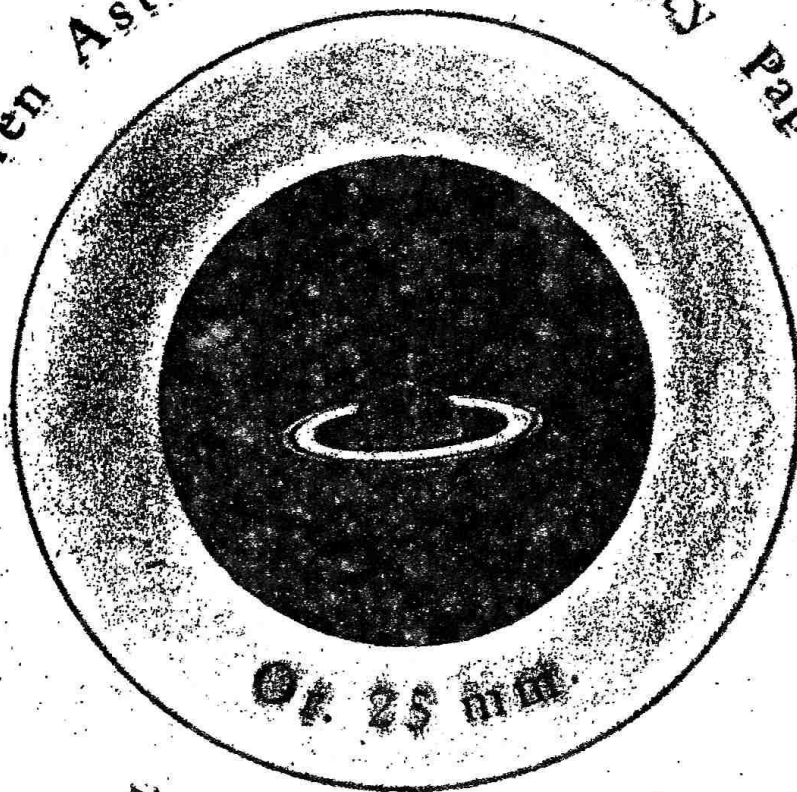


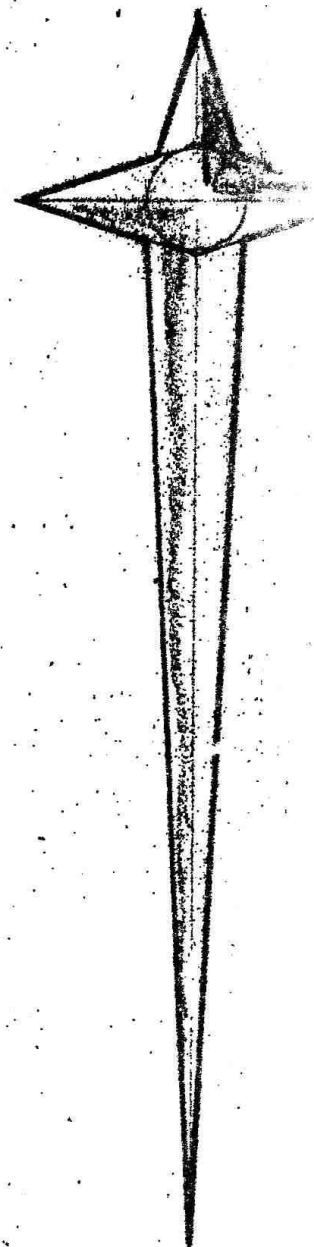
W. A. S. P.

Volume IX Number 12

Warren Astronomical Society Paper!



DECEMBER 1975



merry christmas @ happy new year

The Warren Astronomical Society is a local, nonprofit organization of amateur astronomers. Membership is open to all interested persons. Annual dues are as follows: *\$2.00 for Student (K through college) Membership, \$4.00 for General Membership, and \$5.00 for a Family Membership. Add \$6.00 for a one year subscription to Sky and Telescope magazine.* General meetings are held on the third Thursday of every month.

The Warren Astronomical Society Paper (W.A.S.P.) is published monthly, by and for the members of the Warren Astronomical Society. Subscriptions are free to all Warren Astronomical Society members. Personal advertisements by Warren Astronomical Society members are also free. Non-member subscriptions and advertisements are available upon arrangement with any of the editors of the W.A.S.P. Contributions, literary or otherwise, are always welcome. Contributions to the W.A.S.P. should be submitted to either of the editors listed below.

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	15850 State Fair	2991 Charnwood
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The editors of the W.A.S.P. will exchange copies of this publication with other club publications on an even exchange basis. If your club would like to participate in such an exchange, please contact one of the above listed editors. The Warren Astronomical Society maintains correspondence, sometimes intermittent, with the following organizations:

THE ADAMS ASTRONOMICAL SOCIETY

THE ASTRONOMICAL LEAGUE

THE DETROIT ASTRONOMICAL SOCIETY

THE DETROIT OBSERVATIONAL AND ASTROPHOTOGRAPHIC ASSOCIATION

THE FORT WAYNE ASTRONOMICAL SOCIETY

THE GRAND RAPIDS AMATEUR ASTRONOMICAL ASSOCIATION

THE KALAMAZOO ASTRONOMICAL SOCIETY

THE MIAMI VALLEY ASTRONOMICAL SOCIETY

THE OLGELTHORPE ASTRONOMICAL SOCIETY

THE ORANGE COUNTY ASTRONOMICAL SOCIETY

THE SUNSET ASTRONOMICAL SOCIETY

Cosmic Calendar

November 1975 Configurations Of Sun, Moon, Planets

DAY: HOUR:

20	8 pm	W.A..S. General Meeting at M.C.C.C.
21	17hr.	Mars 5° North of Moon
24	04hr	Saturn 5° North of Moon
26	07hr	Last Quarter Moon
28	21hr	Mercury <i>in</i> superior conjunction
29	19hr	Venus 5° of Moon
30	15hr	Uranus 2° North of Moon

December 1975 Configurations of Sun, Moon, and Planets

DAY: HOUR:

1	06hr	Ceres at opposition
3	01hr	NEW MOON
3		Messier and Astro. meeting at Cranbrook 8pm sharp. Contact Carl Noble for details 573-0937
9	00hr	Mars is at opposition
10	15hr	FIRST QUARTER
13	01hr	Jupiter 5° S. of Moon
16		Warren Astronomical Society annual banquet, see details elsewhere in this Issue.
18	15hr	FULL MOON
18		W.A.S. General Meeting at 8pm in K bldg. M.C.C.C.
21	08hr	Saturn 5° N. of Moon
22	12hr	Solstice
25	15hr	LAST QUARTER
25		Isaac Newton born, 1642
27		Johannes Kepler born, 1571
31		John Flamsteed (Royal Astronomer) died, 1719



Club News.....

Cranbrook's members' night was a great success this year, with over 800 people attending.

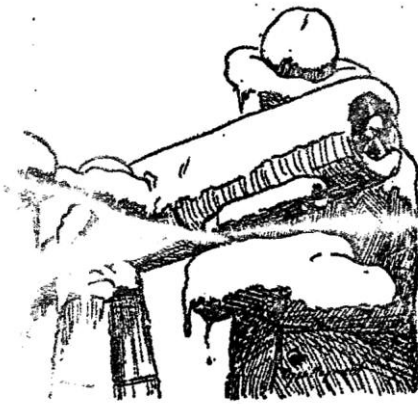
Special thanks to Garry Boyd, Lou Faix, Pete Kwentus, Don Misson, Carl Noble, Cary White, and Rick Bichel, for taking along their Telescopes. I would like to mention a very special thanks to Diane McCullough and Ray Bullock. They did an excellent job representing the Warren Astronomical Society.

The high point of the evening occurred when Pete blew a fuse in his oscillator, stopping all the clock drives.

The first Wednesday in December will be our first meeting at the Cranbrook Institute of Science. The session, a combined Messier and Astrophotography meeting, will begin at 8 p.m.

We're looking for a good turnout of our members, but please be prompt. For directions to Cranbrook, see the "Planetarium Gazing" article elsewhere in this issue.

