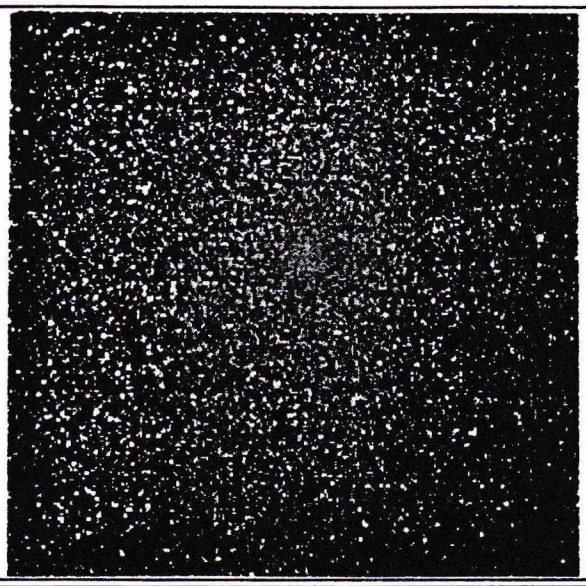
REFLECTIONS



REFLECTIONS

The globular cluster NGC 104 in Tucana
(also known as 47 Tucanae).
Located at R. A.: 0h 24.1m, Dec.: -72° 5′. Magnitude = 4.0.

March 1995

Bernard Friberg and Douglas Warshow, Editors

Of the University Lowbrow Astronomers

The University Lowbrow Astronomers is a club of enthusiasts which meets on the third Friday of each month in the University of Michigan's Physics and Astronomy building (Dennison Hall, Room 807). 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-Pinckney Road; there is a map near the end of the newsletter) on Saturdays before and after the new moon; if it's cloudy or very cold just before sunset, call (313) 480-4514 to see if the event is cancelled. For further information, contact Bill Razgunas at (313) 995-0934.

This Month

March 2	Computer subgroup meeting at 7:30 PM at Doug Warshow's place. Call (313) 998-1158 for more information.
March 4	Open house at Peach Mountain.
March 17	Meeting at 807 Dennison. Patricia Hanlan will talk about elliptical galaxies.
March 20	Spring starts at 9:14 PM EST.
March 25	Open house at Peach Mountain.

Next Month

April 1	Open house at Peach Mountain.
April 2	Computer subgroup meeting at 7:30 PM at Doug Warshow's place. Call (313) 998-1158 for more info.
	Daylight Saving Time begins. Spring forward, folks.
April 21	Meeting at 807 Dennison. Elections followed by various five-minute talks.
April 22	Open house at Peach Mountain.
April 28	Leslie Science Center open house at 7:00 PM.

NOTES FROM UNDERGROUND

by Spy X

The following information was "beam-split" from the realm of cyberspace (non-verbatim):

The UM Department of Astronomy will be holding public open houses atop Angell Hall on March 10 & 24 and April 17 (weather permitting). The hosting graduate students will be using the the new 16" telescope, along with a 8" Celestron. The observing sessions will begin at dusk and end at 11:00 PM. •

VISITING MAUNA KEA: ANY ADVICE?

by Bill Higgins

A pal is going to Hawaii soon and would like to visit observatories atop Mauna Kea. I have an excellent description posted by Lt. Cdr. J. W. Cupp (002@pnet16.cts.com) in October 1991 on how to visit. I was wondering if anybody has further advice now that a few years have gone by. I'll append Cupp's posting so you can comment on it:

VISITING MAUNA KEA OBSERVATORIES IN HAWAII

Okay, so the eclipse is over. Mauna Kea is still there and with its complex of nine first rate observatories it is well worth the visit for any enthusiast. But making the trip requires a little preparation. Having just returned from the Big Island of Hawaii, I went up to see Mauna Kea and I thought I'd spread around what I learned where it seems likely to do the most good. If you're planning a visit to Hawaii set aside some time, preferably on a Saturday, to visit the University of Hawaii Institute for Astronomy. First, you have to have a 4-wheel-drive vehicle; laws not only of the State of Hawaii but common sense (and almost, physics) prohibit you from going to the summit without one. It's disheartening to get so close and be barred, so don't try it in a 2-wheel-drive. Instead, go to Harper's Car and Truck Rentals in Hilo and get a 4WD for one day. [Call Harper's at (808) 969-1478.] I rented an Isuzu Trooper (seats five) for $60 for one day. Not only that, but Harper's has handouts on the U.H. Institute for Astronomy including maps. They also make provisions for after-hours drop off and don't mind if you have little experience driving 4WD vehicles. (I have no connection to Harpers, I'm just a satisfied customer and like to see good business rewarded with more business). 9,200 feet up Mauna Kea is the U.H. Onizuka Visitor Information Station and they offer the following programs: on Fridays and Saturdays a short talk is followed by a guided tour of the observatory, beginning at 2:00 P. M. On Saturdays and Sundays another short talk is followed by star gazing at the VIS, beginning at 7:00 P. M. All VIS programs are free of charge. As I've said, beyond the VIS you can't go to the 13,800 foot summit without a 4WD. Although you can make it to the VIS in a 2WD, be careful because almost all the car rental agencies in the area prohibit use of their cars up Mauna Kea at all. (You might get away with it, many do, but you might also get a stiff fine or civil lawsuit.) Some precautionary notes: Despite all the bad press, the road to Mauna Kea and the road to the VIS are in very good shape. The narrow parts are gradually being repaved and widened. From Hilo it's about 45 minutes to the top. The VIS is only open Friday to Monday and the hours are irregular; call (808) 961-2180 for current information before you waste a trip up. It is very cold at altitude. No matter what the weather in Hilo, expect about 35°F and 30 knots of wind, and they advise you conditions can deteriorate to 20°F and 70 knots of wind without warning. I guess the answer is layers of clothing which

