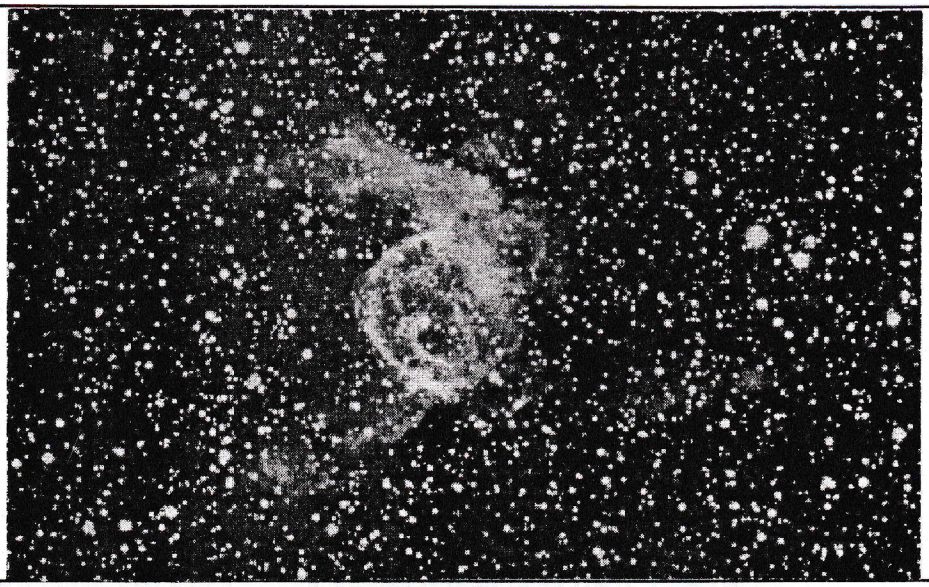
REFLECTIONS



REFLECTIONS

The emission nebula NGC 2359 in Canis Major.
Located at R. A.: 7h 18.6m, Dec.: -13° 12'.
A Wolf-Rayet star resides at the center of the 8 arc minute cloud.

February 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

February 2	Computer subgroup meeting at Bill Razgunas' house at 7:30 PM. Call (313) 995-0934 for details.
February 4	Open house at Peach Mountain.
February 11	Mars at opposition (magnitude = -1.2).
February 17	Meeting at 807 Dennison. Deano Smith will speak about cataclysmic variables.
February 25	Open house at Peach Mountain.

Next Month

March 2	Computer subgroup meeting at 7:30 PM. Location TBA.
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.

THE JOVIAN AURORAL SPECTROGRAPH ROCKET

by Mark Vincent

The Jovian Auroral Spectrogragh Rocket (JASPR) is designed to study the auroral and dayglow processes on Jupiter in the far ultraviolet wavelengths (FUV). The two experiments on board are an imaging spectrograph, designed, built and tested at the Space Research Laboratory (SPRL) and a CCD/filter combination built and supported by the Jet Propulsion Laboratory. The spectograph provides the highest resolution hydrogen Lyman-α line profile across the Jovian disk currently available. The coverage area includes parts of both auroral ovals and the equatorial region. This will aid in our understanding of the auroral source(s), the upper atmospheric dynamics and the deuterium/hydrogen ratio. The interstellar medium line profile is also recorded. A solar-blind microchannel plate detector, built by Sigmund Scientific, records each photon in the spectrograph's focal plane. The telemetry electronics for the detector were designed and tested at SPRL. A SPRL engineer designed and wrote the software for an onboard computer which supplies backup data storage. The spectrograph provides higher spectral resolution over a larger spatial area than the Goddard High Resolution Spectrograph on board the Hubble Space Telescope (HST). The CCD and filter combination are the same type as employed by the Wide Field/Planetary Camera 2 installed on HST. The FUV imaging ability is obtained with the use of a sodium Wood's filter which transmits the FUV while blocking longer wavelengths. JASPR was the first to flight test this combination in summer 1993. The spectrograph and full disk image are exposed simultaneously.