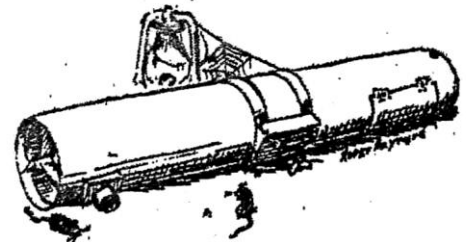
The editors apologize to Doug Lenear, for neglecting to credit him the messier catalogue, which appeared in last month's W.A.S.P.



...and it's downright serious

Winter is coming again folks, which as you know means some good observing, so, dig those scopes out, and take advantage of some good "seeing".

Remember, the observatory is being worked on during these cold months, if you have anything to contribute for this effort contact Lou Faix, at 781-3338.



Oblivion under the eaves

ALL INVITED



WARREN ASTRONOMICAL SOCIETY FOURTH ANNUAL CHRISTMAS BANQUET

DATE: Tuesday, December 16
TIME: 7:30 p. m.
PLACE: Peredisio Cafe
17630 Woodward
(Four blocks north
of 6 Mile Road)

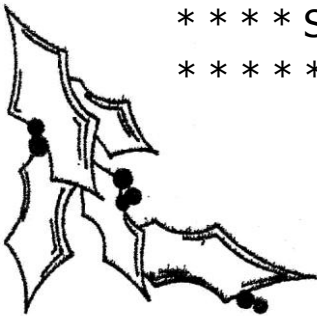
MENU: (A choice of three)

Sliced Beef Tenderloin	\$ 7.90
Veal Parmesan	\$ 7.55
French-fried Shrimp	\$ 8.15

**Prices Include Tip and Tax

(Dinners include soup, salad, spaghetti,
potato, beverage, and dessert)

Please turn in money (no checks) to:
Diane McCullough by Thurs., Dec. II
18811 Highlite Dr. S., Mt. Clemens 48043
791-8752



* * * * SPECIAL CHRISTMAS PROGRAM * * * *

* * * * * DOOR PRIZES * * * * *

LETTER FROM THE EDITOR

You've all heard of such famous pairs as Laurel and Hardy, Jekyll and Hyde, now meet Boyd and Bullock, co-editors of the W.A.S.P.

Many of you don't know who Bullock is, I'm not surprised, I've only been a member since June. It all began back in April when my friend asked if I'd care to go to a meeting of the Warren Astronomical Society. I went in April and May, liked what I saw and joined. Little did I know that I was to have a comet by the tail and go into the ascending node.

My only newsletter experience was back on my high school newspaper. I was asked to write an editorial on the 18-year old vote proposal. Unfortunately nobody told me which side to argue. Perhaps they thought I didn't have to be told. When the editorial against the proposal was distributed the Furies were unleashed. I ended up writing harmless crossword puzzles.

The only reason I mention this is to illustrate my dilemma. How do I know what you, the members, expect of me and the W.A.S.P.? Gary and I are slowly making some changes, and we HAVE to know if there is something about the paper you don't like. Likewise we want to know what you do like, or would like to see.

As you read this issue notice the different margins and spacing on some of the articles. Also note the varied headlines and use of illustrations.

Don't worry about hurting anyone's feelings (anything told to us in confidence will be kept confidential), be blunt if you have to. This paper can only improve through your suggestions and criticisms.

Yours for a better W.A.S.P.,

Raymond Bullock

To the members of the Warren Astronomical Society:

I wish to express a few thoughts I had about our General Meetings which are held once a month. They have in the past been enjoyable and informative, and it is the wish of the Executive Officers to keep them this way.

The main purpose of this club is to stimulate interest in the area of Amateur Astronomy. Sometimes, however, we amateurs get so good that we start to be "professionals" and in the process perhaps lose track of the word "amateur". It is therefore my wish to draw on even a larger group of our membership to participate in our general meetings. I have heard comments that our programs in the past have been excellent and interesting. However, I have also heard remarks that "we are a club which is going nowhere." To those who subscribe to this second remark, here is a chance for you to help us. We would like to ask you to aid us in setting up good programming for our general meetings.

As a suggestion, this is the way the meetings in the future could be held. We will first begin promptly at 7:45 p.m., and have a 15 minute business meeting. It will be difficult at first to begin at 7:45 p.m., but after a while we will get used to it! After the short business meeting I can see one or two good segments of programming, with a break between. There will be times when one person or a group of persons can put on a program revolving around one main topic. We may, however, want two separate topics in the evening. It is our hope also that there will be times when a professional speaker will lead the program. It is my hope that we can enthuse and interest the very beginner to the very advanced no matter what the programming happens to be. There should be a time also for discussion and questions - this way anyone can get involved.

It may sound like this is the way we have always held the meetings. This is true, but it is the hope of many members of the club that we can have a set idea of what each general meeting will be about. It is hard to run an effective program when several people pop up and want to be part of the program at the last minute. We will continue the practice of having two meetings a year centered on the theme of "Display Night". These events will be the opportunity for everyone to bring in a sample of their astronomical endeavors. It would be wise also to set aside every other month to show slides or pictures to the entire group towards the end of the evening. However, anyone can bring slides and show them to those who are interested at any meeting.

I am trying to make our meetings as concise and interesting as possible. I hope others will let me know their feelings about our meetings, and possible suggestions on how to make them more interesting. We do need you to help us bring this club up to a standard of excellence. Will you join us and help with our programs for the general meetings?

Thank you for your time and your past and future efforts.

Carl L. Noble
President

WHO'S WHO at the W.A.S.

BECAUSE there has been such a turnover in officers at the W. A. S. in the past two months, we are printing the current list, to bring everyone up to date. The officers' duties are listed in the August 1975 W.A.S.P. A new complete membership roster begins on the next page.

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11508 Newburn
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573-0937

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OBSERVATORY CHAIRMAN

Lou Faix
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781-3338

SECOND VICE PRESIDENT

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879-6765

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Mt. Clemens, 48043
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Angie Bommarito
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884-0528



“Carl and the Gang”

WARREN ASTRONOMICAL SOCIETY
CLUB ROSTER

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BOMMARITO, TONY & ANGIE	5117 CHATSWORTH DETROIT, MICHIGAN 48224	884-0528
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CIVIC, ROGER & NANCY	26335 BEACONSFIELD ROSEVILLE, MICHIGAN 48266	775-6634

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MISSON, DONALD	23072 BEECHWOOD EAST DETROIT, MICHIGAN 48021	776-0424
MORIN, GARY	11203 EAST 14 MILE ROAD STERLING HEIGHTS, MICHIGAN 48077	268-9359
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REED, DAVID	2866 SERRA STERLING HEIGHTS, MICHIGAN 48077	939-0358
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VALKA, FRANK	50 FONTANA GROSSE POINTE SHORES. MICHIGAN	TU4-9523
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WEIBEL, RICHARD	1344 RIDGE ROAD YPSILANTI, MICHIGAN 48197	
WELL, ROGER	22601 SUNNYDALE ST. CLAIR SHORES, MICHIGAN 48081	771-3522
WHITE, CARY	1489 WALTON BOULEVARD ROCHESTER, MICHIGAN	652-0043
WILSON, KENNETH	11157 GRENADA DRIVE STERLING HEIGHTS, MICHIGAN 48077	268-9337
WILLIAMS, NORTON	P. O. BOX 383 BIRMINGHAM, MICHIGAN 48012	646-1157
WILLIAMS, TED	2736 LAKE CHARNWOOD TROY, MICHIGAN 48084	879-6514
WINTERS, BILL	1046 BRISTAL CT. NORTHVILLE, MICHIGAN 48167	349-3892

OPEN CLUSTERS IN A CLUSTER

By Frank McCullough

For the, observer, winter means the thought of setting up his or hers telescope and observing during a cold winter night. The one thing the sky, does offer in our behalf is the placement of relatively bright open clusters in the winter Milky Way. Whether it be observer or astrophotographer, these bright objects help cut back time in finding, and photographing. Most of them are splendid objects to look at and are scattered through Taurus, Perseus, Cassiopeia, Cancer, and Auriga.