(Continued on page 3)

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can be added as needed. That's what I did and I was fine except for after sunset on the summit, and I didn't stay there long. Because of the danger of oxygen deprivation, children under age 16 are not permitted beyond the VIS. Make sure you pack along lots of water and fluids. I took a six pack of soda, plus fruit juice and drank water at every fountain; I was still severely dehydrated upon return and it took all the next day to recover. Also I suggest several high sugar food sources, such as granola bars and chocolate be carried along. The Institute recommends the following additional precautions: no scuba 24 hours before hand, no alcohol the day of ascent, stop smoking 48 hours prior to going up and cut down on carbohydrates and other gas producing food the day before your trip. Don't let me scare you by the above. It's a spectacular trip and well worth the little effort to make it. You'll see a sunset like no other and a good guided tour of some of the finest observatory equipment anywhere in the world. Last note: active duty military personnel contemplating the trip, e-mail me for additional notes on visiting the Big Island if you're unfamiliar with the area. —J. W. Cupp UUCP: humu!nctams1!pnet16!002 Naval Telecommunications CenterARPA:humu!nctams!pnet16!002@nosc.mil P.O. Box 55INET: 002@pnet16.cts.com Note: the above is merely my opinion, and not to be construed as anything else.

Responses:

First, you have to have a 4 wheel drive vehicle; laws not only of the State of Hawaii but common sense (and almost, physics) prohibit you from going to the summit without one. The day I went up (in a 4WD) I saw several ordinary cars driving up the road with little difficulty. Though I haven't done so myself, it looked to me like it would be easy enough. By 4WD standards the Mauna Kea road is a freeway. 9,200 feet up Mauna Kea is the U.H. Onizuka Visitor Information Station. One of the keys to having a good time at high altitude is acclimation. Don't just rush up the mountain as fast as you can. Spend some time at the visitor center; have your lunch there; walk around a bit. It really does make a difference. It is very cold at altitude. No matter what the weather in Hilo, expect about 35°F and 30 knots of wind, and they advise you conditions can deteriorate to 20°F and 70 knots of wind without warning. It was much warmer than that the day I was there, but definitely chilly. It's a nice change from Hilo. Also, don't give up if the mountain looks cloudy from Hilo. Often you will drive through the cloud a while and then emerge above it. If you're lucky enough to experience this you will never forget it. The danger of oxygen deprivation. If you start feeling lightheaded or faint, try walking around a bit. If the symptoms persist GO DOWN (and make sure someone else drives). A healthy person is in no real danger at 13,000 ft. but it may be inadvisable for some. Don't let me scare you by the above. It's a spectacular trip and well worth the little effort to make it. Ditto. It was, in fact, the highlight of my Hawaiian trip.

—Bill Arnett

Some precautionary notes. Despite all the bad press, the road to Mauna Kea and the road to the VIS are in very good shape. The narrow parts are gradually being repaved and widened. Saddle Road has been repaved up to milepost 19. There are 4 miles of old pavement remaining between mileposts 19 and 23. From milepost 23 to 28, where the summit access road turnoff is, the pavement is good, though there are no shoulders. The access road is paved up to Hale Pohaku. Beyond that, the road is gravel (or volcanic cinders) for 4 more miles. At the top of Black Hill, the pavement picks up again and continues to the summit. This summit pavement wasn't in place when the person

(Continued on page 4)

(Continued from page 3)

who wrote this advice was there, hence access by two-wheel-drive vehicles is easier, but I still wouldn't recommend it. Not only is the road still steep, which is best navigated with the low gear selection on four-wheel-drive vehicles, but the Saddle Road restrictions on rental cars still apply. And the four miles of unpaved road can be rendered impassable to cars by heavy rains, which do occur from time to time. From Hilo it's about 45 minutes to the top. Maybe if you're Mario Andretti. Extremely optimistic. It usually takes an hour to get from Hilo to Hale Pohaku (Onizuka Visitor Center, at the 9,200-foot level), and another half hour to get to the summit. Some time spent acclimatizing at Hale Pohaku is advisable before continuing to the summit. I'd recommend packing a light lunch and taking the time to consume it at Hale Pohaku. Don't bother with alcohol; the thin air makes you light-headed enough already, and the combination has proven deadly when negotiating Killer Hill going back down. People with heart conditions or respiratory problems should not attempt to visit the summit. The air pressure is about 60 percent that at sea level (that is, less than what commercial jet aircraft are pressurized to).