Sounding rockets provide a relatively quick and inexpensive way to test new equipment and obtain data. Parts of this payload were built in 1968 at Johns Hopkins University. The payload arrived at SPRL in 1989 and has been rebuilt and flown twice since then. Graduate students, faculty and engineers at SPRL have done most of this work. A SPRL engineer goes into the field with the payload for technical support. The latest payload integration occurred in fall 1994 at Wallops Flight Facility. Two flights are scheduled in spring 1995 from White Sands Missile Range. The flights start by observing Arcturus to record a solar-like spectrum then shifts to Jupiter for approximately 275 seconds of observation. The second flight will include a brief exposure of Earth's moon to record the reflected solar Lyman-α line. The versatility of the payload is increased by the ability of the spectrograph to be tuned on the ground to obtain high- resolution spectra at other wavelengths. Future targets include Venus, Jupiter, the interstellar medium and possibly comets.

Update:

The mission readiness review on January 25 went very well and the launch date is set for 9:33 UT on March 30. That's 2:33 in the morning, a real redeye flight! The first backup date is the morning of April Fools Day (we don't want a delay). The launch site is White Sands Missile Test Range.

A few vital statistics: the booster is a Terrier-Black Brant IX, it's overall length is 640.76" and weighs 5770 lbs at launch. The payload itself, both ours and NASA's, is 215" long, 17.26" in diameter and weighs 914 lbs at recovery. Note: for recovery, about a dozen people must pick this up, carry it and place it in the helicopter. Now, how fast and high does it go? Well, it's goes 0 to 94 mph in 0.6 seconds: approximately 7.1 g's (Hey, D. C.: can your Chevette match that?). And that's just clearing the rail! It pulls 11 g's just before first stage burnout. Maximum velocity, 4,449 mph or mach 6.2, is reached in 44 sec. This speed carries the payload to a predicted apogee of 154 mi. We will get about 347 sec above 68 mi which is the minimum altitude to

(Continued on page 5)