Before we go observing, let's have a general knowledge of what an open cluster really is.

Galactic clusters are the proper names, because they lie near the principle plane of our galaxy. Most of them lie in the Milky Way except for a few of the nearest ones, such as the Coma Berenices cluster, which is in the direction of the north pole of the Milky Way. These star groupings are loosely assembled and not concentrated toward their centers, such as a globular cluster for example would be.

We recognize some 500 galactic clusters in our region of the galaxy. A cluster can consist of two dozen to a few hundred, to over a thousand stars, such as the case of the double cluster in Perseus. More could be found if it were not for the remote clusters being too faint to be picked up in the bright areas of the Milky Way, and others are concealed by dust and gas in the dark areas. All open clusters are found within 20,000 light years of our sun, where the closest globular cluster is 22,000 L.Y. (Omega Centauri).

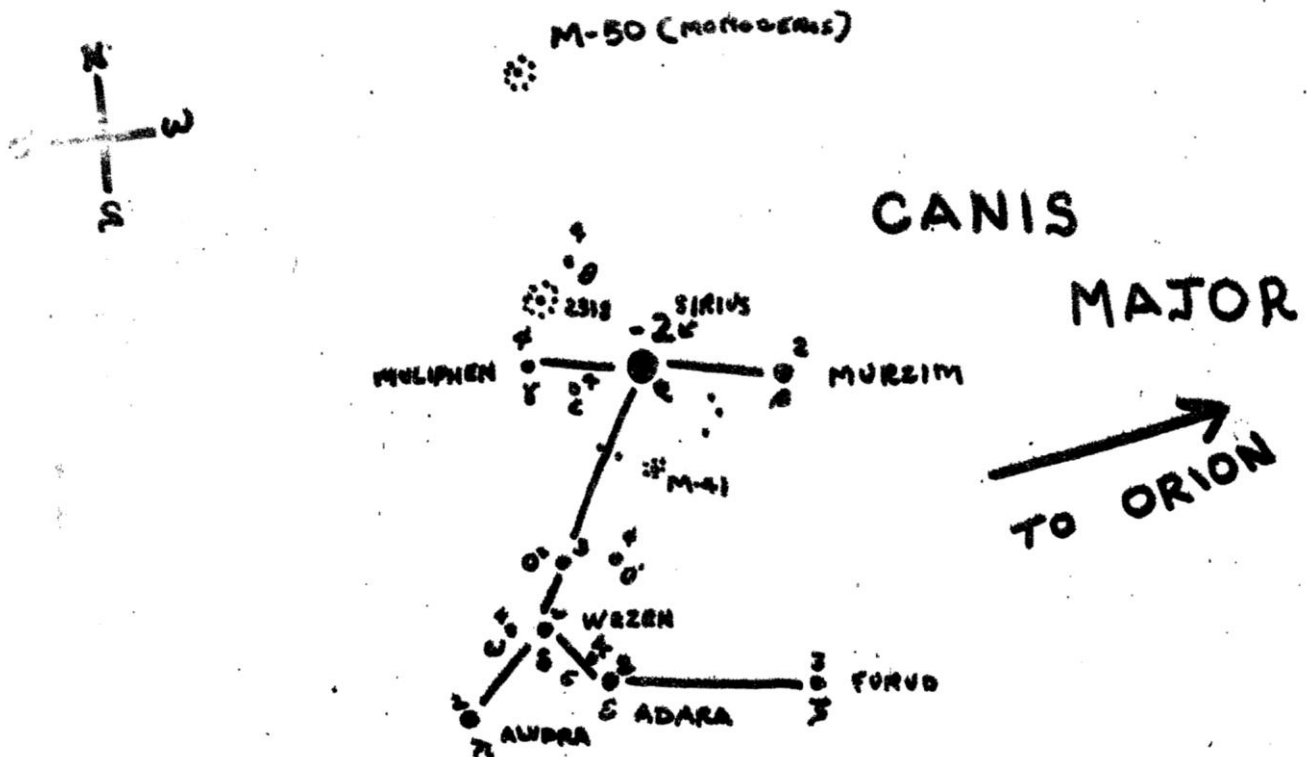
Some clusters are so close that we measure proper motion of these stars. The Hyades are a good example of this situation. This grouping marking the face of Taurus the Bull has its center 130 Light Years from the sun and consists of at least 150 stars. It is moving toward the east and receding from us, so that the parallel paths of its stars are converging toward a point in the sky east of the present position of Betelgeuse in Orion. This motion toward a certain point allows us to determine distance without the use of parallax method. We have been able to conclude the Hyades passed closest to the sun 800,000 years ago, one half the distance it now lies from us. The closest clusters to us are as follows: Hyades (130 L.Y.), Coma Berenices (261 L.Y.), Pleiades (408 L.Y.), M44 Beehive (515 L.Y.), and M39 (864 L.Y.).

The age of clusters are as follows, the youngest being NGC 2362 at 5 million L.Y., the Pleiades as middle-aged, the Hyades and Beehive are rather old clusters, with M-67 being one of the grand daddies at 7 billion years.

The objects of true interest for the scope or binoculars would be: 1) M-35, a fine large open cluster in the foot of Gemini. In the scope it is a fine spray of stars of 6th magnitude nature. 2) The double cluster NGC 869-864) is 7,000 L.Y. from us and is 75 L.Y. across, and looks like glittering jewels on a coal black background. It lies between Perseus and Cassiopeia and can be seen as a hazy patch of light. 3) The' Pleiades (M-45) a fine large cluster in Taurus, 408 L.Y. from us, measures 120 min. of arch and actually consists of 500 stars, 50 L.Y. across.

The list goes on, but make sure you see the difference in the clusters which lie in Auriga (M-36, M-37, M-38). The nights will be cold, but the objects should come to the observer rather fast.

Good luck and balmy winters!



In my one article this month we talk about open clusters. In this constellation you will find a superb open cluster M-41, also a fainter NGC 2318, and above that is one of the best, M-50 in Monoceros. Also we will touch on a rather Sirius topic. (I thought you might enjoy that).

By the time Canis Major hits the celestial meridian at 9:00 p.m. the nights are well on their way to being cold. However, the skies are clearer and observing from the backyard is more of a reality rather than the smoggy light polluted nights summer offers.'

And for you Mythological Maniacs ... CONSTELLATION OF THE MONTH !!

Information taken from FIELD BOOK OF THE SKIES by William T. Olcott.

CONSTELLATION OF THE MONTH

by Frank McCullough,

CANIS MAJOR

CANIS MAJOR - THE GREATER DOG

Location – The three so-called “Belt Stars” in Orion’s girdle Point southeast to the bluish-white star Sirius in Canis Major, known also as the “Dog Star.” It is to us the most brilliant star in the heavens.

Sirius rises in the early evening about Christmas time, by March 1st it shines , directly south, and it is lost to our view in the west by the middle of May.

The stars Betelgeuse in Orion, Procyon in Canis Minor, and Sirius form a nearly equilateral triangle. These stars, with Naos in the Ship Argo and Phaet in the Dove, form a huge figure known as the Egyptian X.

MYTHOLOGY

All others he excels; no fairer light ,
Ascends the skies, none set so clear and bright.

-- Manilius

From the earliest times Sirius has been known as the "Dog of Orion." and the star has been famous, since the dawn of history.

Sirius was worshiped by the Egyptians, and many of their temples were built in its honor, notably the temple of Isis at Denderah. The Egyptians held Sirius in high regard for the service the star rendered them, for its appearance in the east warned them of the rising of the river Nile each year, and enabled them to plan for the inundation.

Sirius has always been known as the "Dog Star," a name that may have been given it for the reason that the star's appearance served as a warning, just as the barking of the dog warns his master of danger.

The term “Dog Days” is associated with Sirius. These days derive their name from the fact that in ancient times Sirius was overhead at this season of the year in the daytime, and its rays were supposed to mingle with the sun's rays and thought to add to the heat it radiates, thus accounting for the unusual heat in Summer.