—tholen@galileo.ifa.hawaii.edu •

FASTER PHOTOGRAPHY

by Tom Ryan

How would you like to turn your present telescope into a full aperture f/1.8 system for photographic or electronic imaging? It doesn't take a lot of exotic hardware. You don't have to make a Schmidt corrector plate. In fact, you probably have everything you need to do this lying around the house right now.

No, I'm not talking about eye of newt, toe of frog, wool of bat, and tongue of dog. It can be done with a common 7x50 binocular or finder lens, and a 50 mm camera. Thanks to Mark Cray and a December 1973 Gleanings article in Sky and Telescope, you can enjoy shorter exposure times than ever before. Here's how I encountered this device, and how it works.

When Mark acquired two 320 mm focal length achromatic finder lenses, he decided to build a giant Erfle eyepiece for the 24" telescope. Not knowing what the spacing between the lenses should be for best imaging, Mark decided to do what most astronomers would never do: he decided to experiment with his materials. After a few trials, he met with success and the large eyepiece at Peach Mountain is the remarkable result.

Mark then wondered if photography through this eyepiece would be possible. More experimentation with the camera and lens spacing, and much main scope refocusing, led to some astonishing color prints of the Orion Nebula and the Trapezium. The exposure times were short and the stars were as focused as they ever get in the 24". Mark had developed a diffraction- (or main scope) limited focal reducer which operated at an estimated f/2.5.

To put this in perspective, Rutten and Venrooij, in their book, Telescope Optics, state that focal reducers are "quite difficult to design". I had come to the same conclusion after spending many tens of hours with an optical design program trying, and failing, to design a practical focal reducer for the 24" f/25 scope. When Mark told me what he had done, I ran his design through the program to find out how it works.

The key to the focal reducer's success is the camera lens. Now, a 50 mm f/1.8 camera lens represents about five man-years of design effort by some of the world's best optical designers. However, thanks to the miracle of mass production, you probably already own one or two of these things. Here's how to use one to speed up your telescope.

The simplest way to use a camera lens to reduce your telescope's f/ratio is shown in Figure 1:

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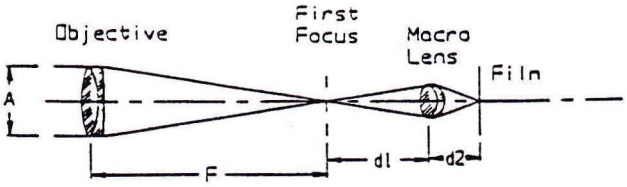


FIGURE 1

The lens has to be focused on the primary's focal plane, which is why a macro lens is recommended. Macro lenses are designed to focus on objects close to the lens itself.

Mark's arrangement, in its simplest form, appears in Figure 2:

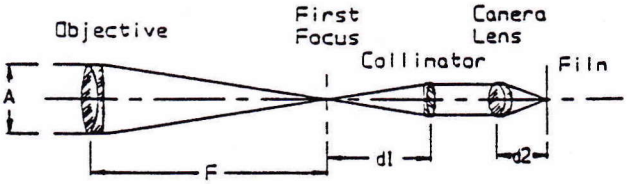


FIGURE 2

Here the camera lens is focused on infinity, and the collimator lens is used to make the telescope's light parallel.

The following formulae apply to the diagrams in this article:

EFL = F(d2/d1)

Effective Focal Ratio = EFL/A, or = (Objective's f/ratio)(d2/d1)

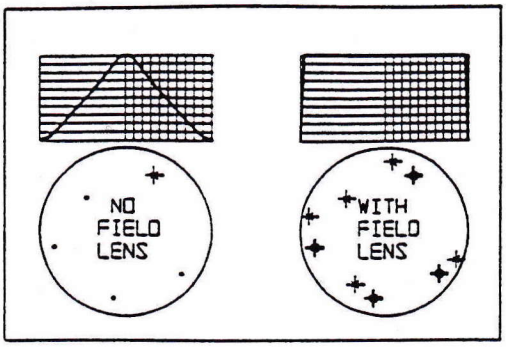
The Gleanings article gave the following example:

Suppose the objective is a 6" f/8 reflector, and the collimator is a 7x50 binocular objective with a focal length of about 7.6". The magnification of this combination is 48"/7.6" = 6.3 power. The exit pupil of the collimator is the aperture divided by the magnification, or 6"/6.3 = 0.95" diameter. The binocular lens, 50 mm (2") in diameter, will not vignette the on-axis beam.

Now suppose a 50 mm f/1.8 camera lens is placed behind the collimator, and focused on infinity. Its wide open aperture is 50 mm/1.8 = 27.8 mm = 1.1 inches, which is also larger than the beam. Thus the camera lens won't vignette the on-axis beam, either. The formulas above say that the EFL is 48(1.97/7.6), or 12.6". Dividing by the aperture, 6", gives 12.6"/6", or a very rapid system focal ratio of f/2.1.

If the focal ratio we just calculated had turned out to be smaller than the camera's f/ratio, then the camera's f/ratio would be the system's focal ratio and some light would be lost through vignetting. In other words, no choice of telescope or collimator can make the system faster than the camera lens.