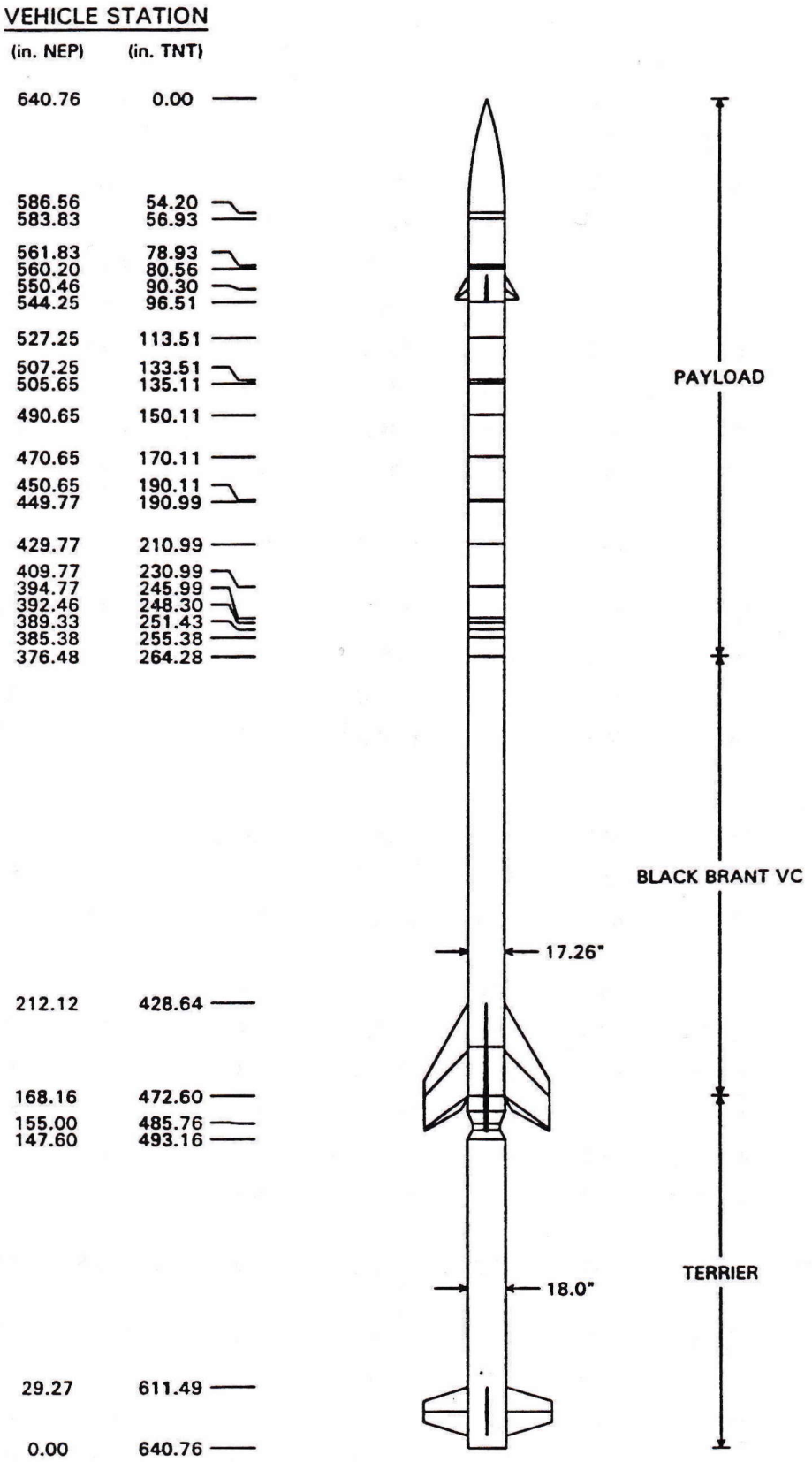


Figure 2-2. Terrier Black Brant 36.104 UL Vehicle Configuration

Terrier-Black Brant 36.104 UL Nominal Sequence of Events

Event	Time (sec)	Altitude (km)	Range (km)	Velocity (m/s)	Mach No.	Dynamic Pressure(psf)	Flt. Elev. (deg)
Rail release	0.6	1.2	0.0	41.8	.1	19.9	86.3
Terrier burnout	5.2	2.3	0.1	400.3	1.2	1641.2	85.7
BBVC ignition	12.0	4.7	0.3	305.9	0.9	752.3	85.8
S-19 decouple	18.0	7.1	0.4	514.8	1.6	1637.9	86.1
BBVC burnout	44.4	39.0	3.0	1988.8	6.2	201.8	85.0
Despin	63.0	74.1	6.2	1806.3	6.3	1.7	84.5
Separation & ACS ON	67.0	81.2	6.9	1768.1	6.3	0.5	84.4
Cage S-19 gyro	68.0	83.0	7.1	1758.6	6.3	0.4	84.3
Nose tip eject	70.0	86.4	7.4	1739.6	6.4	0.2	84.3
Video camera ON	75.0	95.0	8.3	1692.3	6.3	0.0	84.1
ACS erect & shutter open; experiment H.V. ON; CPU ON	76.0	96.7	8.5	1682.8	6.2	0.0	84.1
Spacom tracker centered	82.0	106.5	9.5	1626.2	5.5	0.0	83.9
ACS acquire first target	85.0	111.3	10.0	1598.0	4.9	0.0	83.8
Spacom tracker on first target	90.0	119.2	10.9	1551.0	4.0	0.0	83.6
FUV-CCD begin image	95.0	126.8	11.7	1504.2	3.8	0.0	83.4
FUV-CCD stop/read image; end of Procyon observation; star tracker centered	115.0	154.8	15.1	1318.1	3.4	0.0	82.5
ACS acquire Jupiter	121.0	162.4	16.1	1262.7	3.2	0.0	82.1
Spacom tracker on track	125.0	167.4	16.8	1225.8	3.1	0.0	81.9
Locked on Jupiter; FUV-CCD begin image	131.0	174.5	17.8	1170.7	3.0	0.0	81.5
Apogee	257.7	247.5	38.9	172.3	0.4	0.0	0.0
FUV-CCD stop/read image	433.0	107.1	68.2	1622.9	5.4	0.0	-83.9
Spacom tracker centered	435.0	103.8	68.5	1641.8	5.7	0.0	-83.9
S-19 uncage; shutter close	448.0	81.8	70.7	1764.8	6.3	0.5	-84.3
Experiment H.V. OFF	453.0	72.9	71.6	1812.5	6.3	2.0	-84.5
Video camera OFF; experiment power OFF; CPU OFF	460.0	60.0	72.8	1878.2	6.0	12.6	-84.7
S-19 OFF	476.0	29.3	75.5	1948.7	6.4	833.7	-85.1
Ballistic impact	491.3	1.2	77.8	—	—	—	-85.5
Chute deploy	563.0	4.9	83.7	106.3	0.3	88.0	-64.7
Chute/payload impact	836.0	1.2	83.7	8.8	0.0	0.9	-90.0

(Continued from page 2)
reliably obtain data. If all goes well the chute will bring the payload down to a 20 mph landing just 836 sec after ignition. •

A CLEAR NIGHT (AT LAST)!

by Doug Scobel

On the night of January 26, a rare astronomical event occurred - the sky was clear and there was no moon! Well, it's rare in Michigan in January, anyway. After shaking off the initial disbelief, and after a call from Bernard Friberg, he and I decided to go out to Peach Mountain to register some ancient photons on our retinae (to stargaze, that is, for you novices). It was late by the time we were able to leave, so I packed up my old (20+ years), trusty, 6" f/8 telescope (which loads into the van and sets up much quicker than the 13"), hastily picked up Bernard, and we headed out for the observatory.