A legend that has come down to us concerning Sirius relates that it was the dog Aurora gave to Cephalos. It was said to have surpassed all other dogs in fleetness. Cephalos thought he would prove this fact to his satisfaction by racing his dog with a fox. For a time, the two creatures were on even terms. Jupiter was so pleased with the performance of the dog that he placed him in the sky as a reward.

SIRIUS

Sirius has a magnitude of -1.58, and is about 300 times brighter than the average 6th magnitude star. It is about 27 times brighter than the sun, and nearly twice the diameter.

CONSTELLATION OF THE MONTH (continued)

Of all the stars visible to the unaided eye in northern latitudes, Sirius is the nearest, at a distance of 8.7 light years. At this distance, the sun would appear as a star a little brighter than Polaris.

Its radial velocity, that is, its rate of speed in line of sight, is 5 miles a second toward us.

THE COMPANION TO SIRIUS

Famous as the star Sirius is, it has a still more remarkable companion. In fact, the companion to Sirius may be regarded as one of the most wonderful and interesting stars in the Universe.

Since its actual discovery in 1862 by Alvan Clark (thus confirming visually Bessel's mathematical prediction of 1844) this star has been under constant observation. Only 1/10,000 as bright as Sirius, it revolves with this brilliant star around a common center of gravity, in a period of about 50 years, almost exactly the value predicted by Bessel.

The actual distance between Sirius and its companion averages almost exactly 20 times the distance that separates us from the sun (93 million miles). The orbit is highly eccentric, and, the distance between the two stars varies considerably. In 1894 the companion star was so nearly in line with Sirius as to be invisible even in our largest telescopes.

The principal fact of interest concerning the companion to Sirius is the disproportionate relationship between its size and mass. In this respect the star presents an anomaly. A study of its mass has greatly modified our theories of the atom.

The companion to Sirius is known as a "White Dwarf star". It has a mass 0.9 times that of the sun, yet it is 360 times fainter. It is 10,000 times fainter than Sirius.

In size it is about 3 times the diameter of the earth, and has 250,000 times the earth's mass. One cubic inch of it weighs a ton. It is 3000 times as dense as gold, 5,000 times as dense as lead, and 60,000 times as heavy as water.

The companion to Sirius is also famous for the measure of proof it accords Einstein's Theory of Relativity. According to this theory light leaving the intense gravitational field of the companion would be "slowed down", and the consequent shift of the spectrum lines would indicate a recessional velocity of considerable amount.

As Sirius and the Companion form a close binary system, the easily measured radial velocity of the bright star is a certain means of checking the actual motion of the Companion toward or away from the Earth.

The spectra of Sirius and the Companion were, after a year's effort, successfully obtained at Mt. Wilson by Dr. Adams, who overcame the great photographic difficulties presented by the high brilliance of Sirius and the faintness of the Companion.

Careful comparison, measurement and computation showed a "large shift as predicted. Expressing the results in the usual unit of kilometers per second, the mean of his measurements came to 19, while the predicted shift was 20."

The fiery Sirius alters hue,
And bickers into red and emerald.

-Tennyson

THE END.

PLANETARIUM GAZING

by E. Ciptic

Compared to such far flung places like Lansing and Grand Rapids, this month's planetarium tour will be right in your own backyard, at the Cranbrook Institute of Science.

The Robert McMath Planetarium holds more demonstrations annually than any other planetarium in the world. Eight public demonstrations are scheduled each week with numerous programs scheduled for school children and other groups as well. On the average there are four demonstrations every day of the year. The present machine, a Spitz 512, was installed two years ago to replace an older model.

Cranbrook has a unique policy. Unlike most planetariums, demonstrations are given live by a lecturer. Since Cranbrook is an educational institution, the purpose is to use the planetarium as a tool for education, not as a toy to put on fancy light and music shows. The McMath has the right balance for teaching and entertaining.

Each month there is a different topic, however, every demonstration begins with identifying the stars, constellations and planets that are visible that night. This is the perfect way for everyone to learn their way around the sky. It was by going to the planetarium twice a month for a year that I learned how to tell the constellations apart

The December topic is (what else?) The Star of Bethlehem. Demonstrations are every Sunday at 2, 3, and 4 p.m., "Wednesday at 4 p.m. and Saturday at 2, 3, 4, and 7:30 p.m., Additional demonstrations are added when needed.

If you are truly unfortunate, you will be stuck with Raymond Bullock as demonstrator. This poor jerk is still trying to figure out how the arrow pointer works. His present project is photographing all the Messier objects in the planetarium "where the sky is real dark, the stars are real bright, and there are no clouds or diurnal motion to worry about. He is indebted to Ken Wilson for giving him the idea.

The planetarium is located inside the Institute of Science, and is free with museum admission (\$2 for adults, \$1 for Senior citizens and students, kindergarten through college). Remember to pick up the planetarium pass when you pay admission as only 83 people can be accommodated at a time.

What else to see?

The Institute of Science contains exhibits on astronomy, botany, insects, underwater life, mammals, geology, Indiana, mineralogy, do-It-yourself physics hall, observatory, and a lot more. It is open every day except major holidays, Monday - Friday-10 a.m. to 5 p.m., Saturday 1 p.m. to 9 p.m., Sunday 1 p.m. to 5 p.m.

The Nature Center is open every Saturday and Sunday from 1 to 5 p.m. Passes can be picked up in the museum at no additional charge. The Nature Center contains foot trails, exhibits pertaining to nature, and a live see-through bee hive (although there might not be much activity this late in the year).

The Hulbert Observatory is open every clear Saturday night, April through November. The instrument is a 6" refractor, built in 1927. The clock drive was installed by Robert McMath, who also did the drive for the 200" at Mt. Palomar. There is a one dollar charge per person to look through the telescope. On cloudy Saturday nights, and before it gets dark on clear Saturdays, you can look AT the telescope and observatory at no extra charge.

The Academy of Art is open Tuesday through Sunday from 1 p.m. to 5 p.m. Admission is \$1 for adults. 75¢ for students.

Cranbrook Gardens are open from April through October, 1 to 5 p.m. daily. Admission is 50¢ per person.

Cranbrook House was built by George Booth, the founder of the Cranbrook Community. A special tour has been scheduled for the public on Saturday, December 13, at 2 p.m. Admission is \$1.50, and reservations must be made in advance. Call 645-3152. The house has been restored inside and out, and is well worth seeing.

Obviously, you can't see everything in one visit. Even though many of the attractions are closed until next spring, I would suggest coming out now and seeing what is available. Then you can wait a bit and return in the spring and see everything else.

