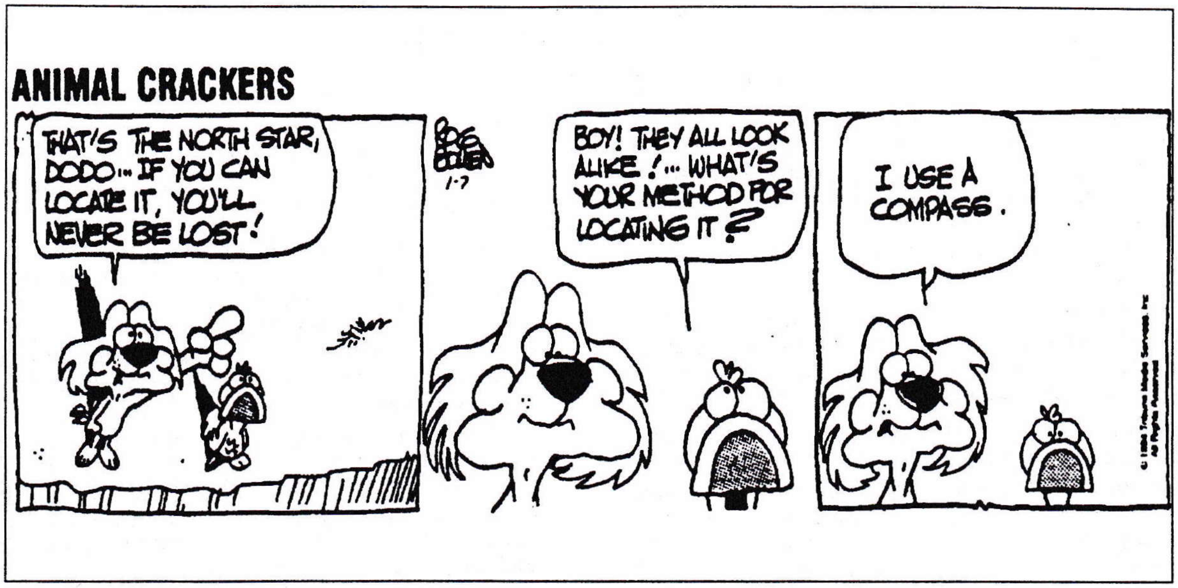
REFLECTIONS



January 1994

OK, I know it's not exactly astronomical, but I just had to use this one....
Besides, considering my article inside it's actually kind of topical!

Kurt Hillig
Editor

Of the University Lowbrow Astronomers

The University Lowbrow Astronomers is a club of astronomy enthusiasts which meets on the third Friday of each month in the University of Michigan's Detroit Observatory at the corner of Observatory and Ann Streets in Ann Arbor. Meetings begin at 7:30 PM and are open to the public. Public star parties are also held twice a month, at the University's Peach Mountain Observatory on North Territorial Road (1.1 miles west of Dexter-Pinkney Road; map on page 7) on the Saturdays before and after the new moon; the star party is cancelled if it's cloudy at sunset. For further information, call Stuart Cohen at 665-0131.

This Month:

January 15 - Public Open House at the **Peach Mountain Observatory**. It's been a pretty cloudy year so far, and when it's been clear we've all been too busy; but then you won't get this newsletter until Monday anyway....

January 21 - Meeting at the **Detroit Observatory** in **Ann Arbor**. Our own Bill Durrant will talk about interplanetary dust, ancillary to an experiment aboard NASA's LDEF orbiter, done while he was with the Royal Aeronautical Society.

Cheaper than Truth!

You say you don't want to spend a lot of money on that so-called astronomical flashlight in your favorite astro products catalog? Or that you did buy one only to find that the light is too bright and spoils your night vision while reading your star charts? Just make one yourself. Go to your favorite hobby shop or even the model department at Meijers or KMart, and buy a can of Testor's Gloss Red spray paint. (Of course, you'll need a flashlight, too.) Take the bulb end apart and remove the clear lens. Spray one side of the lens with a couple coats of the red paint. Make sure it is covered completely, and that no white light will get through. Let it dry overnight, and put it back together, with the painted side of the lens inside (this will prevent the paint from getting scratched off with use). When you try it in daylight, it doesn't look very bright. But when you're out in the dark, it gives a nice diffuse red glow, just right for reading star charts without spoiling your (or your fellow observer's) night vision!

Next Month and Beyond:

February 1 - Computer Subgroup Meeting at **Tom Ryan's** house (a Tuesday). More on the upcoming solar eclipse and our project to televise it on Ann Arbor's cable system. Call Tom at 662-4188 for directions.

February 5 - Public Open House at **Peach Mountain**. It's gonna be a cold one, but M42's starting to head west already. Seven sisters will be out there to greet you!

February 12 - Public Open House at the **Peach Mountain Observatory**. The Summer Triangle should be rising shortly before dawn – break out the Bermuda shorts!

February 18 - Meeting at the **Detroit Observatory**. Dr. Nick Steneck, UM Professor of History, on "The History and Preservation of the Detroit Observatory".

March 1 - Computer Subgroup Meeting

For Sale

A vaccuum coating system, suitable for coating substrates up to 24" in diameter. This consists of a 24" x 32" (approx) stainless steel vaccuum chamber, vaccuum pumps, gauges, power supply, etc. The chamber is slightly corroded – it was last used by KMS Fusion for salt coatings – but is vaccuum-tight; a few minutes with a wire brush is all it needs. A complete, self-contained unit – just plug it into any 30A 220VAC outlet. Ideal for aluminizing mirrors in your home workshop; the perfect gift for Valentine's day!

New price was over $40,000; asking $5000. Contact Fred Schebor at 426-2363 (evenings) for more information.

Polar Alignment
in 417 Easy Steps

by Kurt Hillig and Jim vanNuland

Just got a fancy new scope and you're ready to try some three-hour unguided astrophotos? Tired of kinking your neck to look through a badly positioned finder scope, and curious about what those funny numbered disks on your old C-14's fork mount are for? Finally got that 17" Dobson mounted on a home-made three-squirrel-power driven platform and you need to know which way north is?

Well, friends, what you need is Polar Alignment! After Pyramid Power, it's the greatest thing since pulsed illuminators for guiding eyepieces! How do you do it? Well, I'll take a stab at explaining it. Drop your socks and grab your pencils....