When we set up, I discovered that I brought the wrong allen wrench for putting my mounting together, and Bernard discovered that he forgot his gloves. I'm thinking to myself, "We're not getting off to a very good start here." But, I found an extra pair of mittens in my van, and Bernard found a small screwdriver in the observatory, that fit the set screws on my mounting, so maybe it would not be so bad after all. I still had the uneasy feeling that the clouds would roll in any minute, just like they did the last three trips I've made out to Peach.

But, they didn't, and we got in an excellent evening of observing. So what did we look at? Bernard started with M42, the Great Nebula in Orion. I started with some Messier objects I've never "officially" observed and recorded as such. The smaller scope, with it's larger field of view, would be ideal for some of these objects. Here's a rundown on what we observed:

M35: This is one of my favorite open clusters. It's large, but packed with a LOT of bright stars. Even in the 6", the nearby NGC 2158, much smaller and fainter, was visible, glowing softly in the distance.

M41: This large open cluster is somewhat loose, compared with M35, but has some very bright stars. A very nice object.

M42/M43: What can be said that hasn't been said before about the most beautiful diffuse nebula in the sky? The seeing was very steady, so the trapezium was very sharp. The E and F stars were easily seen in the 24". Even in my 6" it was spectacular. At low power, the nebula fits neatly in the field of my lowest power eyepiece, and with a broadband nebular filter (a Lumicon Deep Sky), you can see the entire extent of the nebulosity. There's so much detail it defies description. The only way to see it is with your own eyes through a telescope. Photographs really don't do it justice, as the brighter regions invariably get burned out. Through a telescope, the stars seem to float, in 3-D relief, in front of the glowing clouds. In the 24", the dark regions clearly appeared to be closer to us, obscuring the glowing gas behind it.

M46 & M47: These open clusters are only 1-2° apart and provide a nice contrast. M46 is fairly large and rich but the stars are somewhat faint. M47, on the other hand, is much less dense, but the stars are much brighter. An added bonus is the planetary nebula NGC 2438 "embedded" (it's actually closer to us) in M46. It is 11th mag., and about 1' across, but was plainly visible in the 6" with averted vision as a small, round, gray disk with a "hollow" center, like a much smaller and fainter Ring Nebula. I'll have to revisit it with the 13".

M48: This is a large (almost 60' across), loose gathering of moderately bright stars. A nice view.

M50: This is a nice open cluster of bright

(Continued on page 6)

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stars, a little smaller than some of the other open clusters we observed, about 15′ across.

M67: This unimpressive open cluster contains a dozen or two fairly dim stars.

M79: This is the only globular cluster we observed. It's fairly small, about 9′ across, with a fairly bright nucleus. It looked mottled in my 6", but the outer regions were resolved pretty well in the 24". At declination -24°, it barely gets more than 20° above the southern horizon. From an observing site where it gets higher in the sky, I'm sure it looks more impressive.

M93: This is a nice little open cluster of moderately bright stars. It also is pretty far south in declination - it would look better if it were higher in the sky.

NGC 2392: This is a planetary nebula called the Eskimo Nebula. In professional photographs, it has the appearance of a person's face in a fur-lined hood, not unlike an Eskimo. In my 6", it looked like a round disk with a brighter core. The central star is very bright, probably the easiest one to see of all the planetaries I've observed. In the 24", with the 55mm eye-piece, you could see the brighter "face" in the center, occupying about the middle third of the disk. The outer halo is clearly fainter, and there is a sharp division between it and the center.

Mars: Mars is currently in Leo, and was surprisingly impressive in both scopes. It is approaching opposition (Feb. 11), and showed lots of detail. It was almost too bright in the 24", spoiling the night vision in my right eye for a while. The 6" was much more comfortable to view (more aperture isn't always a good thing). It's showing an impressively sized disk, and will continue to for the next month or so. The northern polar ice cap was very prominent, with a sharp cut-off to a dark adjacent region. Dark markings were also visible towards the southern limb. The good seeing was a big plus here.

