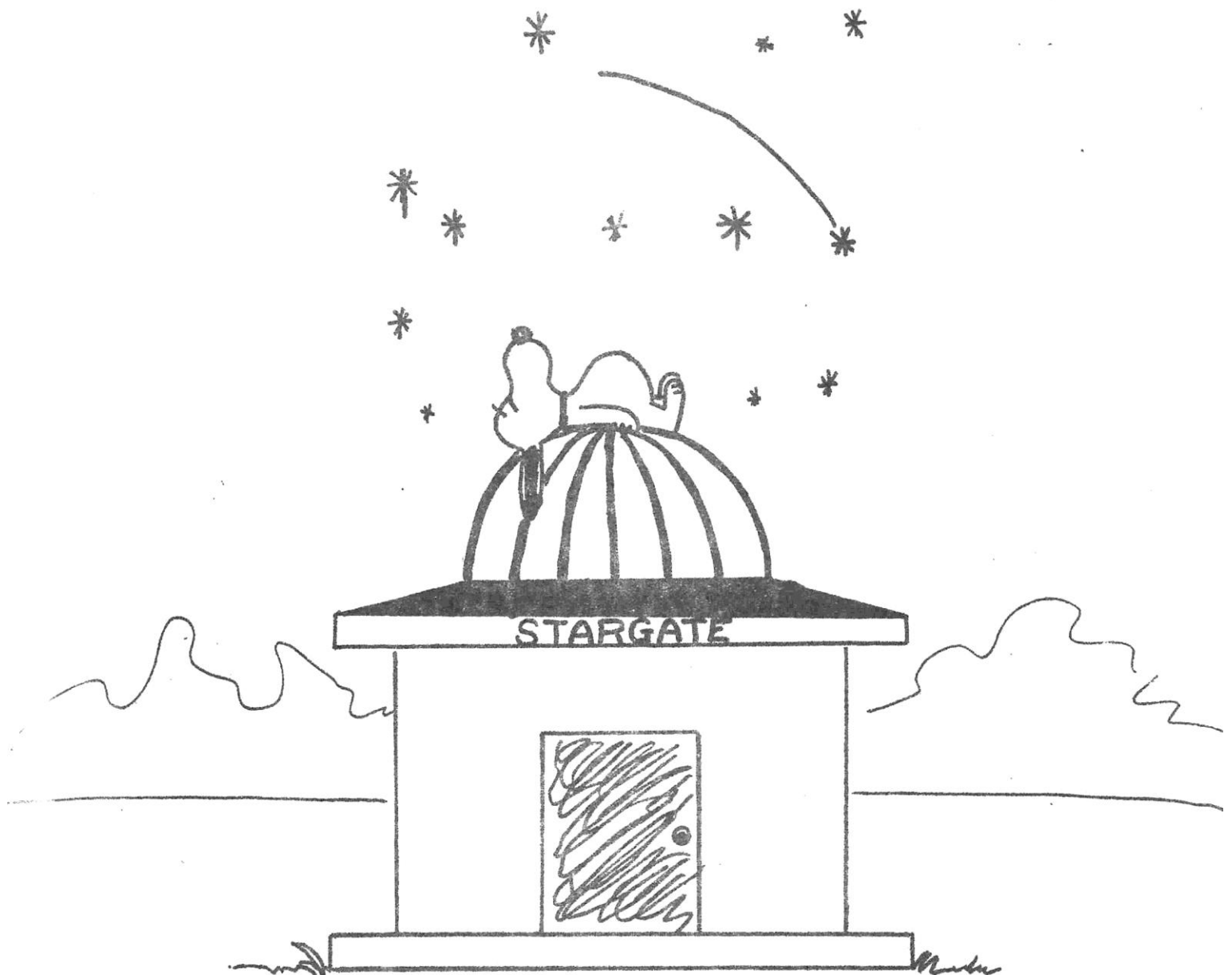


the WAST*

* THE MONTHLY JOURNAL OF THE WARREN ASTRONOMICAL SOCIETY



I NEVER MISS A
DELTA AQUARIID MAXIMUM!

JULY 1975

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 for General Membership, and \$5.00 for a Family Membership. Add \$5.00 for a one year subscription to Sky and Telescope magazine. General meetings are held on the third Thursday of every month at Macomb County Community College (South Campus on Twelve Mile Road near Schoenherr in Warren) in room 311 of "B" building, at 8 p.m.