There are two basic levels of polar alignment: crude, and superb. The crude level is usually good enough for visual work, unless you're hunting for very faint objects or have really bad star charts – and if you're lucky enough to have a fork-mount scope with a manual tangent-arm declination adjustment it's also easy and surprisingly accurate. The super alignment is what you need if you're going to try some photography (unless you really like elongated stars in your pictures).

Warning: the following are northern hemisphere directions. If you try these in the southern hemisphere, you'll look really foolish! Let's start with the basic alignment (since it's the first step for the precise alignment as well, it's a good place to start).

Know Thy Scope The first thing you need to do is look at your scope mount – in particular identify the setting circles (if you've got 'em) and figure out how to adjust them – and also look at how the slow-motion declination control works. If your scope is like mine (a Meade 2045D), on a fork mount, there's an arm 6 to 10 inches long driven by a screw; turn the screw and the arm rotates the scope slowly about the dec axis. Carefully measure the distance from the center of the dec axis to the point where this screw drives the arm – on my scope it's about 7-$^1/_8$". Then measure the pitch of the screw thread (pick up a few different sizes of machine screws at the hardware store and compare them if necessary). A common thread that's used is "#6-32" - the "#6" indicates its diameter, and the "32" means that there are 32 threads per inch. Now do some geometry. One turn of the dec knob moves the end of the arm 1/32" (or whatever), and the arm is 7-$^1/_8$" long, so this turns the arm by an angle equal to the arctangent of ($^1/_{32}$ / 7.125) – in this case exactly 1/4 of a degree.

Why the heck am I wasting your time with this calculation? Because the nearest landmark to true north – which you need for polar alignment – is the North Star, Polaris, and it's 3/4 of a degree away from true north. For my scope, that's three full turns of the dec knob; for your scope you'll have to do the calculation yourself! Of course, for this to work, you need to have the dec axis pointing in the right direction – but then that's what I was going to mention next anyway....

Coarse Alignment If your scope has an RA setting circle, this part's easy; if not it takes a bit more care. Polaris is offset from true north by 3/4 of a degree, at an RA of 2h 18m. So to find the direction in which Polaris is offset, you'll need a list of easily recognizable stars with their RA's (if you've got setting circles), or else you'll have to learn how to recognize either Mira or Arcturus (one of them has to be visible, too, or it won't work).

So, it's finally time to take the scope outside and set it up. (Thought I'd never get to it, didn't you!) Start by figuring out which way north is – use a compass if necessary – and set your scope's polar axis to point that way. You'll have to find Polaris, so you better start looking for it; once you've got it, point the polar axis as close to it as you can by eye (for the Ann Arbor area it will be tilted up a bit under 45° from horizontal). Next, align the scope so it's pointing parallel to the polar axis – i.e. also pointing at Polaris. If you've got your dec setting circle calibrated, set it to exactly 90°. Now, the tricky part is to simultaneously get the scope exactly parallel with the polar axis, while getting that axis pointing directly at Polaris.

First, lock the declination axis on the scope so it can't move in dec, then look through the eyepiece and rotate the scope back and forth around the polar axis. If the scope is really parallel to the axis, then the star pattern you see will rotate about the center of the field of view. If it's not parallel, the stars will move out of view as you rotate the scope. By tweaking the fine control on the decaxis, adjust it until the star field rotates around the center of the field of view as you swing the scope; once you've got this, the scope and polar axes are parallel, and you can lock this setting and use it to calibrate the dec setting circle to 90°. (Incidentally, you can do this in the daytime with the scope pointed at a tree; but it's more fun at night!) Now that the scope is parallel to the polar axis, <u>lock the dec axis to keep it parallel</u>.

The next step is to point the polar axis exactly at Polaris; look through the eyepiece (use your lowest power to start) and adjust the scope mount – not the scope on the mount, but the entire mount! – until Polaris is centered in the field. Switch to high power, and swing the scope back and forth around the polar axis while fine-tuning the mount position until Polaris is centered throughout the rotation. At this point you've got almost perfect alignment, but to a point 3/4 of a degree from where you want to point (get the point?). Note: this is easiest early in the evening when Polaris is the only star visible in the twilight – once it's dark there are lots of stars visible and picking out Polaris can be tricky!

Now unlock the dec axis, and point the scope at one of the stars you've got in your RA table – say, Vega, at RA 18h 36.6m. Once you've got this centered in view, lock the RA and dec axes and set the RA setting circle to the RA of the star you're looking at; this gives you the RA calibration you need to tell which direction to go from Polaris to find true north. If you don't have an RA setting circle, don't despair! Mira (you do know how to find it, right?) has the same RA as Polaris (close enough), and Arcturus is almost exactly 12h (180°) away; if you can find either of these, line up on it and lock the RA axis. If you do have an RA circle, rotate the scope to an RA of 2h 18.3m and then lock the RA axis. We're almost done – just a few more steps!

Move the scope back to Polaris – which should mean moving only in declination – and center it. Now, using the dec slow motion control, move the scope exactly 3/4 of a degree in declination. You've got two directions you can move it; be sure you choose the right one! (Hint, the right direction will point the scope closer to Cassiopeia.) And, finally, with the RA and dec axes locked, reposition the scope mount until Polaris is centered in view once more. At this point, the setting circles should read an RA of 2h 18.3m and a declination of 89°14' – and, if you were careful, you should be within a tenth of a degree of true polar alignment! (You can check this against the coordinates you've got for the other stars on your calibration list; the RA may need to be tweaked once more.) To recap so far:

<u>Hillig's Complicated Method for Polar Alignment</u>

1) Align the scope parallel to the mount's polar axis.
2) Adjust the mount until the scope points directly at Polaris.
3) Set the RA circle by lining up on a known star.
4) Move the scope to RA 2h 18m, and point back to Polaris.
5) Offset the dec axis by exactly 3/4 of a degree.
6) Adjust the mount until Polaris is centered again.

Whew! I thought this was going to be easy to explain!

continued....

The SiO Maser in IRc2

by Kurt Hillig

Thursday night, the newsletter's gotta go to Kinko's tomorrow, and I've still got two and a half columns to fill. Well, I don't think Mr. Chuzzlewitz is going to come through this month; let's see what I can find on the bookshelf to plagiarize – oops, I mean, do some quick research in... Here's one – "Relativistic Astrophysics and Particle Cosmology: Proceedings of the Sixteenth Texas Symposium..." – no, I don't think that one will work. How about this: "Symposium on The Orion Nebula to Honor Henry Draper, Annals of the New York Academy of Sciences vol. 395" – yes, this looks good, there's a pretty picture on the cover. Let's take a look inside...