The clouds never did roll in, but we decided to call it a night and pack it in around 1:00. After dropping Bernard off at his house, I noticed something on the dash that I hadn't noticed earlier - Bernard's gloves! They had been there all night but neither of us saw them.

Got home, unpacked, and in bed by the (dis)respectable hour of 2:30 AM. Back up at six for work. Here I am at my workstation, during my lunch hour the next day typing this. Bleary-eyed and trying to stay awake, I ask myself if it was worth it to stay up most of the night just to look at the night sky through an old, somewhat neglected tele-scope on a cold January night. Silly question. •

TELESCOPE FOR SALE

I am offering to sell my Meade 4" Schmidt-Cassegrain telescope. It comes with two eyepieces (12mm Ortho and 40mm Kellner), metal tabletop tripod, AC power cord and carrying case. The optical tube assembly is on a fork mount (with clock drive). Thought I'd offer it to your club for $100 including shipping. Please contact Tony Freyberg at (914) 238-5457 or by e-mail at JGPT02A@prodigy.com. •

MORE OBSERVER'S NOTES

by Doug Scobel

On Thursday, February 2, it was clear again! That made three mostly clear nights out of the past eight. Incredible!

Chris Sarnecki and I wound up back on Peach Mountain for some more observing. Chris brought his 7x50 binoculars and a tripod to hunt up some of the bigger and brighter deep-sky objects. This time I brought my 13.1" f/4.5 dob, to follow up on some objects

(Continued on page 7)

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I observed a week earlier with my 6", and to perhaps hunt down some others.

While waiting for the scope to cool down, I couldn't resist looking at M42 at low power. What a sight!

Once the scope cooled down, and images started getting reasonable, I turned to M79, a globular cluster low in the south in Lepus. In the 6", it was little more than a glow with a bright center and hints of resolution in the outer regions. What a difference more aperture makes! At about 215x, it expanded into a fainter, miniature M13, resolved into stars right to the core. It gets quite bright in the center, almost like M15.

I also revisited M46, in Puppis. More specifically the planetary nebula NGC 2438 "embedded" in it. In the 13", it was very conspicuous. At about 215x, with a Lumicon UHC filter, it very much reminded me of the Ring Nebula, with an oval shape, and fainter central region. There is also a star visible near the center, but it is offset enough that I don't believe it to be the central star of the nebula.

I next turned to the Rosette Nebula in Monoceros. It involves a fine open cluster (NGC 2244), and a surrounding nebula (NGC 2246, 2237-2239). The open cluster is a nice grouping of bright stars, easily visible in the 8x50 finder. Portions of the nebula were just visible to the northwest. But it's real glory showed itself by using a Lumicon Oxygen [III] filter in my lowest power eyepiece. Now the entire nebula revealed itself, like a wreath completely surrounding the cluster, filling the nearly 1° field. Mottling and detail in the nebula was easily visible. It would have provided a good exercise in making a drawing if it weren't so cold.

The treat of the night was Mars. Shining brightly in Leo's mane, it was nothing short of spectacular! I stopped my scope down to an unobstructed 5" f/11, and used a #21 orange filter in my 7mm eyepiece, which yields about 215x. The seeing was quite steady, and would sometimes settle right down for a second or two. When it did, Mars turned into what looked like a Hubble Space Telescope image. The northern polar cap was prominent, and dark markings bordered and delineated it. To the south, very dark markings were visible, connected by fainter ones. Other areas of the disk showed fainter markings, and everything seemed to be connected to everything else. I can now understand how Percival Lowell saw "channels" or "canals" on Mars. It was definitely one of those once- or twice-a-year (in Michigan at least) nights of steady seeing.

But, alas, the alarm clock will be rudely calling later in the morning, so we packed up and left a little earlier than we normally would. But the heavenly images vividly remain, and will have to suffice through the many inevitable cloudy or moonlit nights to come. •

LESLIE SCIENCE CENTER OPEN HOUSES

On the evenings of April 28 and May 6, the Leslie Science Center will conduct open house sessions. This notification may seem bit early, but it always best to get the logistics arranged as soon as possible. These events are mainly aimed towards families who cannot normally attend the regular open houses at Peach Mountain. Considering the number of people who were able to make it out to the McMath last month, a good turn out is expected at LSC. The activities will begin at 7:00 PM on both evenings, so please arrive at the Center by 6:00 PM. If you plan on attending either or both of these sessions, contact Bill Razgunas at (313) 995-0934. •

WHY DO ASTRONOMY?