How well does the system work? With a 10" f/8 set up as in Fig. 2, star images are less than 0.001" in diameter across a flat field. The only drawback is off-axis vignetting. For the 10", the fully illuminated spot on the film plane is about 0.050" in diameter, and the illumination falls off linearly after that, reaching zero at a 0.25" radius. This effect can be seen in Fig. 5:



ILLUMINATION PROFILE

12 MM DIAMETER SPOTS ON 35 MM FILM

FIGURE 5

What other combinations of objectives, collimators, and camera lenses could be used? Since you probably already have the objective and camera lens, we just need to find a lens which will collimate the light and not vignette

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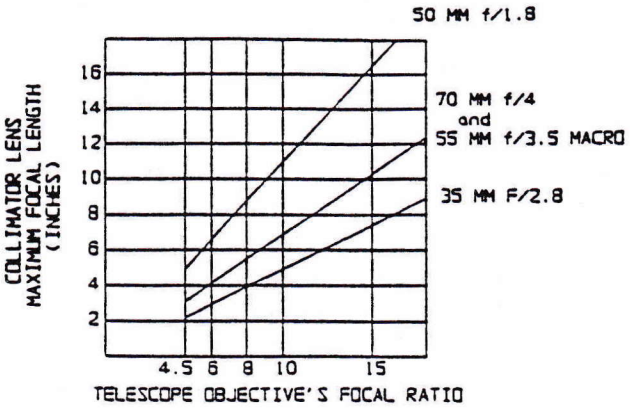
the objective. Below is a graph for four camera lenses used with various f/ratio objectives:



$$\text{(MAXIMUM COLLIMATOR FOCAL LENGTH TO AVOID VIGNETTING)} = \frac{\text{(PRIMARY'S FOCAL RATIO)(CAMERA'S FOCAL LENGTH)}}{\text{(CAMERA'S FOCAL RATIO)}}$$

This graph shows that owners of fast scopes need to find short focal length achromats to avoid vignetting by the camera lens. A longer focal length collimating lens will vignette. A shorter collimating lens will give a longer effective focal ratio than the camera lens' f/ratio. Since 50 mm diameter, 7.6" focal length achromats are most common, owners of fast scopes might consider using a Barlow lens to bring their primary's focal ratio up to f/8 or so.

If a person happens to have two identical achromats, he can do even better. If he has a fast scope, he can double them up and effectively have a shorter focal length collimator. The formula for combining lenses A and B is:

Fcombined = (Fa)(Fb)/[Fa + Fb - (lens separation)].

Putting the lenses in contact has the most effect.

The owner of a slower scope can instead use one of the lenses as a field lens, as shown in Fig. 3 and 4:

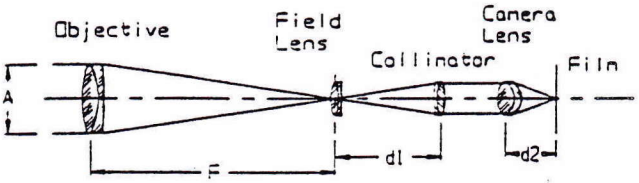


FIGURE 3

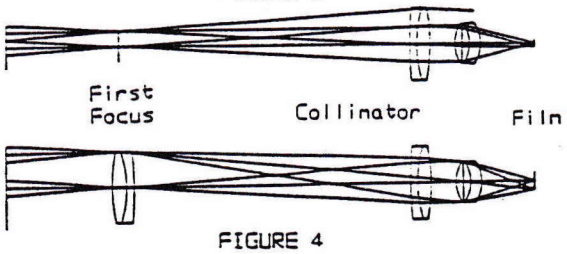


FIGURE 4

Notice that the field lens, placed at the objective's focal plane, bends the rays at the edge of the field back into the camera lens without changing their final focus. This reduces vignetting to zero across a spot 0.5" in diameter for our 10" f/8 objective. Unfortunately, the field now curves slightly. Stars can be focused to either 0.001" diameter at the center and 0.010" at the edge, or 0.005" diameter across the whole field. For CCD imaging on common scopes, this kind of focal reducer is nearly perfect. It gives a uniformly illuminated field that is larger than the CCD, fills it with uniformly aberrated stars, and does so at f/1.8.

If you want to experiment with one of these systems, try to use identical lenses for the field and collimator lenses. Place the field lens at or near the objective's focus. Focus the camera lens on infinity and place it about 0.75 to 1.5 inches behind the collimator lens. Focus the system by moving the collimator lens-camera combination with respect to the objective-field lens combination. And after you see the results, buy Mark a beer the next time you see him. •

JUNIPER SKY, FROST AND BORRELLY

by Carolyn Strong

(Continued on page 7)

(Continued from page 6)