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.

EDITORS:	Kenneth Wilson	Frank McCullough
	11157 Grenada	34136 Clinton Plaza Dr.
	Sterling Heights,	Frazer,
	Michigan, 48077	Michigan, 48026
	268-9337	791-8752

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 OLYMPIC ASTRONOMICAL SOCIETY

THE ORANGE COUNTY ASTRONOMICAL SOCIETY

Other organizations are invited to join this list.

THIS MONTH'S COVER BY: Kevin Wilson

THIS MONTH'S STAFF INCLUDES: Raymond Bullock, Larry Kalinowski, Diane McCullough,
Frank McCullough, Don Dossa.

JULY

EVENT

1	Last Quarter Moon.
3	Messier Club meeting at 8 p.m., contact Frank McCullough (791-8752) for details.
9	New Moon.
10	Astrophotography meeting at 8 p.m., contact Larry Kalinowski (776-9720) for details.
11	First transatlantic television transmission by satellite via U.S. Telstar I in 1962.
14	U.S. Mariner IV flies past Mars, takes first photographs in 1965.
15	First Quarter Moon.
17	Warren Astronomical Society monthly general meeting at 8 p.m. at Macomb County Community College (South Campus on Twelve Mile Road near Schoenherr) in room B 311.
18	Robert Hooke born in 1635. English scientist made important contributions to optics, gravitation and astronomy.
20	American astronaut Neil Armstrong is first man to walk on the Moon in 1969.
23	Full Moon. First U.S. Earth Resources Technology Satellite (ERTS-I) launched in 1972.
31	Last Quarter Moon.

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Club News

The W.A.S. lunar eclipse gathering at Stargate Observatory on May 24th was well attended by many old as well as new faces. Those who stayed the entire evening were treated with hazy views of the initial partial phases and about the first ten minutes of totality before the clouds finally moved in to hide the moon until the last five minutes of totality which were also alternately clear. The last set of partial phases were also seen between clouds. All agreed that this was a particularly dark eclipse even with the effects of the clouds.

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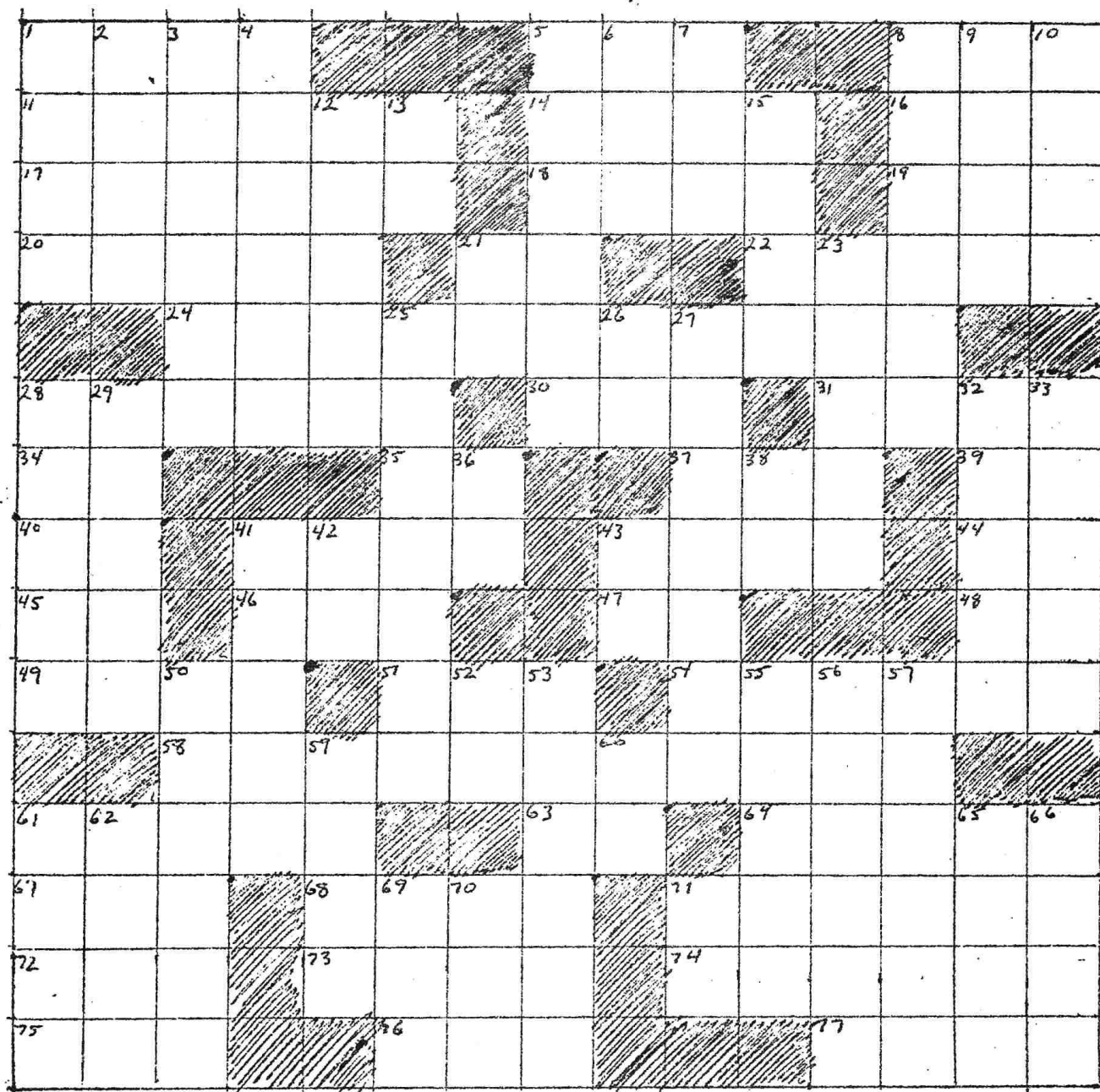
It seems that the Warren Astronomical Society is about to have another observatory in its midst. Dave Harrington has poured the cement foundation, wired and installed the pier for a backyard observatory at his new home in Troy, Michigan. Dave's 14-inch with its herniating mount has now found a permanent home. Dave hasn't decided on a name for the observatory yet, but his kids are busy inventing one. I'm sure Dave would welcome any suggestions from his fellow W.A.S. members.