(Or, What do we get for our tax money?)

by Dave Finley (NRAO)

The purpose of the VLA, the VLBA and of NRAO is to do fundamental research on the

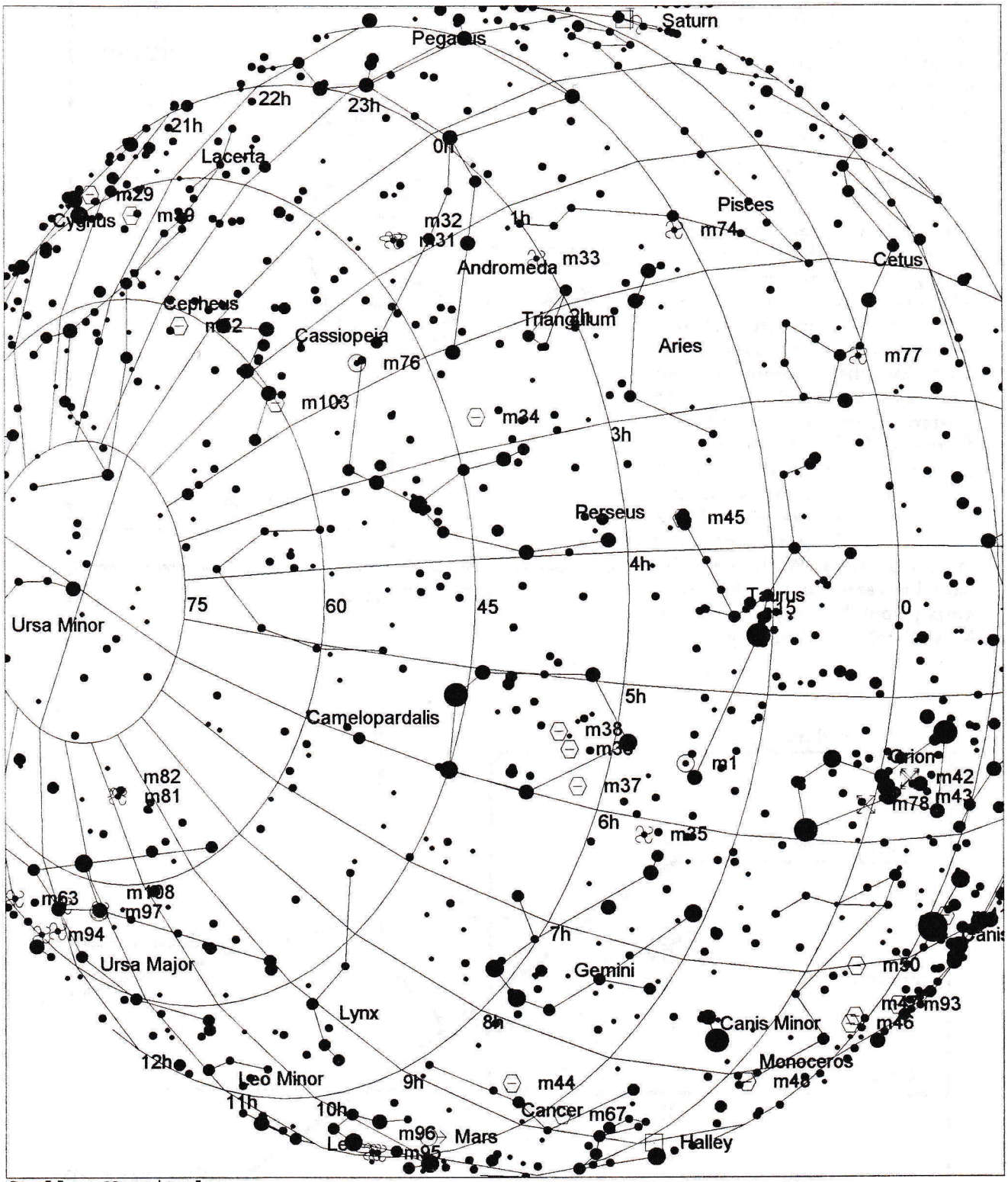
(Continued on page 8)