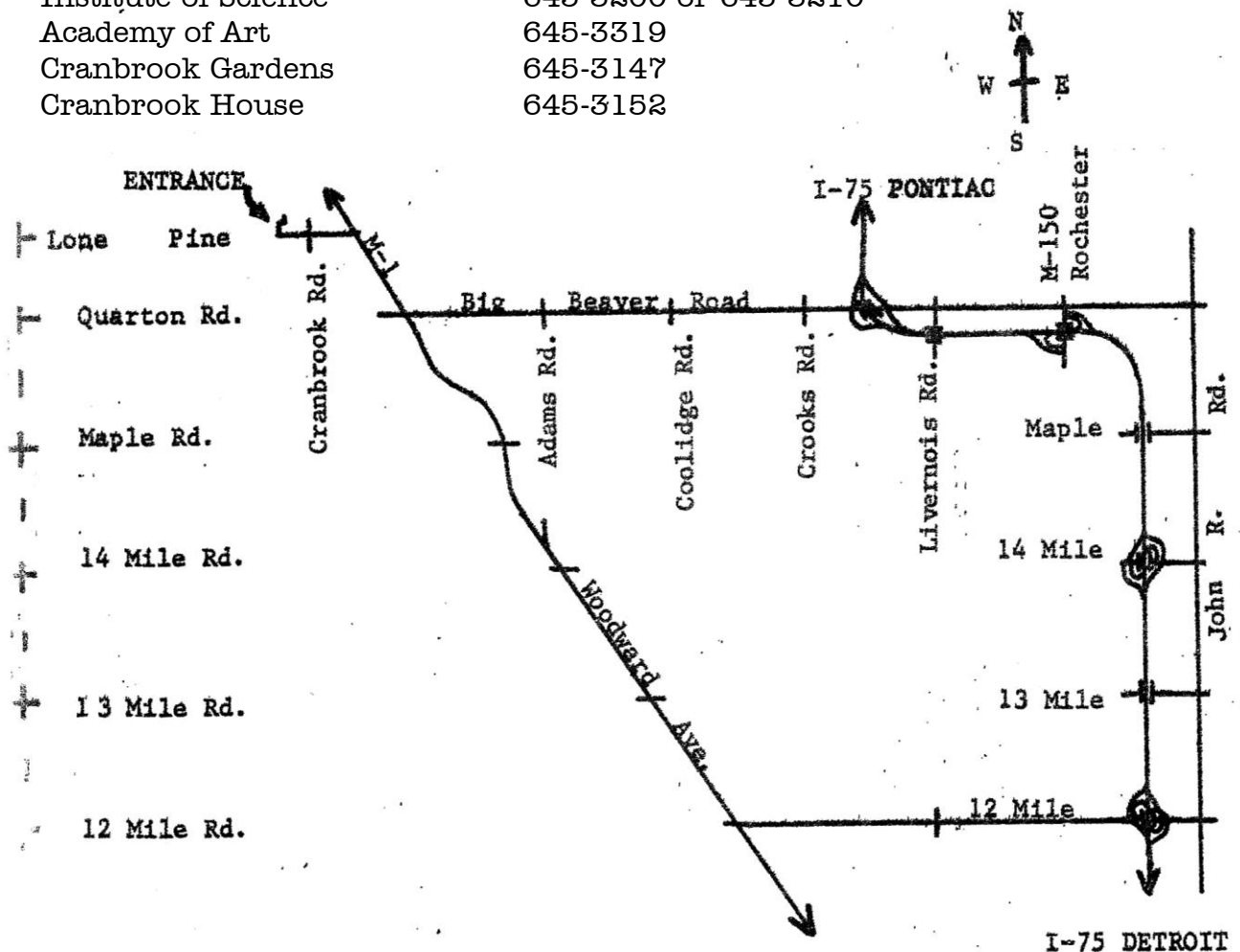
How to get there. (From Detroit.)

Take I-75 to the Big Beaver Road exit and turn left (west). Drive to Woodward Avenue (3½ miles) and turn right. Go ½ mile to Lone Pine Road and turn left. The entrance to Cranbrook is 1 mile west of Woodward on the north side of the street. (See map below.)

If you go on a weekend you will have to buy a grounds pass, but it can be used as credit for admission to the museums (50¢ per ticket).

For more information call:

Institute of Science	645-3200 or 645-3210
Academy of Art	645-3319
Cranbrook Gardens	645-3147
Cranbrook House	645-3152



A.T.M. for the Frantic Fringe!

Most of us have always wondered about Amateur Telescope Making, and the main contributors of this fascinating aspect of Amateur Astronomy. Many famous people as Russel Porter, Robert Richey, and Albert G. Ingalls. The men who devoted countless hours in design and engineering and derived no income from their efforts, their sole purpose being the amateur telescope maker. It will be the intention of this department to relate this devotion to our readers. So we present you with Amateur Telescope Making for the Frantic Fringe, that is A.T.M. for the real active group, us:

COMPOSITE MIRRORS

G. Boyd

In recent years a number of astronomers have said that the 200-inch Hale telescope is the biggest that will ever be built. This has not discouraged the proponents of still larger instruments. Two European astronomers have notably continued to experiment with unconventional methods of constructing very large mirrors. They propose making the large mirrors out of smaller ones united on a single fixed support of great rigidity.

The pessimist do not mean that engineers could not build larger telescopes, or that if built these would necessarily be defective in an instrument-engineering sense. The outer limit would be set, not by engineering limitations, but by irregularities in the earth's atmosphere which blurs the images of stars: the larger the telescope, the greater the blurring.

It has almost been forgotten that in 1963 F.G. Pease of the Mount Wilson Observatory published a design for a proposed 300 inch telescope. His design called for a 25-foot mirror in a mounting carried on a horseshoe-bearing similar to the one that now carries the 200-inch, a feature proposed by Russel W. Porter. Pease, an astronomer, precision optician and engineer who with R.W.Ritchey designed the 100-inch telescope, was not frightened by magnitude; he stated that "anything up to 100 feet in aperture can be built provided one wants to pay for it." But the financing or a conventional telescope larger than the 200-inch would be a very serious problem.

(over)



Now we are out for big go-

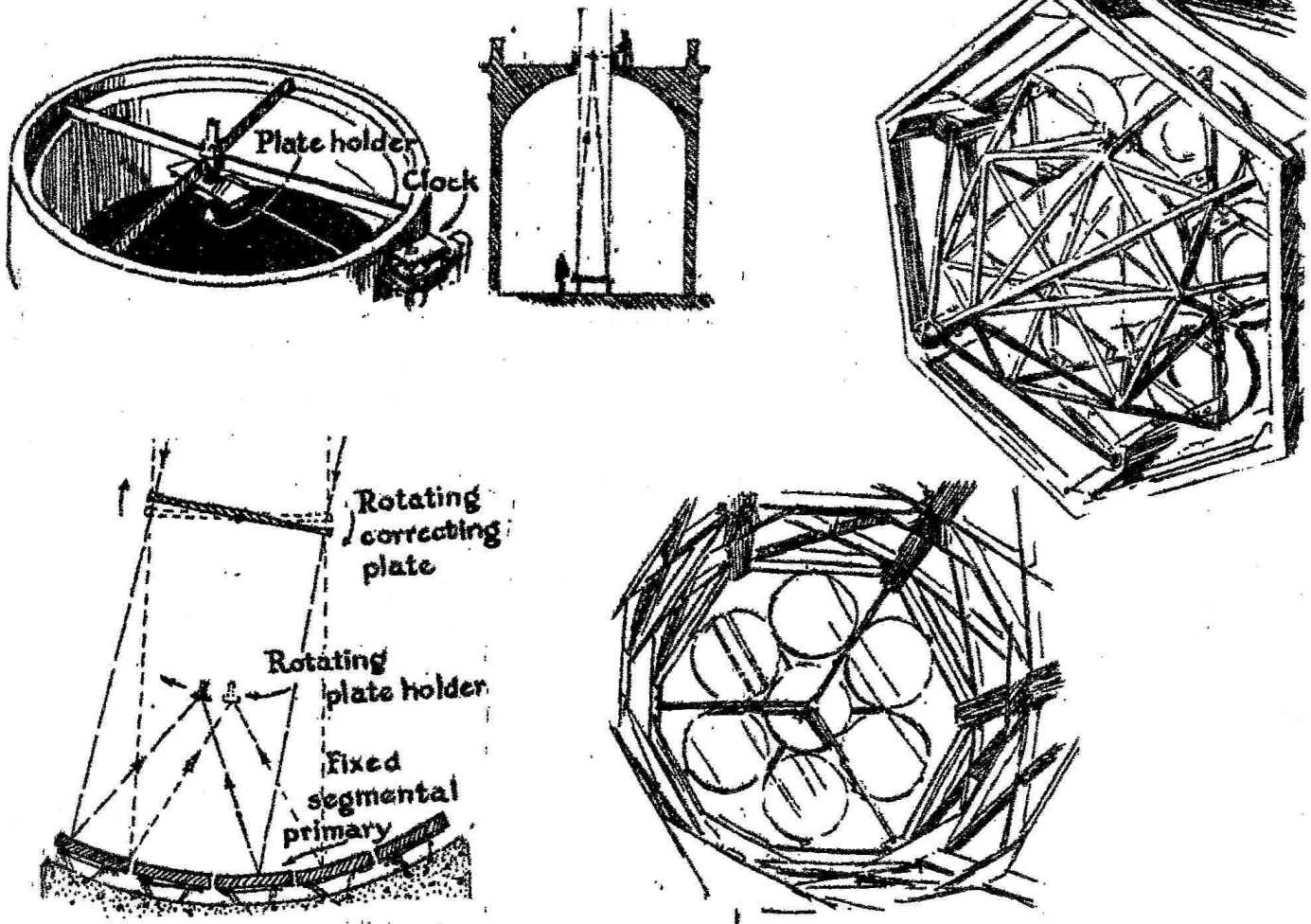
COMPOSITE MIRRORS

The 200-inch cost \$6,550,000, and might cost twice as much today, and a 300-inch would be theoretically three times as bulky and costly. These difficulties can be tackled in a more radical way, that is the method of making gigantic mirrors. They could be built up of identical smaller mirrors that were spherically concave, relatively thin and inexpensively mass-produced. These would be mounted on an extremely rigid common backing. By means of adjusting screws, each ring of mirrors could be raised a little above the ring within it, and each mirror could be tilted to focus on the same spot.