OCT 28 - Friday night. After a week of 4+ inches of rain in Portland, Friday holds a promise of clear skies east of the Cascades. We drive through a hailstorm over the passes, but soon over the mountains we break into clearing. With high pressure building, we know we will at least get some observing time this weekend. The standing water on the sides of the roads tell us that the east side has received significant rain also. What will we find at Juniper Sky, we wonder. Will the road into it be too soft to drive? We arrive long after dark. The sky is clear, gorgeous, black and the road is hard to discern. We drive in carefully, not sure what kind of track our camper and trailer are making. We park in the familiar juniper trees, near the observing field. After parking we walk the ritual half mile back to the road. The land is doing exactly as we hoped. Being mostly sand,there is no mud...it is firm to walk on, and we can hardly see our tire tracks. Our hope is renewed that we will be able to observe here most of the winter...so long as there is not significant snow above 3,500 ft. Our altitude is 3,900 ft. On the way back to the camper we notice things are already heavy with dew. Gary decides he will not observe tonight. I think maybe it is better to wait till morning also. We watch a movie back at the camper. At Gary's first snore, I look outside again. I can't stand it. There is not one cloud...I'm setting up my 8" Celestron! I choose the full snowmobile suit, over the light-weight down suit, and wear gore-tex, snowmobile boots, and wool hat and gloves. The temperature is 30°[F] and dropping fast. I make slow deliberate moves--doing each thing methodically and carefully. I walk slowly in the dark between the trailer and the observing field, setting up. I throw the canvas bag from my tripod over the light of a bright-white flashlight...it gives a warm glow over my working area, totally non-offensive. Frost is forming fast. My observing table is white. This is definitely not an all-nighter, so I decide on a goal...Comet Borrelly. Since it's still rather early, I poke around in familiar areas. NGC 2264--open cluster...it's like the outline of a Christmas tree. Beautiful. The comet area is behind one of the large junipers. I take a look at one of my favorites...Hubble's Variable. It's fan-tastic. So bright, perfectly fan-shaped and comet-like. The sky behind it seems so black. I look at it for a long time. Finally, the comet is out from behind the tree. I find it immediately. Oh boy. Be forewarned, do not look at Hubble's Variable before looking at this comet!! But there is it, just as it should be--a FAINT smudge. Still there is satisfac-tion in having achieved the goal. I try for a few more things, but the frost must be scraped from the telrad and I grow frustrated with dew on the eyepieces. I hear a coyote. There is nothing else--dead, calm, stillness.

OCT 29 - Sunrise, Saturday morning, 22°, a fairyland of frost. We go for a long walk after a big breakfast. All the Cascades have snow...Three Sisters, Broken Top, Mt. Jefferson, Mt. Bachelor...beautiful. Gary is mad because I left the trailer door open and the back end is full of frost. He begins setting up the LX200 around 11:00 A.M. Tycho (the dog) and I curl up like squirrels and sleep for 2 hours on the couch. "Come and see Algieba!" It's Gary yelling at the camper door. I stagger into my shoes while he mumbles something about 2 and 3.5 magnitude double in Leo...while I try to shake the sleep from my head, he's telling me this is a double that you normally have to look at at twilight or full moon to separate. But here it is at 1:00 in the afternoon...I take a look. Oh yeah. Perfect. One brighter star with a little star very near. Two perfect stars. Wow. Neat. Show me more...We start going through all the brighter stars...Regulus, Procyon, etc. Stars with color still have color. We look at Mars. I think if conditions were perfect in the atmosphere you could see features...I like this daytime astronomy. We end by looking at sunspots. A nice little group of those. Late in the

(Continued on page 8)

(Continued from page 7)

afternoon we burn a pile of sagebrush ...cleared during the summer for observing and camping areas. The temperature drops quickly. At night we run through many objects with the LX200, but my scope frosts up quickly. As I write this in Portland Monday night, it is raining again...2" today. The snow level is coming down to 1,000 ft. and I wonder again...what's it like at Juniper Sky? Will we make it there in December?

(*to be continued...*) •

FOURTH ANNUAL MESSIER NIGHT

by Christopher Sarnecki

The Astronomical Societies of Hillsdale and Lenawee Counties are sponsoring their Fourth Annual Messier Marathon on Friday, March 31st and Saturday, April 1st at Lake Hudson State Recreation Area in Clayton, Michigan. This is of course the state's first "Dark Sky" preserve. The site is just over an hour drive by car from Ann Arbor and is located west of Adrian and south of Jackson.

If the weather forecast are good for Saturday night, the Messier Marathon will be held on that night. If the forecast for Friday is better than Saturday, then the event will be held on Friday. Wes Boyd, representing the Astronomical Societies of Hillsdale and Lenawee Counties, can be contacted at (517) 547-7402 (evenings), right up to the last minute, if you have questions.