*

The Warren Astronomical Society's monthly astronomy course ended last month in what could be described as mixed reviews of its success. A second run of the course is being contemplated for the fall. If you have any suggestions as to content, speakers, format, meeting night, etc. Louis Faix would appreciate hearing from you in the near future. Louis' telephone number is: 781-3338.

*

CROSSWORD PUZZLE -Raymond Bullock



(EDITOR'S NOTE: Questions to this puzzle will be found on the next page.
Answers will appear in next month's W.A.S.P.)

QUOTATION OF THE MONTH

"The special value of astrophotography is not what it makes of astronomy, but what it makes of the astronomer. No more is it the passive contemplation of a fixed universe; it becomes the hand to hand struggle where the explorer succeeds in snatching from the physical world which he would like to understand, certain image-information, always partial, which would allow him to make conclusions that are incomplete, and in general, only probable."

-C. J. EDSALL

NOTE. Because I made this puzzle symmetrical, I came up with some incredible letter combinations. In some cases, I was stuck with a jumble of letters because the words going across made sense, but the letters going down didn't. Therefore I used two forms when an abbreviated answer is needed. When you see (abbrev.) it is a legitimate abbreviation, you must think of the right answer and use its abbreviated form (see 6 down). When you see (ab.) you know you have come to an incredible letter combination, with an equally incredible clue. In this case, you need only take the first letter in each clue word. The letters will be capitalized (see 13 down). I hope you don't end up using your own cross words to solve this one. -R. Bullock

ACROSS

1. Charts
5. Little green _____
8. M31 (abbrev.)
11. Takes as one's own
14. Asteroid
16. Federal Energy Admin. (ab.)
17. _____ variable
18. M57 nebula in Lyra
19. Detroit is at 42 deg. N. _____
20. To gush out
21. Greeting
22. Solar prominence
24. Sky theater
28. Crazy
30. Observe
31. Bird's home
34. Sodium (Chemical abbrev.)
35. Prefix for two
37. Celestial dragon (abbrev.)
39. 3.14159 ...
40. Tidal Zone (ab.)
41. Bird of Paradise (South constell.)
43. Russian ruler
44. Inspector General (abbrev.)
45. Et Cetera (ab.)
46. Porpoise (Northern Constellation)
47. Not down
48. Celestial Equator (ab.)
49. The space _____. US vs USSR
51. The Alter (South constell.)
54. Eyepiece
58. Palomar is one
61. _____ Blanche; free rein
63. Electron Microscope (abbrev.)
64. Lunar feature
67. Nigerian tribe
68. From a great distance
71. brilliant person
72. Number of Saturn's satellites
73. Square or cube
74. Chopin wrote them
75. Aquarids meteor shower
76. Jupiter's composition
77. Super-Super Sonic Transport (ab.)