Such a composite mirror could also be constructed of individually figured paraboloids. Obviously these would be more expensive than identical spheres. The resolving power would moreover only equal that of a single mirror, as explained in *Amateur Telescope Making*, page -317. This would, not be true of spheres.

To date only a few of these composite telescopes have been actually built. I must say, their designers are not very pleased with the results. Most of them came to the conclusion that there was an excess of flexure in their mirror mount structure, this coefficient of expansion caused by temperature change never receded enough to use the telescope adequately.

Below are some concepts about the composite telescopes.



The telescope drive system has two main components; the gearing and the motor. As very few amateurs have the capability of improving the gears most turn to changing and improving the motor and its control system. With this in mind, what we will describe here is a DC motor and control circuit that has particular application to the portable telescope and mount.

The most popular motor used in amateur telescope drives is the AC synchronous motor. This motor has the advantage of a constant speed under-varying loads as long as it can be supplied an AC voltage of constant frequency. If power is available from the local utility then one need look no further. If, however, it is to be used on a portable telescope, then additional controls and systems must be added to provide constant frequency 110 volt AC power.

It is the added cost of these circuits and their power consumption that makes the DC motor attractive. First, the cost of the control circuits for the DC motor are less than 70% of the cost for similar ones for the AC motor. Second, the power consumption of a DC motor is 10 milliamps at 12 volts while a comparable AC motor would use, 500 to 1000 milliamps. This is equivalent to running an AC motor one night only on a set of D cells when with the DC motor the batteries would last 50 or more nights.

The description of DC motor and circuits will be divided into the following sections: The Theory, The Construction, The Operation, and the Parts List and Diagram.

The Theory

The operation of the circuit is based on two properties of the DC motor. The output torque of the motor is directly proportional to current and second, due to the action of the brushes and commutator, the motor produces an AC pulsation which has a frequency directly proportional to the armature speed.

IC2 takes the AC signal from the motor through C3 and amplifies it for input to IC3a. IC3a is a phase detector, which compares the frequency of the motor from IC2 with the reference frequency generated by IC3b and generates an error signal. The error signal is amplified and integrated by IC1 and fed back to the motor.

Thus it can be seen that any change in the speed of the motor as immediately detected and corrected by appropriately changing the power to the motor.

IC3b, which provides the reference frequency, is a voltage variable oscillator whose frequency is determined by C6, R10, R12, and the voltage applied to pin 9. R10 determines the effect changing the voltage on pin 9 will have on the frequency while R12 determines minimum frequency when the voltage is zero. For more complete information on this integrated circuit, RCA file #637 and application note #ICAN-6101 should, be referred to.

The Construction

The construction of the circuit is noncritical as to placement of parts other than to minimize the size of the box needed to contain it. The integrated circuits should be placed in sockets due to their sensitivity to static and all soldering should be completed before installing them. R12 should be installed where it can be adjusted without opening the circuit box.

The entire circuit can be mounted in the hand control box or it can be placed at the telescope mount near the motor. In either case a three conductor cable will be needed for the hand control to the motor, (five if declination control is included), R4 must be added to the circuit if there is any tendency for IC1 to latch.

The Operation

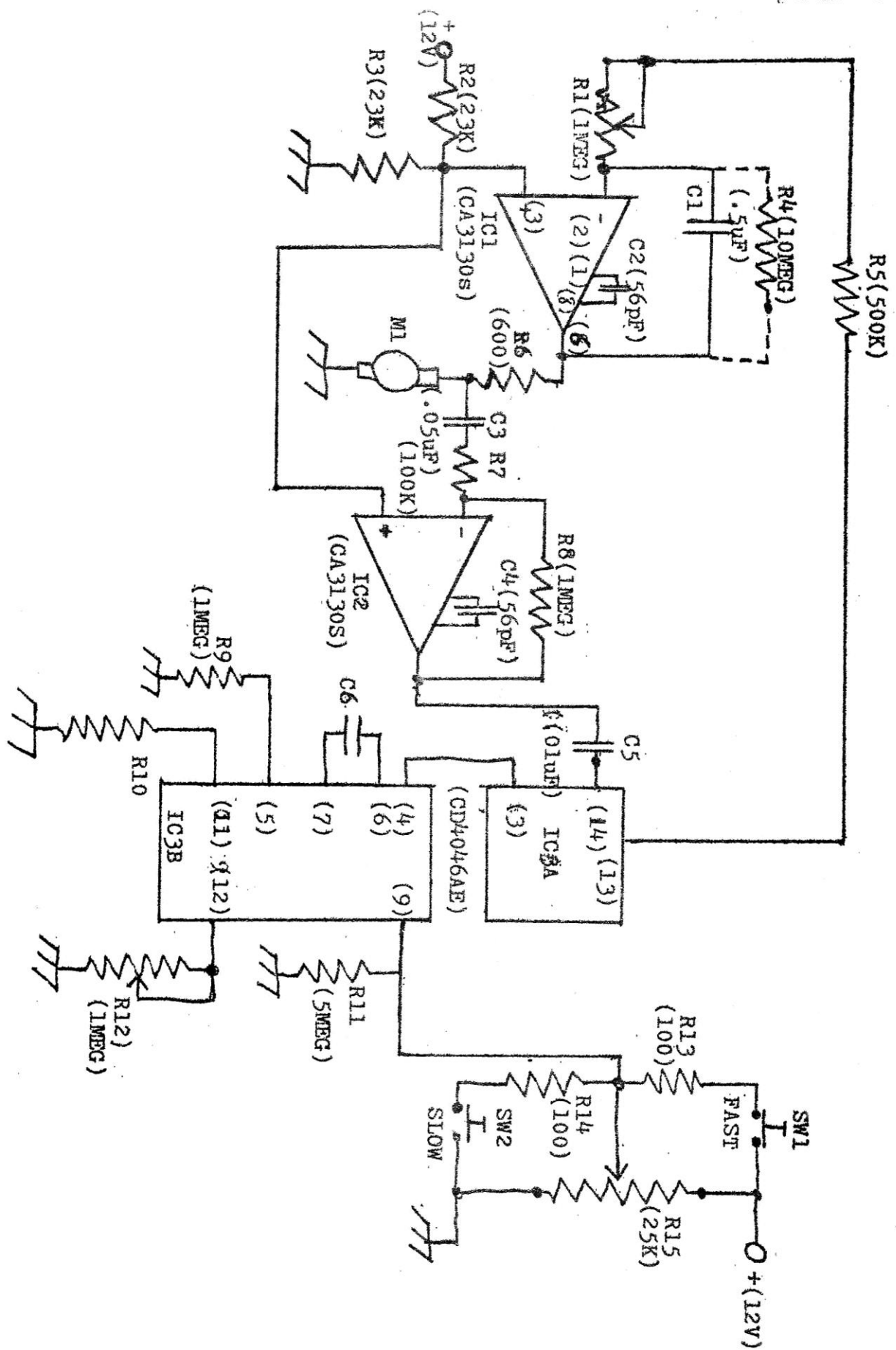
Before the circuit can be operated in the field, some adjustments must be made. First, R1 should be set to midpoint along with R15. Then R12 should be adjusted until the motor is approximately at the correct speed. The motor can then be installed on the telescope and final adjustment begun.