This event is sponsored by a fine group of dedicated Amateur Astronomers and will make you feel welcome at this event, as I felt at last year's marathon. So, come on out to this excellent site and hear Doug Scobel proclaim ,"Wow, I can see the Winter Milky Way !" Feel free to ask Doug or myself just how DARK this site is. Copies of maps will be made available at our March meeting. •

SCALES LIST (Part 1)

by Neil Brandt

Time (seconds)	
2 x 10^15	Timescale for Los Angeles to pass San Francisco via continental drift.
2.4 x 10^15	Typical LMXB evolution time.
7.3 x 10^15	Orbit time for sun around galaxy center.
1.1 x 10^16	PSR 1913+16 orbital gravitational radiation coalescence timescale.
2 x 10^16	Rough supernova biological extinction time.
6 x 10^16	Minimum age of PSR J0437-4715.
6 x 10^16	Time for galaxy to cross a cluster.
1.1 x 10^17	Primeval slime-to-man time.
1.5 x 10^17	Age of Earth and Sun.
1.5 x 10^17	Uranium-238 half-life.
2.7 x 10^17	Look back time to z=1.
3 x 10^17	Main sequence lifetime for a 1 solar mass star.
3.3 x 10^17	Look back time to z=2.
3.3 x 10^17	Sun nuclear time scale.
3.7 x 10^17	Look back time to z=4.
3.8 x 10^17	Rough age of the Milky Way.
3.8 x 10^17	Look back time to the z=4.897 quasar PC 1247+3406.
4 x 10^17	Rough age of 47 Tucanae (an old globular cluster).
4.1 x 10^17	Age of the universe.
2.5 x 10^18	Globular cluster evaporation time.
3 x 10^25	Galaxy dynamical relaxation timescale.
3 x 10^27	Earth/Sun orbital gravitational radiation coalescence timescale.
1 x 10^39	Lower limit on the proton lifetime.
4.7 x 10^73	1 solar mass black hole Hawking evaporation time.