What we usually think of as the Orion Nebula – aka M42 and M43 – is really just the small visible part of a vastly larger cloud of gas and dust about 2500 light-years from Earth (see the map on the back cover). The visible part is about 1° across; but this is really only a bubble, about 3 ly in diameter, on the near side of a complex of dark clouds several hundred ly across. Embedded in these clouds are old stars, new stars, and stars still being formed; many of these are only visible in the infrared or millimeter-wavelength bands. Just behind the visible nebulae lies the Becklin-Neugebauer – Kleinmann-Low cluster, a group of several dense bright infrared sources. The brightest of these "infrared clouds" (many are believed to be illuminated by hot, massive young stars within) have been named IRc1, IRc2, etc. The infrared luminosity of the BN-KL cluster is more than 300,000 times the total luminosity of the Sun.

There are a number of fascinating features seen throughout the Orion Nebula. More than 50 different chemical species have been found in the clouds; shock waves from supernovae form vast shells; young stars send massive jets of hot gas – some almost 0.1% of the Sun's mass *per year* – into the clouds from which they've formed. And in IRc2, they've found a maser – a silicon monoxide maser; the only one known in the universe (at least as of 1982, when this symposium was held).

They've found lots of other molecular masers in space – water, hydroxyl and ammonia masers have all been found, in Orion and elsewhere. But these are all gases, at least under conditions we're used to, and SiO is a solid; and a pretty rugged one – there's a good chance that the aluminum coating on your telescope mirror is protected by a thin overcoat of SiO. So how does nature turn sand (well, almost) into a maser?

I suppose I ought to explain what a maser is, first. Well, you've all seen lasers by now – at least if you've been awake at all in the past ten years. A laser is a special kind of light source; it produces coherent radiation through a process called *stimulated emission* (Light Amplification by Stimulated Emission of Radiation - L.A.S.E.R.). And a maser is just a laser, but at a microwave frequency rather than a visible one. In fact, masers were developed first, and the earliest lasers were called "optical masers"! How do they work? Easy! (Well, it's easy if we ignore all the math...)

An atom or a molecule (and we'll stick to molecules from here on, but this all applies to atoms too) when it absorbs a photon (visible, microwave, infrared or whatever), stores the energy that it receives by going to an "excited" state. In a gas at low density – say in interstellar space – the only way for it to return to its original state is to emit another photon. Now one of the properties of a molecule is that it can't have just any amount of energy; there are only a few "allowed" energy states it can be in. So to absorb a photon, that photon's energy has to exactly match what's needed to take a molecule from its current state to another allowed state; and when it emits a photon, the photon carries exactly that amount of energy away. Since there are only a limited number of states, absorption or emission occurs only at discrete wavelengths. (For example O^{+2} has it's strongest emission in the green; an OIII filter lets just this narrow band of green light through.)

Now if a molecule in an excited state is hit by a photon of the same energy as the one that excited it originally, the incoming photon can induce the molecule to drop to its lower state and emit another photon. One photon in, two photons out; this is the process of stimulated emission.

Now the probability of a lower state molecule absorbing the photon is equal to the probability of an excited state molecule being stimulated to emit a photon. But molecules (like people, in many ways) tend to prefer to be in their lowest energy state. So usually, since there are more low-energy molecules than high-energy ones, photons are absorbed more often than they're emitted.

How do we make a laser or maser? The trick is to create a *population inversion* – to somehow get more molecules into the upper state than there are in the lower state. This way, each incoming photon is more likely to stimulate the emission of a

---

Polar Alignment continued....

(And if anyone out there can figure out how to illustrate this effectively, I'd love some good sketches!) And if that's the crude alignment, how about the precise alignment? Well, you're lucky; all the hard part is over. What's left is easy to do, just slow.

Fine Alignment If you've skipped over the coarse alignment section, go back and do it first! Of course if you've got a better method, feel free to use it... Then find a star roughly overhead (but close to 0° dec), and set the scope on it. Put on the highest power you've got – probably your usual guiding eyepiece. Watch the star, guiding as needed in RA, but watching for drift in declination. If the star drifts toward the north side of the field, adjust the azimuth of the scope clockwise so that the upper end of the polar shaft is moved to the east. If the star drifts toward the south, rotate the azimuth conterclockwise to move the polar axis' northern end west. Keep doing this until you get no drift over several minutes time. The longer you watch, the better you can tweak this – but leave time for observing!

Now go find a star almost due east (or west), and about 25 to 35 degrees up. (If it's too low you'll get refraction errors.) Again, watch the star for drift in the declination. This time, if the drift is toward the north, adjust the elevation to lower (or raise) the north end of the polar shaft. (Note the sense reversal if the star is in the western sky.) After seeing no drift for maybe 10 minutes (or more, if you're fanatical), go back to an overhead star and recheck the drift. If you find that you need to make an adjustment in azimuth, then go back to a low star once again.

Here is a summary – cut this out and tape it to the side of your scope so you won't forget!

Location of star	Star moves to	Do to N end of polar axis
Low, E	S	Raise it
Low, E	N	Lower it
Hi, Mer	N	Move it East
Hi, Mer	S	Move it West
Low, W	N	Raise it
Low, W	S	Lower it

second; these two photons can each cause the emission of another, giving four; and under the right conditions the process can cascade until each incoming photon produces zillions coming out – *light amplification*. How do we achieve a population inversion? Well, it's not easy, which is why it's taken more than 30 years to figure out how to make lasers cheap!

There's one nice side effect of all this: since everything has to happen at exactly the right wavelength, a maser's amplification is extremely selective. A ruby maser, for example – say the one located just ahead of the detector on the 100m radio antenna at the Goldstone Deep Space Network tracking station – might amplify the signal from Voyager II at 12,345.6789 MHz by a factor of a million, while an interfering signal from a communication satellite at 12,345.6785 MHz is only amplified by a factor of two.

Oh-oh – there's not a lot of space left – I'd better start talking about IRc2! I get so long-winded sometimes....

IRc2 appears to be a young, luminous (ca. 10^5 L_{sun}) star with a mass-loss rate of about 10^{-3} M_{sun} per year. The material flowing out from the star is a mixture of gas and dust from the dense nebula from which the star condensed. Driven by radiation pressure from the star, the flow velocity is about 18 km/s from about 6 AU to more than 10,000 AU from the star. Inside of the 12 AU-diameter central region, the material is heated by the star to a temperature of well over 1500K (ca. 1200°C) – hot enough that all of the dust has vaporized, but – at least in the outer parts – cool enough that rugged molecules like SiO, Al_2O_3 (that's sapphire *vapor*!), etc. can form without being blown to atoms.