(Continued from page 7)

nature of the universe in which we live. This research seeks to answer some of the biggest questions we can ask, such as how did the universe begin (or did it begin), how big is it, how old is it, and how will it end (or will it end)? As the science that provides the framework knowledge of where we, and the planet on which we live, fit into the environment of the universe, astronomy is a vital part of the culture of all mankind. A person deprived of the broad outlines of astronomical knowledge is as culturally handicapped as one never exposed to history, literature, music or art. As astronomers communicate new discoveries about the universe, they enrich the intellectual lives of millions. From the dawn of civilization, astronomy has provided important stepping stones for human progress. Our calendar and system of timekeeping came from astronomy. Much of today's mathematics is the result of astronomical research. Trigonometry was invented by Hipparchus, a Greek astronomer. The adoption of logarithms was driven by the needs of astronomical calculations. Calculus, the basis of all modern science and engineering, was invented by Sir Issac Newton for astronomical calculations. Astronomy provided the navigational techniques that allowed sailors and aviators to explore our planet (and today allow spacecraft to explore our solar system). Astronomy's appetite for computational power drove the development of many of the earliest electronic computers. The space age, which brought us the communication and weather satellites upon which we depend each day, would have been impossible without the fundamental knowledge of gravity and orbits discovered by astronomers. At NRAO and other observatories, the needs of astronomers for better instruments continues to drive developments in such diverse fields as electronics, mechanical engineering, and computer science. Astronomy has much yet to contribute to human knowledge and progress. From the airplane to the transistor, from radio to lasers, the developments of the 20th century were based on fundamental knowledge of the physics of matter and energy. Astronomy offers scientists from a wide range of backgrounds with a nearly infinite variety of cosmic "laboratories" for observing physical phenomena. Itis unlikely that any laboratory on Earth will ever produce matter as dense as that of a neutron star, temperatures as hot as those inside a supernova, or gravity as strong as that of a black hole. Yet, astronomers can study the physics of such extreme conditions routinely with instruments such as the VLA and VLBA. Closer to home, the VLBA is a primary instrument providing valuable data on the drift of Earth's continents and the mechanisms of global climate. What will this yield? It is the nature of basic research that we can't predict what will come of this work, except that we probably will be surprised. When Kepler and Newton labored to develop the science of orbital mechanics, they weren't thinking of weather satellites or CNN. Finally, astronomy performs an important educational service for our nation. As an exciting, visual science easily accessible to amateur observers, astronomy stirs scientific curiosity in thousands of young people every year. These young people soon learn that astronomy involves nearly the whole range of the physical sciences, including mathematics, physics, chemistry, geology, engineering and computer science. Many professional scientists in these and other fields first became interested in their profession through astronomy. In today's world marketplace, a competitive nation needs for its entire population, not just its scientists, to have a basic level of scientific literacy. Astronomy, by providing the excitement of new knowledge about the fascinating variety of strange objects in the universe, can help communicate much basic science to all our people. In sum, astronomy has been a cornerstone of technological progress throughout history, has much to contribute in the future, and offers all humans a fundamental sense of our place in an unimaginably vast and exciting universe. •