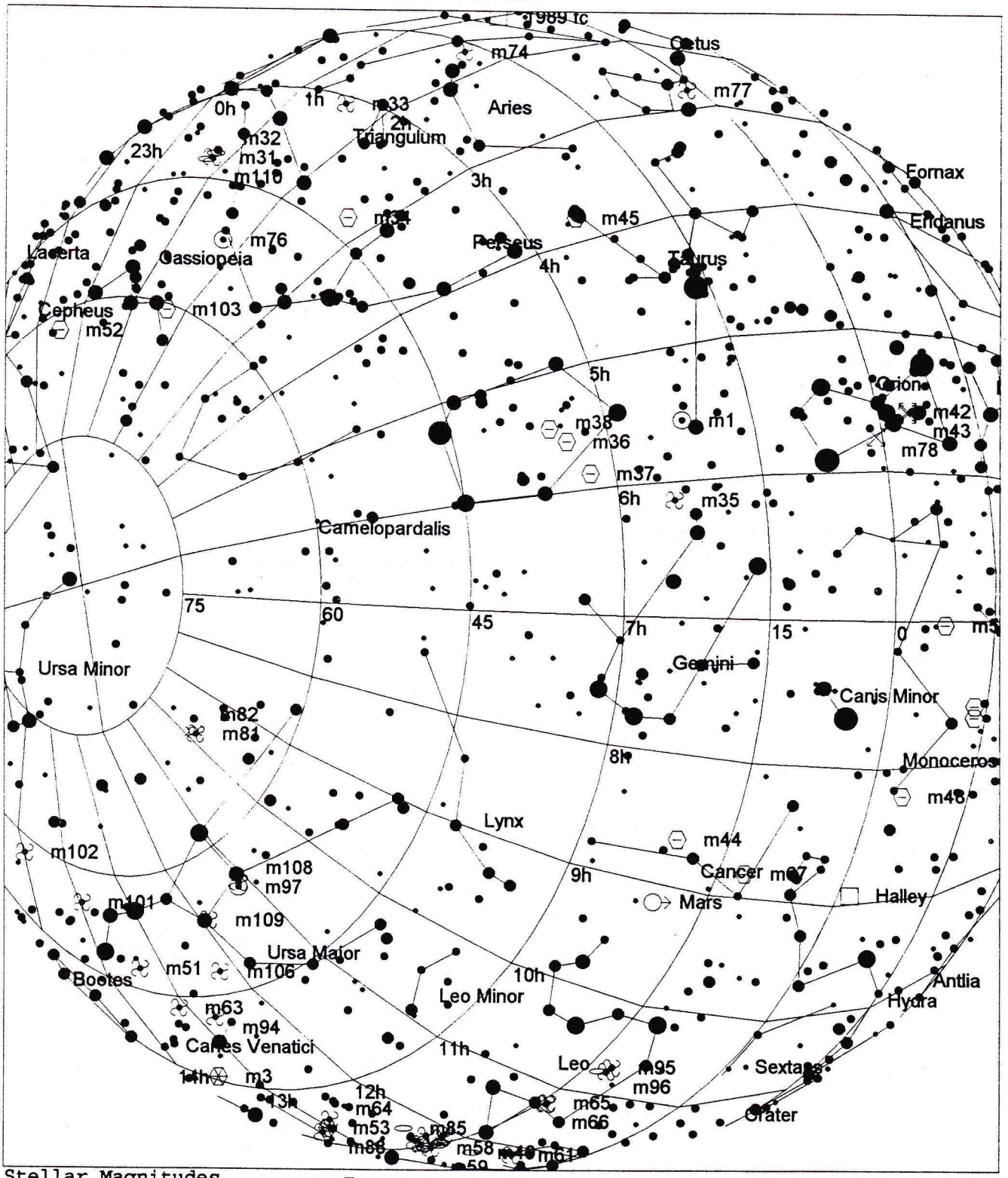
(*to be continued...*) •

Distant Suns

Date/Time: Mar 17, 1995

View From: Earth (horizon mode), 42:20 N lat 83:03 W lon

Aimed At : 90:00 alt 90:00 az 180 fov



Stellar Magnitudes

-1 0 1 2 3 4 5 6

Globular Cluster

Open Cluster

Diffuse Nebulae

Planetary Nebulae

Spiral Galaxy

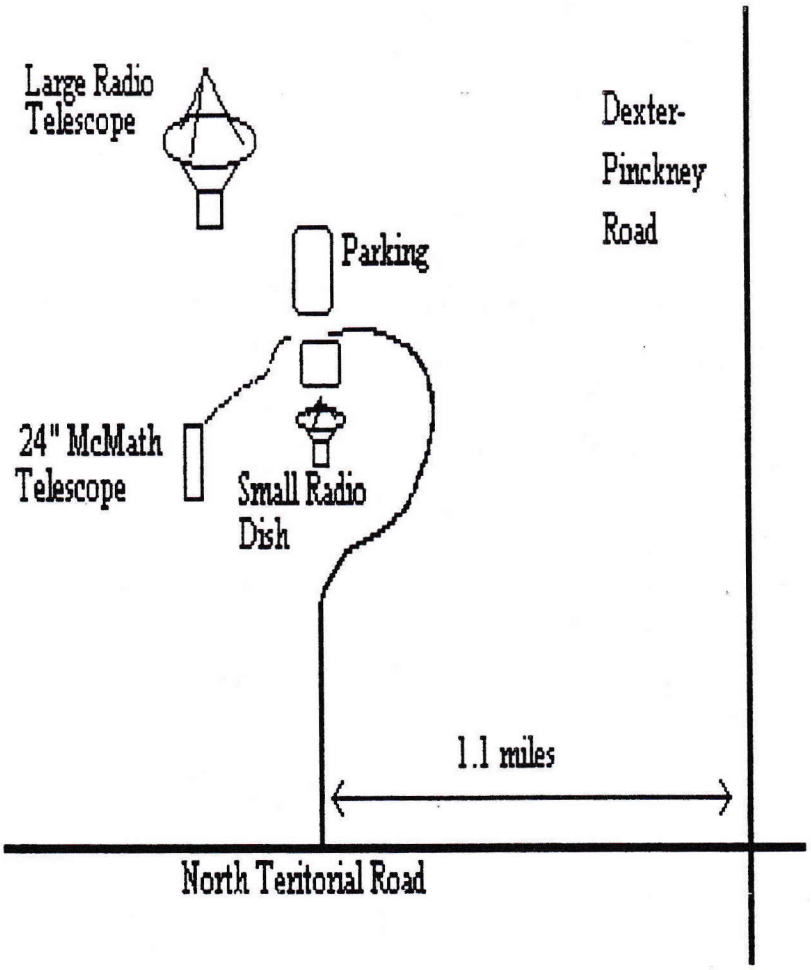
Elliptical Galaxy

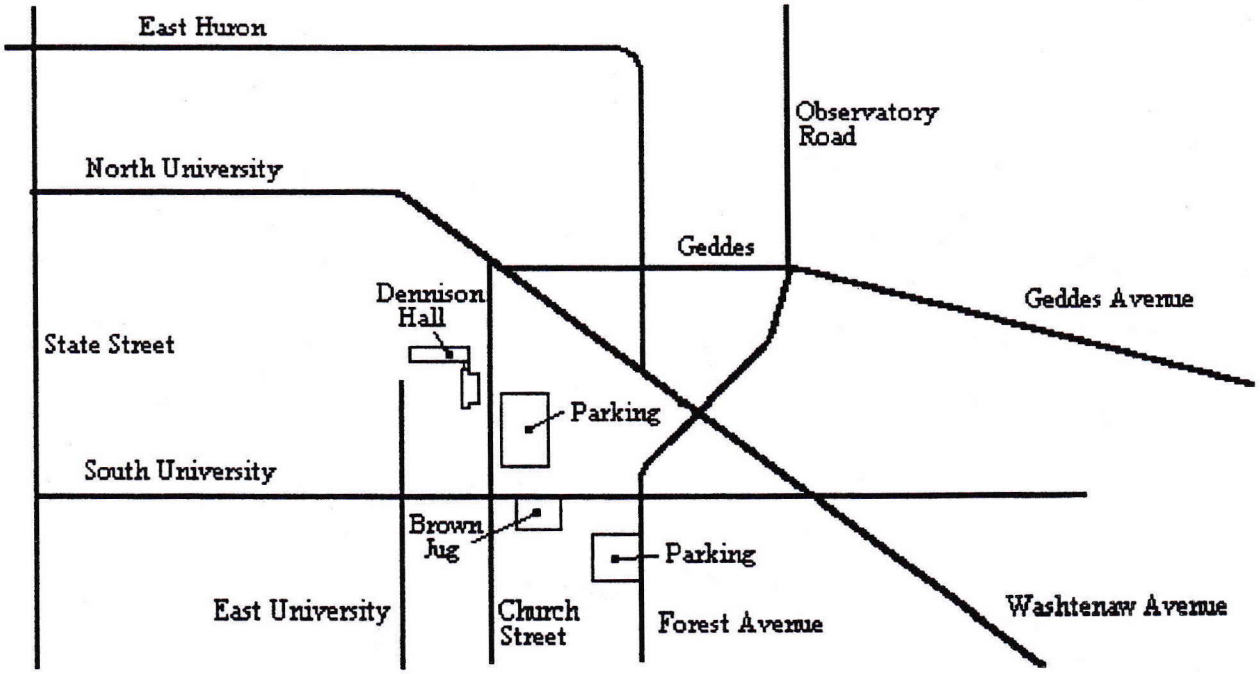
Irregular Galaxy

Places:

Dennison Hall is also known as University of Michigan's Physics and Astronomy building. It is found in Ann Arbor on Church Street about one block north of South University Avenue. This is also one block north of the Brown Jug, our after-meeting eating place. We meet in room 807.

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-Pinckney 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 3rd Friday of each month at 7:30 PM in 807 Dennison Hall. During the summer months, and when weather permits, a club observing session at Peach Mountain will follow the meeting. Computer subgroup meetings are held on the 1st 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 Mtn. Observatory. Star Parties are cancelled if the sky is cloudy or the temperature is below 10°F at sunset; call 480-4514 to check on their status. Many members bring their telescopes; visitors are welcome to do likewise. Peach Mountain gets cold at night so dress warmly - and bring mosquito repellent!

TELEPHONE NUMBERS:

President:	Bill Razgunas	995-0934
Vice Pres:	Kurt Hillig	663-8699
	Stuart Cohen	665-0131
	Tom Ryan	662-4188
	Steve Musko	426-4547
Treasurer:	Doug Scobel	429-4954
Observatory Director:	Bernard Friberg	761-1875
Newsletter:	Douglas Warshow	998-1158