For final adjustment the telescope with a high power cross hair eyepiece should be set on a bright star near the celestial equator. R12 should be carefully adjusted until the star remains fixed in the cross hairs.

The 12 volts of DC power needed for the circuit can be obtained from a well regulated power supply of dry cells. For the best stability a temperature compensated source should be used along with stable components for C6, R10, and R12. For most users standard components can be used satisfactorily with the power supplied by batteries.

Parts List

C1	.5 uF low leakage Mylar or polystyrene
C2, C4	56 pF miniature, for freq. comp. for IC1 & IC2
C3	.05 uF miniature
C5	.01 uF miniature
C6	Temperature stable capacitor. Obtain value from RCA Application note #ICAN-6101, to suit motor and gearing
IC1, IC2	RCA CA3130S operational amp.
IC3	RCA CD4946AE phase locked loop and voltage controlled Oscillator
M1	low current DC geared motor, Hanscraft animation motor or equivalent
R1	1 MEG trimmer
R2, R3	25K $\frac{1}{4}$ watt
R4	10 MEG $\frac{1}{4}$ watt
R5	500K $\frac{1}{4}$ watt
R6	$\frac{1}{2}$ watt to suit motor, 600 ohms for recommended motor
R7	100K $\frac{1}{4}$ watt
R8, R9	1 MEG $\frac{1}{4}$ watt
R10	see RCA ICAN-6101, selects range or R15
R11	5 MEG $\frac{1}{4}$ watt
R12	1 MEG multi-turn trimmer
R13, R14	100 ohm $\frac{1}{2}$ watt
R15	25K wire wound linear potentiometer
SW1, SW2	Normally open momentary pushbutton switches



Donald Misson

ASTRONOMY--1930's STYLE

-R. Bullock

One of the most amusing things an astronomer can read has to be an old astronomy book. The "facts" that were being presented are incredible! You don't have to go back one hundred years either, I recently obtained a copy of a book titled *The Universe Unfolding*, a 140 page book printed in 1932, one of a series of books in the Century of Progress Series. This book, subtitled "The Story of Man's increasing comprehension of the Universe Around Him" was written by Robert H. Baker, Professor of Astronomy in the University of Illinois.

Let me share part of Chapter VII with you. Called "Beyond the Milky Way", this chapter gets nearly everything wrong! Following the quotes are the facts as we know them today, some 43 years later.

"... the 'great nebula' in Andromeda and Messier 33 in Triangulum ... are the nearest of the external spiral systems, and the only ones visible to the naked eye."

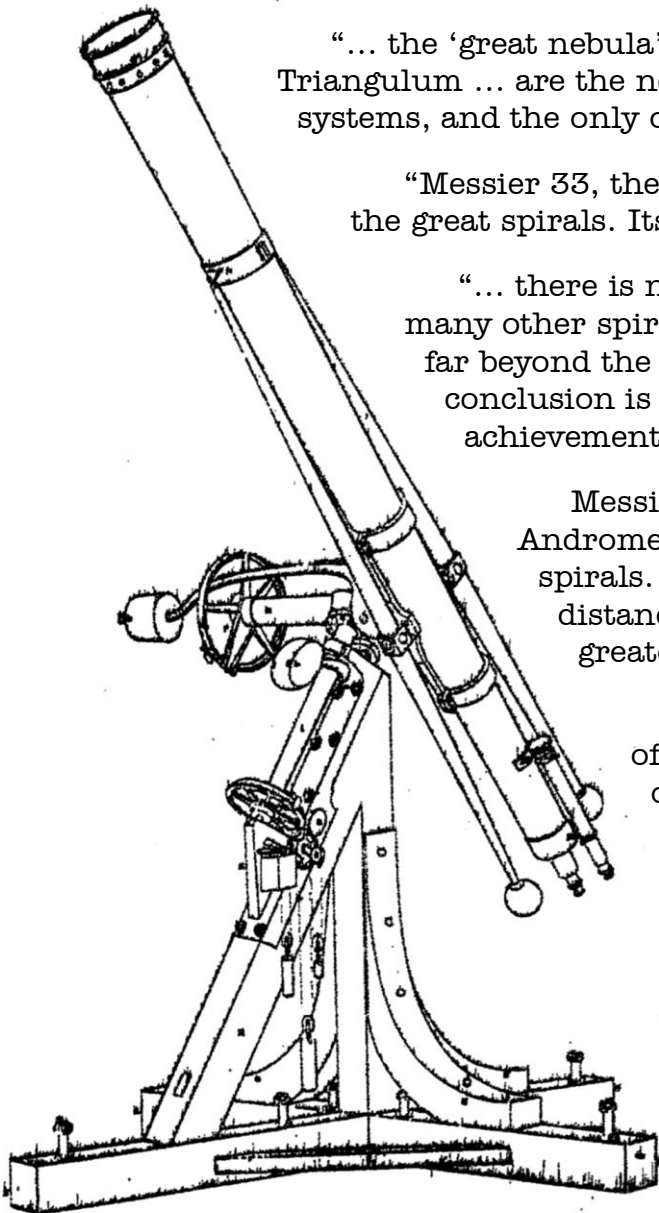
"Messier 33, the fainter of the two, is the nearest of the great spirals. Its distance is 770,000 light years ..."

"... there is no longer any doubt that this and many other spiral structures are external galaxies far beyond the Milky Way. This important conclusion is among the foremost scientific achievements of the past decade.

Messier 31, the 'great nebula' in Andromeda is the most famous of the great spirals. It is easily the brightest, though its distance of 800,000 light years is slightly greater than that of Messier 33.

"Hubble has derived the distances of the nearest galaxies from studies of their Cepheid variable stars which appear on his photographs. But only a few systems show separate stars even with the 100" telescope.

"Thirty million galaxies inhabit the region of space around us which is open to inspection with present telescopes ... The projected (i.e. 'proposed') 200" telescope will show additional multitudes ..."



The Celestial Handbook by Robert Burnham, Jr. of the Lowell Observatory has some slightly 'different' figures. Printed in 1966, volume one says "The Great Andromeda Galaxy ... is the brightest and nearest of all the spirals, and the only one which can be considered a definite, obvious naked eye object.

"Dr. E. Hubble definitely established the great spiral as an extra-galactic object, and derived a tentative distance of about 900,000 light years. Hubble's discovery was announced at the meeting of the American Astronomical Society in Washington D. C. in December, 1924, and dramatically ended the long controversy over the nature of the 'spiral nebulae'. Further studies, still using the pulsating cepheids as distance indicators, caused a revision to about 750,000 light years.

"In 1953, however; investigation of the Andromeda Galaxy with the newly oompleted 200-inch telescope ... (indicated) a distance of 2.2 million light years for M31, and the next nearest spiral (M33 in Triangulum) at about 2.4 million light years. It is not expected that any further great revisions will be required."

I can't help but wonder if people 40 years hence will laugh at our 'facts'.

NEXT MONTH: Three theories of the construction of the Milky Way
system -1930's style.