DOWN

1. Ronald's hamburgers: Big _____
2. Astronomers Demand Extra Pay-(ab.)
3. Kind of baseball hits (2 words)
4. Some Phrases Here Really Look Asinine (ab.)
5. Rewards
6. Celestial river (abbrev.)
7. Negative prefix
8. On fire (2 words)
9. Not far
10. International _____ Line
12. Saturn satellite
13. Solar Day (ab.)
15. Star Gazers Find Io (ab.)
21. Sun fuses its H into _____
23. Of the Moon
25. The "Owl" and "Crab"
26. Atomic Energy (ab.)
27. Jovian feature (2 words)
28. _____ stellar dust
29. Plain in Peru. Did vonDaniken's "gods" land at this "airport"?
32. Virgin star
33. Jungle cat
36. Island (abbrev.)
38. Star co-ordinate (abbrev.)
41. Repay ____ (What is owed)
42. Protestant Episcopal (abbrev.)
43. You (Spanish)
50. _____ Borealis
52. Railroad (abbrev.)
53. Looks to one side to see dim object
55. Kohoutek
56. Planet
57. April meteor shower
59. Scorch
60. Morning (abbrev.)
61. Quote
62. Encourage; aid and _____
65. International Universal Excursion Starship (ab.)
66. Assistant (abbrev.)
69. Descended cloud
70. Astronomical Observers Association (ab.)
71. Galactic Equator (ab.)



CRANBROOK INSTITUTE OF SCIENCE

ADULT AND STUDENT CLASSES

The Cranbrook Institute of Science is offering several introductory astronomy courses this summer. These are the sort of courses that often turn a mildly interested novice into a lifelong, active amateur or professional astronomer. So, if you've been trying to get your kid or your next door neighbor bitten by the astronomy bug, these may just be the thing to do it. Enrollments are limited, so it's best to sign up early. The grade levels indicated refer to grades completed in June, not the grade the student will enter in the fall. For further information please call 644-1600.

STUDENT CLASSES

STORIES IN THE STARS (grades 3-4)

Tuesdays and Thursdays, July 8-24; 9:30-10:30 a.m. (6 sessions)

Fee: \$12.00 (Members, \$10.80)

In this beginning study of the sky and the stars, students will learn to recognize constellations and the stories behind them, find out how to tell time and the season of the year by looking at the sky, and make their own star charts. Each class period will include a session in the planetarium.

INTRODUCTION TO ASTRONOMY (grades 5-6)

Tuesdays and Thursdays, July 29-August 21; 9:30-11:00 a.m. (8 sessions)

Fee: \$16.00 (Members, \$14.40)

The moon, sun, planets, constellations, and recent astronomical discoveries will be studied in this course. Students will learn how the rotation of the earth affects what we see in the sky, what a galaxy is, and something about the tools astronomers use to study the universe. Each class will include a session in the planetarium.

ADULT CLASSES AND SPECIAL COURSES FOR FAMILY FUN

TELESOPES: HOW THEY WORK AND HOW TO USE THEM

Section 1: Sundays, July 13-August 3; 1:00-3:00. p.m. (4 weeks)

Section 2: Wednesdays, July 16-August 6; 9:30-11:30 a.m. (4 weeks)

Fee: \$16.00 (Members, \$14.40)

Back again by popular demand, this participation workshop will satisfy both the beginner wishing to make an intelligent selection of an instrument and the experienced telescope owner wanting to understand and/or improve his instrument. Emphasis will be placed on the basics optics of a telescope. Participants will also develop some expertise in telescope field work by considering sidereal time (star time), the use of setting circles, clock drives, and star charts. The class will include one evening session in the observatory, giving participants a chance to use the Institute's 6-inch refracting telescope. Children (minimum age 12) may enroll with or without parents.