	Bernard Friberg	761-1875
Membership:	Doug Scobel	429-4954
Peach Mtn. Keyholder:	Fred Schebor	426-2363

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 the following address:

Doug Scobel
1426 Wedgewood Drive
Saline, MI 48176

Magazines:

Members of the Lowbrow Astronomers can get a discount on subscriptions to any of these magazines:

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

For more information, please contact the club treasurer (Doug Scobel: 429-4954).

Sky Map:

The sky map in this issue of Reflections was produced by Douglas Warshow using Distant Suns 2.0 for Windows drawn for the end of twilight on the monthly meeting date.

Photographs:

All photographs converted for publishing by Bernard Friberg (as well as last month's issue).

Newsletter Contributions:

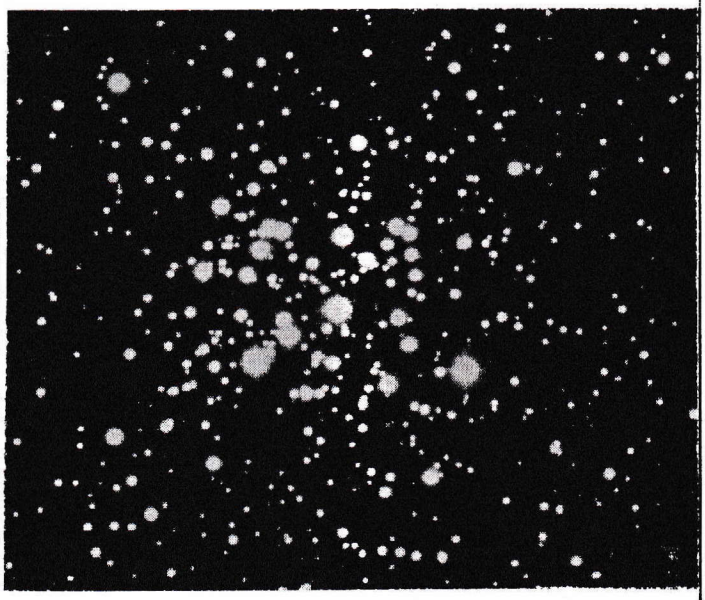
Members (and non-members) are encouraged to write about any astronomy-related area in which they are interested. Call the editor (Douglas Warshow) at 998-1158, or send e-mail to 75054,310 via CompuServe (or 75054.310@CompuServe.com via Internet) to discuss length format, etc. Submission of photographs is also welcome. Announcements and articles are due 14 days before each meeting (i. e., the first Friday of the month). Contributions should be mailed to:

Douglas Warshow
1010 Catherine, Apt. 408
Ann Arbor, MI 48104-1647

Monthly Meeting

Patricia Hanlan
will give a lecture
on
"Elliptical Galaxies."

at 7:30 PM
at
Room 807 Dennison Hall
Physics and Astronomy Bldg.



NGC 3293 in Carina
R. A.: 10 h 35.8m, Dec.: -58° 14′
Magnitude: 4.7

University Lobrow Astronomers
1740 David Ct.
Ann Arbor, MI 48105

Check your membership expiration date on the mailing label!