MINOR WILD BEAR

*Submitted by
Dorine Hunsley*

U G E I P A S D S A A V O N V C L S C O R P I U A
S A T U R N S O Y T A T O M L T E R I N I S S
R E R Y U P H I S R B E I A C E L R T S P M O I
B T X T Z O O S A G I T T A R I U S T E M A S P
V R P A H O A O X N T K G E T N S O N G M M O U
I E W U V T N B T K G E V X T E P A Y E L L R O
N N N R S E L O C E P H A V N S E L C A O O A N E
U R A U P A M S O T L E P H E R R C O D S A A
S C N S S C D E I A S E V V O E G A L S O S A S
A M R R E L N E A I P R Z A K S D V S R E O R Z
V E O A U G Z C B T A D M T T E K U I M C H O U
Y V M B L O U P S T E H E E L P T V O P L O Q Q
K O E L L O O L S T E L L A R E H C P O I S U S
L N D I J T P Q U F L L O C C E H E C U I R N
I S A V U C R I M S A Y S I E U G I E F O L L
M C L L P S N C C T N M M R C R E R A E N J A G
Q L P E I P A O I M O O U O N E V P Y I D O S E
U M I P T E P O O L N N R E V A S A M A J O R N
A N O B E N N G O M O O T T P R R A I M C A U
S O L A R S Y S E N R C E A E S C S A D O S E
A C E L R A P O L L O T E M U R O T T R L A O I
R T B L A C K H O L E S S P Q N S A P A T H I N
S S D I O T E W A L P A S T E R O I D S R O K E

ANDROMEDA
APOLLO
ASTEROIDS
ASTRONOMY
BLACK HOLES
CASSIOPEIA
CEPHEUS
CEUS
COMETS

CYGNUS
DRACO
EARTH
ECLIPSES
ORION
GEMINI

SCORPIUS
VIRGO
LEO
SAGITTARIUS
CONSTELLATIONS
GALAXY
LIRIA
NOVA
NEBULAE
MILKY WAY
MOON
METEOROIDS
MERCURY
JUPITER
MARS
PLUTO



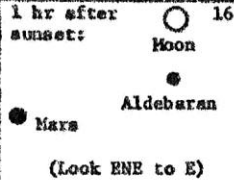
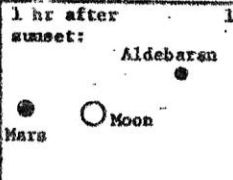


NEPTUNE
OPHTES
REGULUS
PLANETS
PERSEUS
PLANETOLDS
POLARIS
PULSARS
QUASARS
RINGS
ROTATION
VEGEL
SATELLITES
SOLAR SYSTEM
SUN SPOTS
T-10 TRIM

SATURN
STARS
SENIUS
SUN
STEELAR
TELESCOPS
TAURUS
UNIVERSE
URSA MINOR
URSA MAJOR
URANUS
VENUS
ZENITH
ZODIAC
ZUBEN/ALTAIR

*Extra Credit Work!
by one of my students
Bob Smith*

SKY CALENDAR DECEMBER 1975

Information for helping teachers and students observe the sky

SUNDAY	MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY	SATURDAY
GENERAL INFORMATION ON PLANETS FOR DECEMBER: SEE BLOCKS FOLLOWING DECEMBER 31. This week and next: Mars outshines Sirius, the brightest star. Though not as bright as Venus in morning sky or Jupiter in evening, Mars is easy to identify by its reddish color.	1 Face SE 1 hr before sunrise: Note Spica 4.2° lower right of brilliant Venus. Watch them separate this month... Last morning to see waning crescent moon. Look 25° lower left of Venus.	2  New Moon, not visible. Moon sets with sun and dark side is toward us. Tomorrow night, if sky is very clear, very thin moon might be seen in binoculars.	3 Search for 1 day old crescent moon tonight: Note sun's location 30 minutes before sunset. Then 54 minutes later (24 minutes after sunset) moon will be in nearly same spot. Use binoculars.	4 Tonight's 2 day old moon is much easier to see than last night. Look low SW during evening twilight. Look early! Moon sets within 2 hrs after sundown.	5 As evening sky darkens, note bluish light on dark side of moon. It's called "earthshine" or "the old moon in the new moon's arms". On what night will you last see it?	6 Notice the two 3rd magnitude stars, Alpha and Beta in Capricornus, close to the moon. Alpha, the star to the north, is an easy double... a pretty sight in binoculars!
	8 Mars, rising in NE very shortly after sunset, is nearest to earth tonight, 52.6 million miles. Mars will not be as close again until 1984.	9 Earth passes Mars at intervals of 25 to 27 months. The next 2 approaches will be in Jan 1978 and Feb 1980, when Mars will be 61 million and 63 million miles from earth, respectively.	10  First Quarter (Evening Half Moon). Moon 90° or 1/4 circle east of sun in afternoon and evening sky.	11 A planet close to opposition (see Dec 15) is in the sky all night. Mars, for example, now rises in NE around sunset, is highest in middle of night, and sets in NW around sunrise.	12 Jupiter near moon tonight. 10 pm to 6 am tonight and next two nights are best for Geminid meteor shower. Best time is after moonset. Meteors may appear anywhere in sky.	13 Mars at its brightest (little change until late in month). Watch Mars fade to brightness of North Star by August 1976.
	15 Mars at opposition: Earth passes between Mars and the sun. Seen from earth, the sun and Mars appear in opposite parts of the sky.	16  1 hr after sunset: Moon, Aldebaran, Mars (Look ENE to E)	17  1 hr after sunset: Aldebaran, Moon, Mars	18  Full Moon. By sunset this evening it is several hours past the exact time of full. Therefore the moon rises shortly after sunset. Watch it rise.	19 One hour before sunrise: Note 3rd magnitude star Alpha Librae 2° south of Venus. Planet has shifted 21° east since passing Spica Dec. 1. Now Spica is 21° upper right of Venus.	20 3 hrs after sunset: Face ENE. Castor, Pollux, Saturn, Moon
21 This month's chart shows the sky at 8 pm local time on this date. 11 stars and 3 planets of first magnitude or brighter are shown. Can you find all of them in sky?	22 Winter Solstice. Today's midday sun is the lowest of the year, 26.5° above horizon as seen from latitude 40° N. For several weeks sun's midday altitude changes very little, hence solstice, "sun stands still".	23 1 hr before sunrise: Look high in SW. Regulus, Moon	24 "Why do we celebrate Christmas on December 25th?" See George Lovi's <i>Ramblings</i> column in December 1974 <i>Sky and Telescope</i> .	25  Last Quarter (Morning Half Moon). Moon 90° or 1/4 circle west of sun in morning sky, before and after sunrise.	26 Mercury now sets in SW about 1 hr after sun. It is only bright "star" very low in SW about 45 min after sunset. It becomes much easier to see by end of month.	27 1 hr before sunrise: Look 35° above horizon in SSE. Spica, Moon
28 This week watch Venus approach head of Scorpius. It will pass 1° north of Beta Jan 3, and 6 1/2° north of Antares Jan 9.	29 1 hr before sunrise: Face SE. Venus, Beta, Antares	30 1 hr before sunrise: Venus, Beta, Antares	31 Major evening events in early 1976: Saturn all-night object in Jan, visible thru Jan; Mars in eve sky thru July, Jupiter thru mid-Apr. Mercury visible Jan and Apr. Mars passes Saturn in May.	Evening Planets: Jupiter, the brightest evening object, is high in SE at dusk. It passes due south near 8 pm local time in early Dec, and 1/2 hr earlier each week. It sets in W 6 hrs after passing S. Bright reddish Mars is in the sky all night, whenever sky is dark. See Dec 7-9, 11, 13, 15. Saturn rises in ENE shortly after Jupiter passes south. Look below Castor and Pollux. Positions of Jupiter, Mars, and Saturn are shown on this month's star chart. Mercury: See Dec 26.	Morning Planets: Venus is brilliant in SE sky for 3 1/2 hrs before sunrise. It is the brightest "star" in the entire sky. Keep track of it until sun rises, and you can see it in daylight. Saturn 1 hr before sunup is well up in WSW to W.	

Magnitudes of the Planets: Venus -3.7; Jupiter -2.2; Mars -1.4 to -1.6 to -1.1; Mercury -0.6; Saturn +0.1
 Positions of the Planets: Venus 36° southeast, Virgo into Libra (see Dec 1, 19, 28); Mars 11° westward, passing between horns of Taurus in midmonth. Jupiter stationary in Pisces; Saturn 1.7° westward in Cancer west of Beehive.

East Lansing Sunrise: Dec 1 7:48 a.m.; Dec 16 8:03 a.m.; Dec 31 8:09 a.m. EST
 Sunset: Dec 1 5:05 p.m.; Dec 16 5:05 p.m.; Dec 31 5:13 p.m. EST