Instructor: Dominic Morinelli, Planetarium Demonstrator, Cranbrook Institute of Science; Science Department, Cranbrook School.

ASTRONOMY in INVISIBLE WAVELENGTHS

by

Don Dossa

When one mentions "astronomy", the particular branch of astronomy that everyone thinks of is the one in which observations are made in "visible" light. One thinks of photographs of the constellations and the night sky that can be "seen" by anyone wandering around at night. The profession of astronomy invokes images of telescopes--"optical" telescopes. However this is only one branch of astronomy. There are many ways to observe the heavens and the utilization of light that we can see is only one small part. This suggests that there exist other branches of astronomy that use "invisible" light in their observations. But before it is possible to talk about invisible light astronomy, the concept of invisible light must be explained.

When one speaks of visible light the reference is to a particularly well defined region of the electromagnetic spectrum. All light, both visible and invisible, is electromagnetic radiation. Visible light is merely that portion of the electromagnetic spectrum to which our eyes are sensitive. Invisible light is, therefore, electromagnetic radiation which we cannot perceive with our eyes. Another way to distinguish light as being either visible or invisible is by its wavelength. If one thinks of electromagnetic radiation as being similar to water waves, then the wavelength is the distance between adjacent crests and the frequency is the number of crests that pass a point in a specified amount of time, usually a second.

For visible light, the range of wavelengths we are talking about is very small. Remembering that there are 254 million Angstroms in one inch, we find visible light to be between 3000 and 7000 Angstroms. Fortunately the electromagnetic spectrum is much wider than a few thousand Angstroms.

The commonly observed ranges of the electromagnetic spectrum have wavelengths 10,000 times smaller than visible light to well over a billion times longer. This extremely wide range provides many phenomena that we are familiar with but don't think of as light. These phenomena include X-rays to ordinary radio. The spectrum is laid out with radio at the long wavelengths ending at wavelengths of a few inches. From here to wavelengths about 20 times that of visible light are found microwaves. Between microwaves and visible light is the infrared region. On the short wavelength side of visible light are found ultraviolet light to 0.02 of visible light wavelengths, and then X-rays down to 0.001 of visible wavelengths. Shorter wavelengths are referred to as gamma rays. In the electromagnetic spectrum we have found everything from radio and television, infrared rays we feel as heat, ultraviolet rays which are used in germicidal lamps and "black light" lamps, and the X-rays used in medicine.

Each of these areas of the electromagnetic spectrum has its own branch of astronomy with its own special equipment and special problems of observation. The techniques used are very different as one might expect. Radio astronomy uses the now familiar dishes to probe the heavens. These radio telescopes are simply extremely sensitive radio receivers that can be pointed at a particular area of the sky to determine the nature of its radio emission. The type of object that one observes with radio telescopes are very cool stars that are not very bright in the visible region, nebulae, quasars, pulsars, neutron stars, and areas that cannot be seen because of intervening gas and dust clouds. Some of the most interesting objects so far discovered have been discovered with radio telescopes. Some of the problems radio astronomers have are the cost of the great amount of electronic equipment that is needed to detect the signals from the heavens. Radio astronomers also have to live with all of the radio and radar transmitters on the earth whose total radio energy output is actually higher than a similar sized area on the sun. Current interest centers on three main areas of research: the nature of Seyfert galaxies and galaxies that

appear to be exploding, the structure of the center of our galaxy, and the search for complex molecules in space. Seyfert galaxies are very similar to quasars in that they appear to be pouring out more energy into space than we account for. We don't know of any process to produce the amount of energy that we are detecting. Recent research indicates that quasars and Seyfert galaxies may actually be the same type of object. Very little is actually known about the structure of the center of our galaxy. Those magnificent dust lanes in Sagittarius completely block our view of the center, at least in visible light. However, the center of our galaxy can be observed in radio wavelengths. The picture of the center of our galaxy that is emerging is one of immense activity, fantastic energies and large explosions. It appears as if the center of the galaxy has just recently exploded, an event not anticipated by most theorists.