Now some calculations – based on lots of laboratory spectroscopy and a fair bit of basic thermodynamics and physics – show that there are two principal conditions that have to be met for a SiO maser to be possible.

First, we know that the density of the gas where the maser is found has to be less than 10^{12} per cc; any higher and the molecules would collide with each other too often. (That's less than one ten-millionth of our atmospheric pressure, though it's still much higher than interplanetary space in the solar system.) Calculations suggest that the density at 10 AU from the star is about 1% of this criterion, giving a comfortable margin of error.

Second, there has to be enough SiO overall to provide sufficient amplification for the masing to take place; and this may be why the IRc2 SiO maser is unique. In order to meet this second condition, the central star – or at least the central volume of the dust cloud no more than a few AU across – must be losing mass at a rate of more than 1/1000 of the Sun's mass per year. Now a reasonable estimate for the mass of this hot young star and the nearby cloud is perhaps 10 to 15 M_{sun}, so at its current rate it will be entirely dissipated in a few thousand years. Clearly, the SiO maser phase is a fleeting event by cosmic standards, and it's not unreasonable to think that it's total duration might only be a few centuries! We just happened to be in the right place at the right time to see it.

Why isn't maser action seen inside 6 AU (determined by VLBI measurements)? Most likely it's because the outflow is too turbulent that close to the star, because there's no dust (it's all vaporized, remember?). At 6 AU, where the temperature drops below 1500K, Al_2O_3 dust condenses; radiation pressure pushes the dust directly outward, which tends to dampen the turbulence. When the flow velocity exceeds the random turbulence velocity, maser action starts. Some turbulence is needed to keep the SiO from cooling too fast, so beyond perhaps 20 - 50 AU it's cold enough that the maser action stops.

That's it! Next month: "Critical Strings from Noncritical Dimensions:A Framework for Mirrors of Rigid Vacua".

Review of the 135th Meeting

December 17, 1993

by Bill Razgunas

Where do you look for video tapes of NASA's cable-cast of the Hubble Space Telescope repair? Courtesy of Tom Pettit, we have access to video tapes of the space shuttle's activities. Tom is able to tie into NASA's satellite link. I borrowed the video tape of the #2 EVA where the astronauts removed the defective solar panel. I found it quite an experience to watch. Talk to Tom about the other tapes that he has available!

Do you want to be certified to use the University's 24" telescope? Please talk to our grand exalted observatory director (D.C. Moons). One advantage of getting certified is that you will receive a copy of the rules and procedures, (which you will already know by that time). Does one benefit from review? YOU BET! Are the rules and procedures available at this time? Unfortunately, not yet. The club is seeking to print the document on special paper impregnated with a mild type of radiation which optimizes brain activity along the lines of strict compliance. It is also difficult to find the right kind of paper since it is in everyone's interest to make some of the pages edible to help sustain a person's strength during lengthy experiences using the telescope. This will also help people remember to bring their rules and procedures with them, since different flavored pages will be provided. ALL KIDDING ASIDE! The procedures manual is in the works.

D.C indicated that we now have a viewing hood. This can help improve one's observing since it minimizes stray light.

Are you interested in photography of nebulosities? Mark Cray has made a valuable addition to the telescope's accessories. Mark has assembled a telecompressor to reduce the telescope's F/ratio. It is now possible to reduce the ratio from F/25 to the range of F/16 through F/4.5. Talk to D.C. for more information.

CLASSIFIED ADVERTISEMENT: If you are a Viton O-Ring and would like to commit your time to the club, please contact Tom Ryan. The telescope's encoder is not working due to failure of the former O-Ring. Your job as the club's new O-Ring promises to be a very rewarding position due to the honor conferred on you by all the grateful telescope user's.

D.C initiated discussion about the funding of signs. The purposes for the signs are to help protect the interests of the University with regard to the radio telescope and other experiments. The other purposes are related to organization of Public Open Houses at Peach Mountain. D.C. agreed to be responsible to get a cost estimate for the signs and to discuss splitting the cost with the U of M. More information will follow.

Kurt Hillig indicated that anyone interested in the orbit of comet Shoemaker-Levy 9 should contact him. [Whoever has the diagrams of its orbit, please bring them to the next meeting - they're the only copies - Ed.]

Finally, Fred Schebor led the group in a stirring explanation of left and right brain activity. This was by way of introducing the Artsy Meaningless Slide Show. Fred provoked us all to exceptional levels of right brain activity – i.e. the 'artsy' side. The slide show began as the group practiced the chant "Gee, that's Neat." Thanks to all who made the slide show possible. Special thanks to Fred for his skillful introduction and implementation.

Computer Subgroup Report

by Roger Tanner

The group met at Doug Nelle's house for a discussion of the upcoming eclipse and the latest news of the Willmann Bell/ University Optics CCD Camera. There were plenty of snacks and refreshments provided by Doug and Bernard.

We started with Fred Schebor discussing some of the conditions for using the public access of the Toledo TV station. The Toledo and Ann Arbor stations are connected so they can share any video generated at either place. The Ann Arbor or Toledo schools can just tune into the public broadcasts. One of the conditions for getting a time spot is they want us to guarantee a program so we will have to come up with a tape in case of cloudy weather. Fred offered to check if NASA has a eclipse video we can use. He also mentioned he has ordered the extensive NASA circular on the eclipse (no. 1301 if you want to order it).

The discussion turned to the equipment. Doug Nelle, Fred Schebor, and Kurt Hillig all have small monochrome CCD cameras suitable for attachment to a scope. It was decided that we would need a white light view through a suitable filter to show the eclipse. The second view we thought would be interesting is to show a hydrogen alpha view of a prominence. Next, a camera view of the equipment and a talking head to describe what is going on. Focal length for the white light view would be about 500 mm and for the H-alpha would be about 2000-4000 mm to show a single flare or sunspot. I will pursue an H-alpha filter from some members of the Warren Astronomy club. Mark offered to try to borrow the Central Michigan University's H-alpha filter if that fails.