Distant Suns

Date/Time: Feb 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

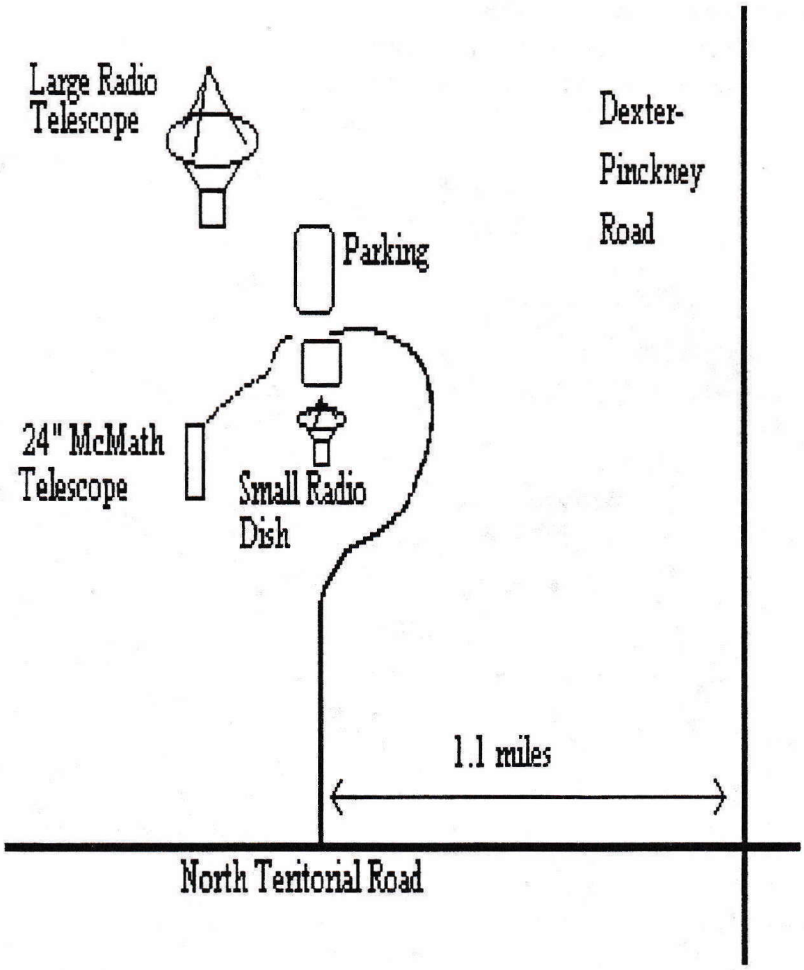
-1 0 1 2 3 4 5 6

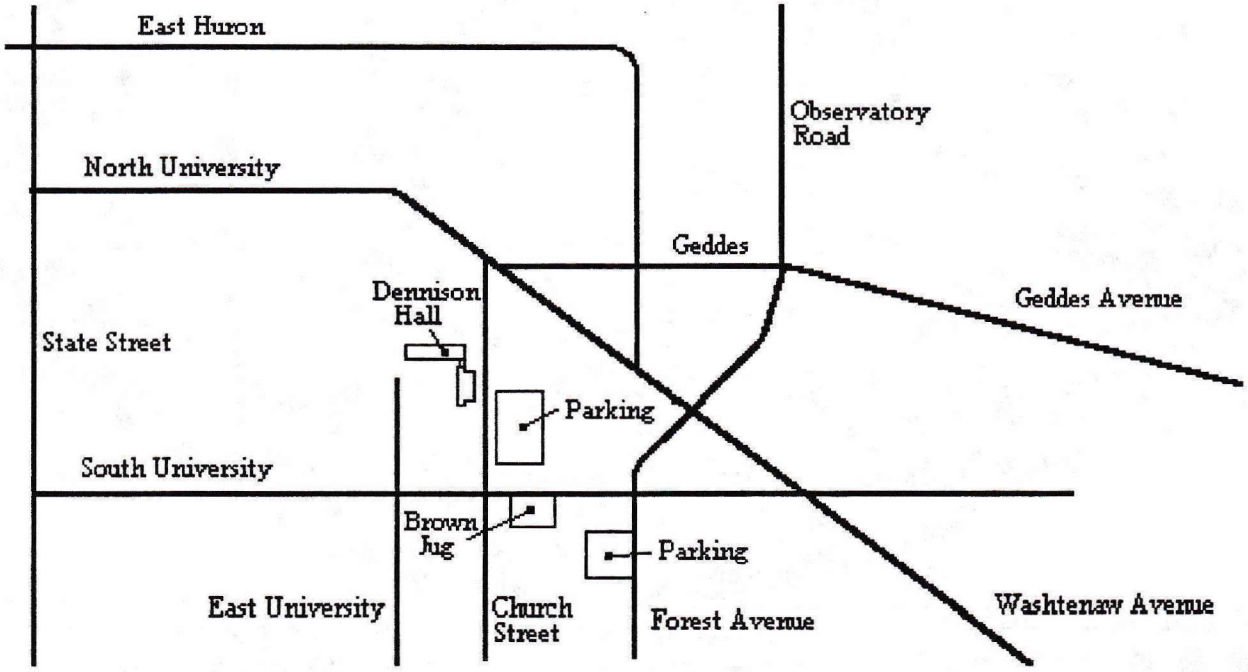
- Globular Cluster
- Open Cluster
- Diffuse Nebulae
- Planetary Nebulae
- Spiral Galaxy
- Elliptical Galaxy
- Irregular Galaxy

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 Douglas Warshow.

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

Deano Smith will present a talk on "Cataclysmic Variables"

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

NGC 6726 in Corona Austrina
R. A.: 19 h 1.7m Dec.: -36° 53′
Magnitude: 6-7
Size: 2 arc minutes wide

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

Check your membership expiration date on the mailing label!