD image of the Trifid Nebula (M20) in Sagittarius was taken by R. Tanner and R. Hill with a Celestron C-5 f10 telescope and a ST4 CCD camera. The exposure was 120 seconds and it was taken from Rik Hill's backyard near downtown Tucson, (as was the image on the front cover).

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