During the discussion of what to do if it's cloudy, we came up with the idea of taping some views of the eclipse generated by an astronomical program on one of the members computers. Several programs such as *Dance of the Planets* and *Voyager II* came to mind. One thing would be to produce a view looking from the sun-side of the Moon showing the shadow moving across the Earth. Maybe also some views illustrating the difference between annular and total eclipses or why the eclipse looks different from Toledo and Ann Arbor. Several people will try their programs to generate some interesting views. Just video taping the screen with a camcorder usually gives poor results, since computer monitors scan the screen at a different rate than video. Doug offered to use some of the equipment at work to convert the computer monitor signal into a video signal which can be recorded on a video recorder.

The next topic was what the view from Ann Arbor would look like. After consulting the Observers Guide, Ann Arbor is well with in the path; the Moon will be just offset about halfway to the edge. The problems of working with the Toledo location prompted several people to suggest using the Ann Arbor public station and just getting a white light feed from Toledo. We discussed getting the Toledo club to set up down there and send us a live video signal. Everybody felt that this would be a much better arrangement. This will be brought up to Stuart Cohen who started this and is handling the relation with the Toledo club. Doug mentioned that we must include some warnings on the screen not to look at the sun directly, and maybe we could show some safe ways to look at it. Doug Bock looked at the coordinates and figured out that his home in Fenton is within a few miles of the edge.

The discussion turned to the problems of the organization of all the various video sources. We counted 5: a white light camera showing the eclipse, a hydrogen alpha filter camera showing a flare or sunspot, a talking head describing what is happening and showing the setup, a tape of some computer generated space views, and possibly a live video feed of a white light view from Toledo. Several people suggested that we just tape everything and show it later. This would lose the spontaneity but would allow a much better production.

The meeting closed with the latest update on the Willmann Bell / University Optics CCD camera. I received the latest Willmann Bell catalog and there was an ad for The CCD Camera Cookbook. I called and talked to Perry Remaklus, the owner of Willmann Bell. He is taking orders for the Cookbook with software and the PC boards, however he said that they will not be available until the March-April time frame. The cookbook is going through extensive proofreading, and the circuit is getting some outside review for design robustness. The other thing is that he mentioned was that the price of the TC245 CCD chip used in the high resolution version of the camera had dropped to $100 recently. The ad estimated that the TC211 camera would cost $200 to build and the TC245 about $350. Tom Ryan brought a catalog of boat sump pumps ranging from $15 on up, several which appeared to be usable. He also bought a Melcor thermoelectric cooler catalog with the technical data and the prices. This is the cooler used in the camera to cool the CCD chip to reduce the thermal noise. So this kit looks good, and it keeps getting cheaper!

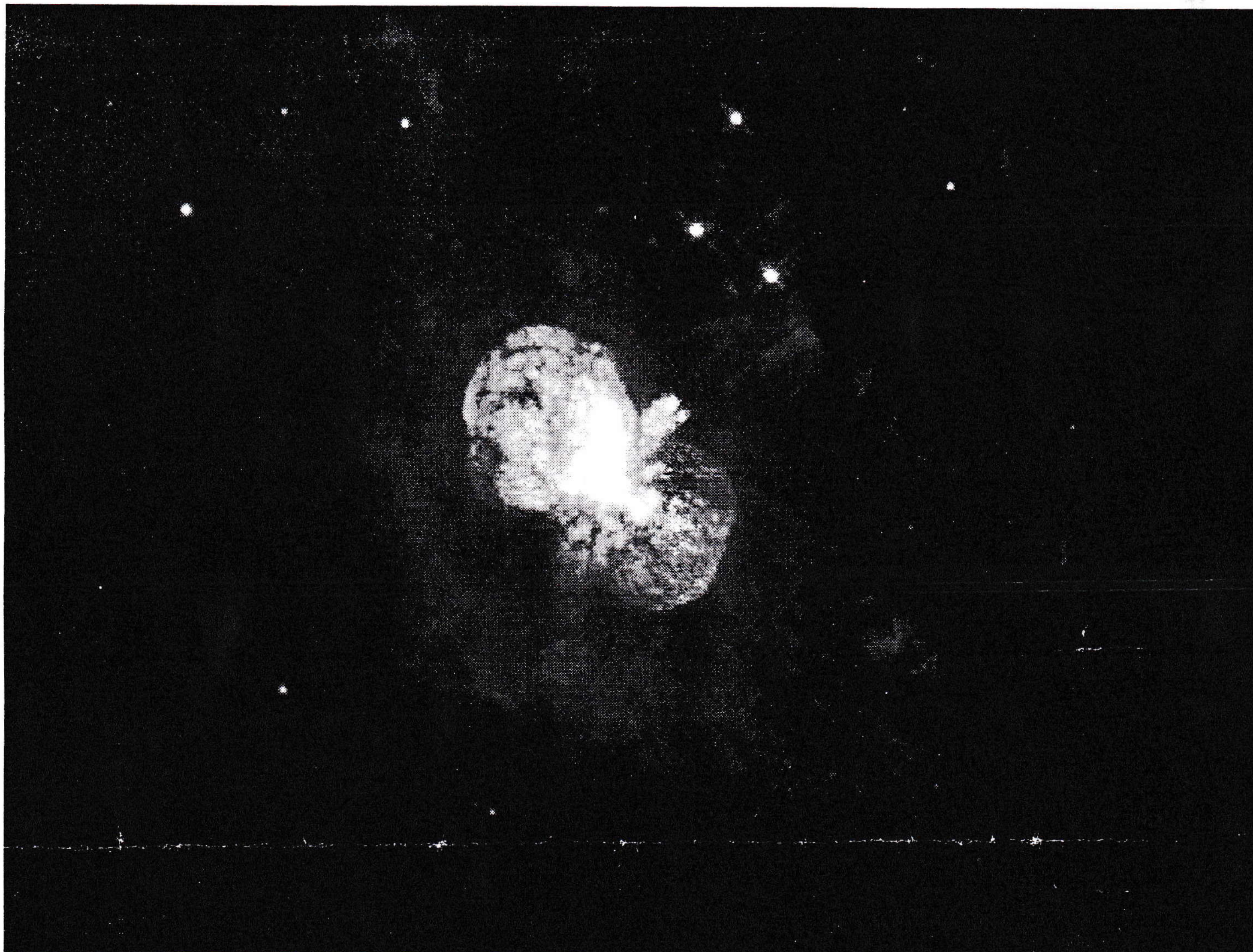
Treasurer's Report

by Doug Scobel

First, the good news: The shirts are in! The Observer's Guides are in! I even have a few calendars left! I'll be bringing them all in to the January 21 meeting, so be sure to be there to pick up all your goodies. Give me a call if you need to make other arrangements for pick-up.