Radio astronomy is also responsible for the detection of a majority of the over 50 complex molecules that have been found in the galaxy. Most of these molecules emit radio energy at certain well-defined frequencies. The detection of the signals not only determines what molecules are present, but also its concentration. The types of molecules found so far have ranged from water to amino acids, which are the basic building blocks of life. The ultimate aim of this research is two-fold--to answer the question of how life began on the earth and to determine if there is life, particularly intelligent life, anywhere else in the universe.

Infrared astronomy faces somewhat different problems than radio or optical astronomy because the atmosphere absorbs a great deal of infrared radiation. There are only a few windows in the atmosphere in the infrared region. This means that most observations must be done from high flying aircraft, balloons, and satellites. The other problem that is experienced is one of detector sensitivity. Infrared receivers are sensitive, obviously, to infrared radiation. Unfortunately, all objects emit infrared radiation to some extent unless they are cooled to almost absolute zero. Therefore the infrared receiver will detect its own radiation, drowning of the desired radiation from space. This means that the entire detector must be cooled to almost absolute zero. This introduces all sorts of problems with brittle metals and equipment frosting up due to its low temperature.

The main thrust of research in this area is in determining the evolution of stars and galaxies, and the place of gaseous clouds in galactic evolution. Theories of evolution of the universe also predict certain distributions of the elements which can be detected in the infrared.

Ultraviolet astronomy has the same problem with atmospheric absorption as infrared astronomy but not to the same degree. Ultraviolet astronomy is used for observations of extremely hot young stars and hot emission nebula to determine their properties and evolution. The techniques used are not as stringent as those for infrared astronomy. Low temperatures are not required but glass cannot be used anywhere because it absorbs the ultraviolet that we are trying to detect. The more expensive quartz lenses must be used every where instead. Some of the interesting areas of the ultraviolet spectrum can only be observed from satellites. Fortunately there are several satellites now in orbit that carry ultraviolet telescopes.

This leaves X-ray and gamma ray astronomy to be discussed. Most people would not even recognize these telescopes. They do not contain any lenses; are mostly electronics, and have detectors consisting of a large array of wires surrounded by a special mixture of gases called "magic gas" by those who work in the area. Other detectors are huge layers of film that capture the tracks of the particles that passed through them, or large bags of magic gas surrounded by detectors that look for light emissions caused by the interaction of the gamma rays and the gas inside. We shall run into a variation of this technique later. This area of astronomy probes the structure of the galaxy and intergalactic space. This high energy radiation is produced deep in the interior of stars, pulsars, neutron stars and supernovas. This is one area of astronomy that has gained a great deal of interest lately because of its potential to answer a number of basic problems in astrophysics. The major problem facing

researchers is that all of this type of astronomy must be carried out at high altitudes of 50,000 feet or higher. This becomes very expensive when one is using balloons to carry the experiments aloft because the balloons cost \$15,000 and the hydrogen gas used to inflate the balloons costs \$20,000. Unfortunately, the balloons cannot be reused. It takes almost three years to design and build one of these telescopes and over a year to analyze the data utilizing a large computer.

This covers the electromagnetic spectrum as far as astronomy is concerned, but there are other areas of astronomy that don't even use electromagnetic radiation to gather information. Although these areas do not belong in a discussion of astronomy in invisible wavelengths, these areas are very interesting and in some cases so new that most people have not even heard of them. One of these areas is cosmic ray astronomy which studies subatomic particles ejected from supernovas, pulsars and exploding galaxies at speeds near the speed of light and at very high energies. This area of research provides information not only on astronomical phenomena but also the very basic physics of sub-nuclear particles. These detectors are similar to those used in gamma ray astronomy because the phenomena are related. Again, all observations must be carried out above the earth's atmosphere. The other two areas are even less well known.