Next, the good news: Here is an overview of the club's finances over the past year. If you want to know more about any details, just give me a call or find me at the meeting.

Balance on January 3, 1993	**$**	**1479.73**
Income		
Dues	$	1368.00
Fundraisers (calendars, shirts, etc.)	$	1543.75
Magazine subscriptions	$	428.00
Interest	$	41.52
Gifts	$	123.00
Miscellaneous	$	39.57
Total income	**$**	**3543.84**
Expenses		
Newsletter (printing & mailing)	$	950.96
Fundraisers (Calendars, shirts, etc.)	$	1216.99
Magazine subscriptions	$	428.00
McMath 24" expenses/improvements	$	803.32
Meetings/talks	$	63.00
Miscellaneous	$	50.76
Total expenses	**$**	**3513.03**
Balance as of January 5, 1994	**$**	**1510.54**



Hubble Works!

Here are the first pictures released by NASA, all taken by the new WFPC II. Too bad I can't print them in color - they're spectacular!

This Page:

Top - Eta Carina.

Bottom - The open cluster R136.

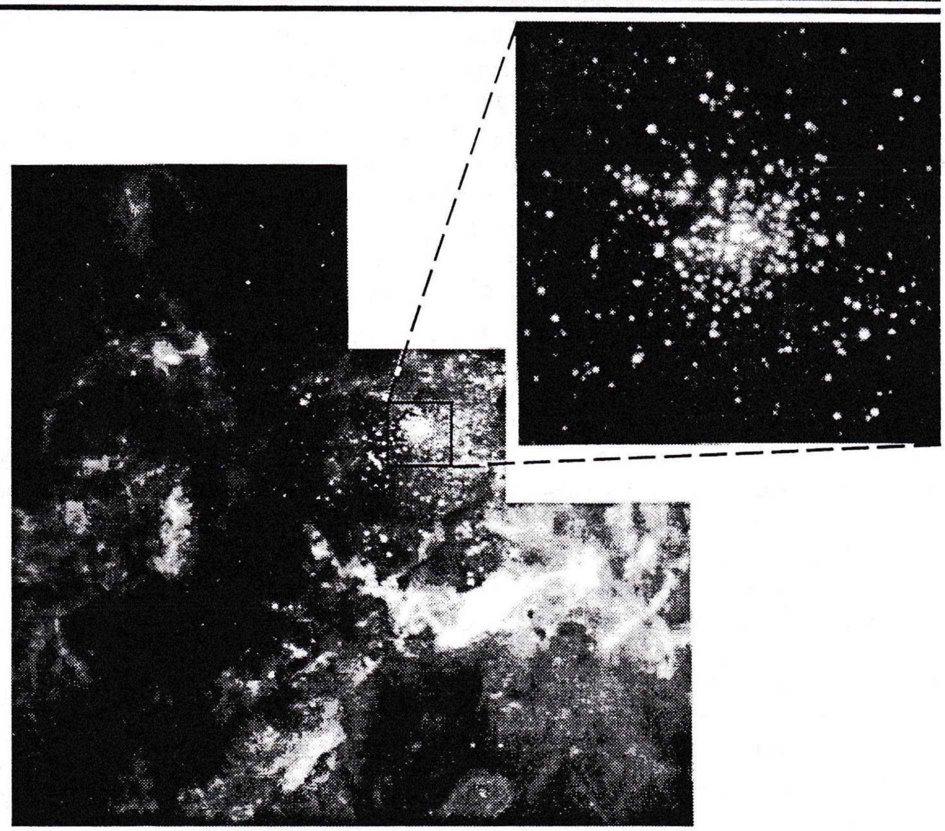
Overleaf:

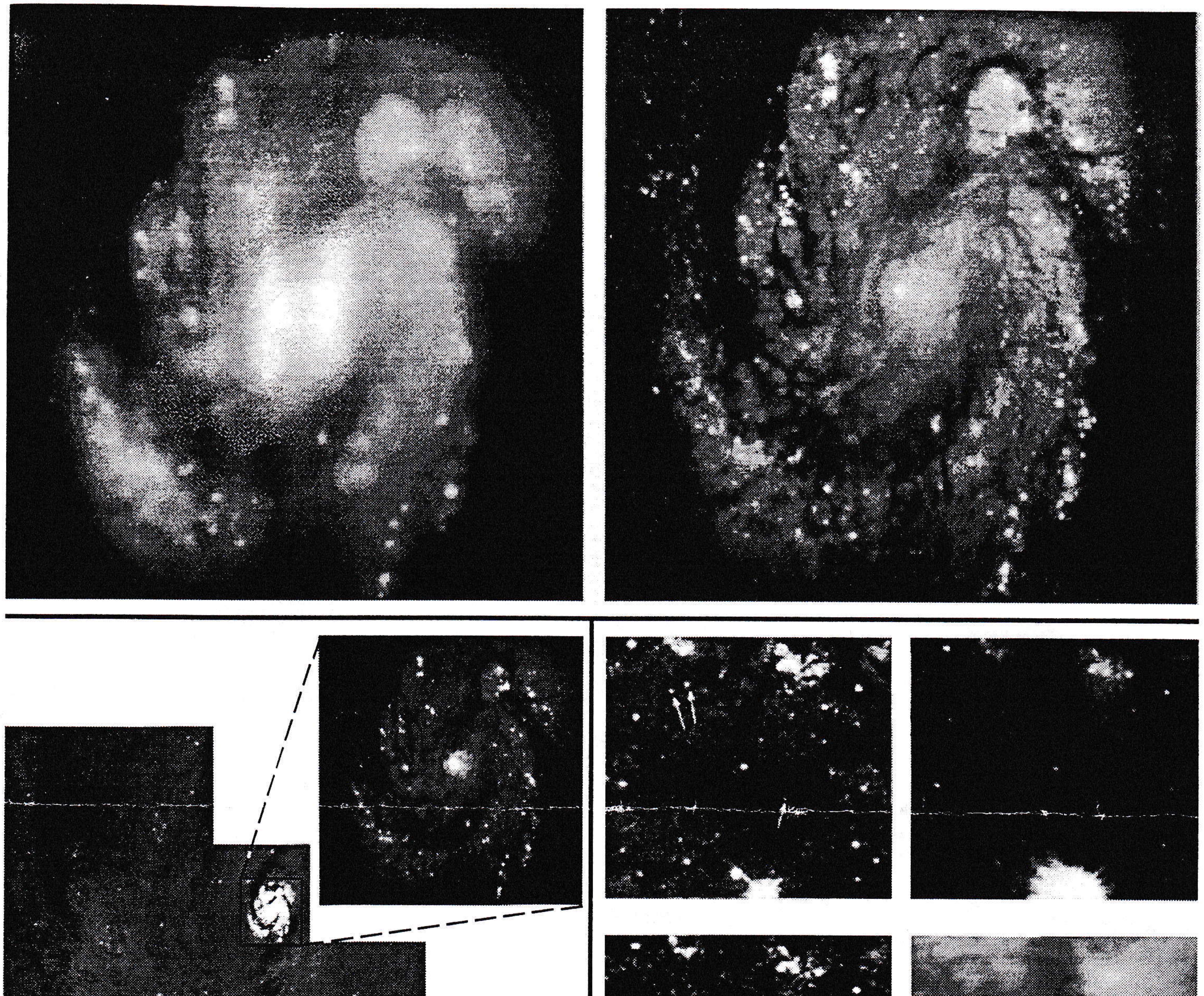
Top - The core of M100, with (right) and without the corrective optics.

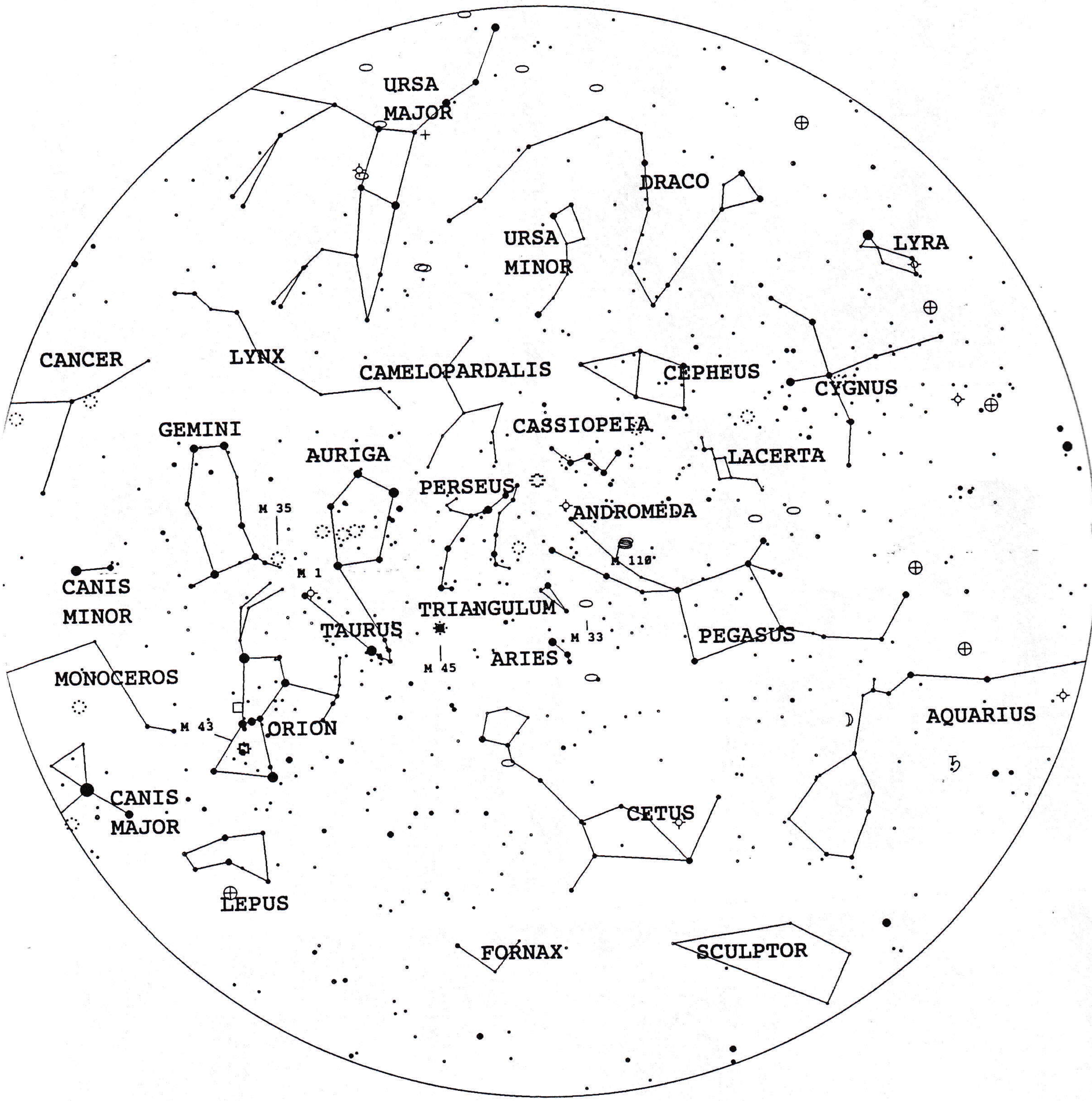
Center Left - M100, showing the region detailed in the top picture.

Center Right - Cepheid variables in M100; before/after on the bottom/top, and raw/processed on the right/left.

Bottom - a star field showing the old (left) and new (right) raw images, with the best processed old image (center).



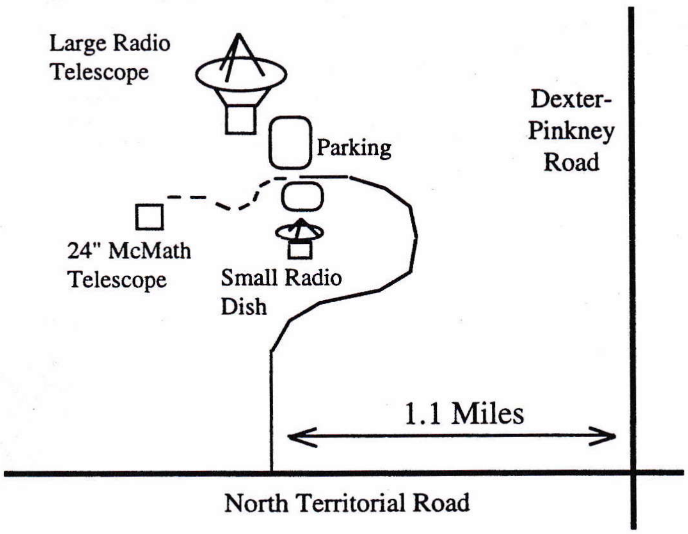



URSA
MAJOR
DRACO
URSA
MINOR
LYRA
CANCER
LYNX
CAMELOPARDALIS
CEPHEUS
CYGNUS
GEMINI
CASSIOPEIA
AURIGA
LACERTA
PERSEUS
M 35
ANDROMEDA
CANIS
MINOR
M 1
M 110
TRIANGULUM
TAURUS
M 33
PEGASUS
ARIES
M 45
MONOCEROS
AQUARIUS
M 43
ORION
CANIS
MAJOR
CETUS
LEPUS
FORNAX
SCULPTOR

☞ Places:

The Detroit Observatory is in Ann Arbor, at the corner of Observatory and Ann Streets, (across from the old University of Michigan hospital and between the Alice Lloyd and Couzens dormitories on the UM campus). The Detroit Observatory is an historic building which houses a 19th century 12-inch refractor and a 6-inch transit telescope.

The Peach Mountain Observatory is the home of the University of Michigan's 25-meter radio telescope, as well as the University's McMath 24-inch telescope which is maintained and used by the Lowbrows. The observatory is located northwest of Dexter; the entrance is on North Territorial Road, 1.1 miles west of Dexter-Pinkney Road. A small maize and blue sign marks the gate. Follow the gravel road one mile to a parking area near the radio telescopes. Walk along the path between the two fenced-in areas (about 300 feet) to reach the McMath telescope building.



☞ Times:

The monthly meetings of the Lowbrows are held on the third Friday of each month at 7:30 PM at the Detroit Observatory. During the summer months, and when weather permits, a club observing session at Peach Mountain will follow the meeting.

Computer group meetings are held on the first of each month, rotating among members' houses. See the calendar on p.1 for the location of the next meeting.

Public Open House / Star Parties are held on the Saturdays before and after each new moon at the Peach Mountain Observatory. Star Parties are cancelled if the sky is cloudy at sunset – call 426-2363 to check on their status. Many members bring their telescopes; visitors are welcome to do likewise. Peach Mountain is home to millions of hungry mosquitos – bring insect repellant, and wear warm clothes!

☞ Dues:

Membership dues in the Lowbrow Astronomers are $20 per year for individuals or families, and $12 per year for students. This entitles you to use the 24" McMath telescope (after some training). Dues can be paid to the club treasurer, Doug Scobel, at any meeting or by mail at this address:

1426 Wedgewood Dr.
Saline, MI 48176

☞ Magazines:

Members of the Lowbrow Astronomers can get a discount on these magazine subscriptions:

Sky and Telescope: $20 / year
Astronomy: $18 / year
Odyssey: $16.95 / year

For more information, contact the treasurer.

❒ Sky Map:

The sky map in this issue of *REFLECTIONS* was produced by Doug Nelle using *Deep Space 3D*, drawn for the end of twilight on the monthly meeting date.

✎ Newsletter Contributions:

Members (and non-members) are encouraged to write about any astronomy-related area in which they are interested. Call the editor (Kurt Hillig) at 663-8699(h) or 747-2867(o), or send e-mail to khillig@umich.edu, to discuss length, format, etc. Announcements and articles are due 14 days before each monthly meeting. Contributions should be mailed to:

Kurt Hillig
1718 Longshore Dr.
Ann Arbor, MI 48105.

☎ Telephone Numbers:

President:	Stuart Cohen	665-0131
Vice Pres:	Doug Nelle	996-8784
Moved to Las Vegas: Gone, but not forgotten!	~~Paul Etzler~~	~~426-1939~~
	Fred Schebor	426-2363
	Tom Ryan	662-4188
Treasurer:	Doug Scobel	429-4954
Observatory:	D. C. Moons	254-9439
Newsletter:	Kurt Hillig	663-8699
Membership:	Steve Musko	426-4547
Open House:	Keith Bozin	549-9525

Peach Mountain Keyholder:

Fred Schebor 426-2363

Monthly Meeting:

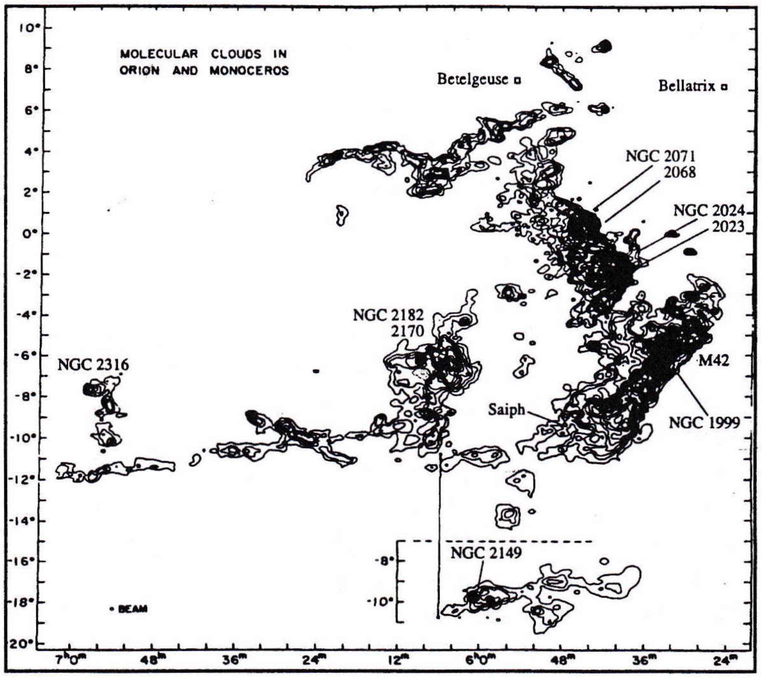
William Durrant

on

Particles in Space

Jan. 21, 1994 at 7:30 PM

At the
Detroit Observatory in
Ann Arbor



A map (1950 coords) of CO in the Orion-Monoceros molecular clouds. The dense features on the right are the Ori A (upper) and Ori B clouds; the central dense feature is the Mon R2 cloud. Inset is the bridge between Ori B and Mon R2. Velocities range from 15 km/sec (southern filament) to 5 km/sec (Ori A), with a 3 km/sec component in the bridge region.

University Lowbrow Astronomers
840 Starwick
Ann Arbor, MI 48105

Check your membership expiration date on the mailing label!