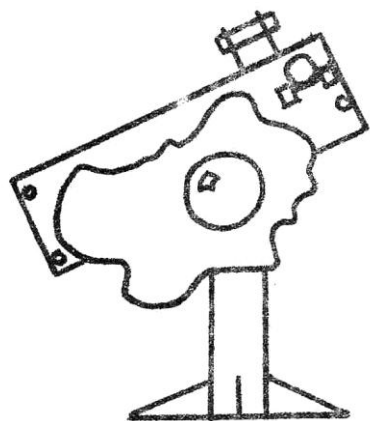
Neutrino astronomy has only been in existence for the last eight years. Neutrinos are mass less particles that travel at the speed of light that are produced by the very nuclear reaction that keeps our sun alive. Neutrinos are emitted by the billions every second from the sun. However, they rarely interact with anything. For example, it would take 26 light years of lead to stop half of the neutrinos emitted from the sun. Since these particles do not interact with anything very easily, they are very hard to detect. The one and only continuously operating neutrino telescope is located over a mile underground in an abandoned silver mine. It uses the mile of earth as shielding against all of the other particles that constantly rain down upon us from the sun and the universe. Only neutrinos can reach that far down into the earth. The telescope consists of a tank containing 100,000 gallons of a simple cleaning compound that is rich in chlorine. One detects the neutrinos by their occasional interaction with a chlorine atom producing a radioactive argon atom. The tank is flushed once a month to collect the argon and count the number of radioactive argon atoms. Of the billion of neutrinos passing through the tank every month only 4 or 5 neutrinos interact with a chlorine atom to form argon. The job of detecting these neutrinos has been compared with the following task: Replace all of the water falling over Niagara Falls with a particular type of grass seed that produces one million seeds per pound. Of all of those seeds falling over the falls every second, find one red seed. But this area of astronomy is considered commonplace compared to the last area of astronomy to be discussed. It is referred to as gravitational astronomy. This branch attempts to detect gravitational waves emitted by the most massive objects in the universe. These telescopes are even more bizarre looking than neutrino telescopes. Gravitational telescopes are usually made of two ton blocks of solid aluminum. A gravitational wave is detected by the minute vibrations it should set up in the block. This method is so new that many astronomers are not convinced that the detectors work at all. The nature of gravitation is not even well established. These detectors are capable of deciding between several different theories that compete with general relativity. Potentially this is the most rewarding area of astrophysics. As the field matures and the data becomes more reliable, this field will become the fastest moving most publicized area of science. It alone has the potential of answering questions like how did our universe start and where it is going, or what is the actual structure of space, itself and its relation to the nature of time.

These are certainly interesting areas of astronomy and show that we can learn more about the universe by studying the heavens in both the visible and invisible light reaching us.

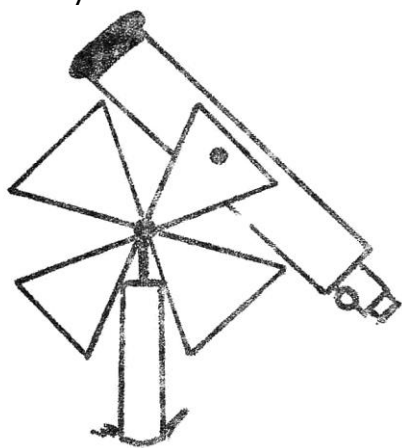
SCHEMINGS FOR ATM'S

By
Kenneth Wilson

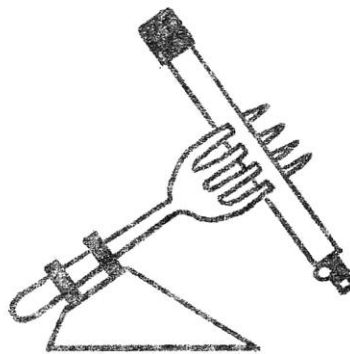
One of the biggest decisions that the Amateur Telescope Maker must make is that of choosing a mounting for his telescope. There are many conventional mountings to choose from, but the true ATM is never satisfied with the conventional. Our relentless W.A.S.P. sources (Jack Anderson, eat your heart out!) have uncovered some sketches for new mounting designs that Edmund has been trying to keep secret. These mountings are so simple that the boys down at Edmund were afraid that every ATM would make one at home instead of buying the more expensive and inferior Edmund mounts. Remember, you saw 'em first in the W.A.S.P.!



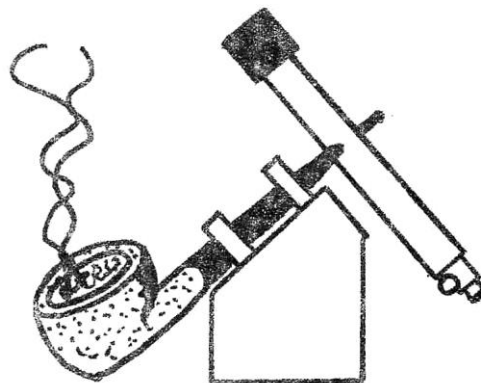
THE YOKE MOUNT-For the observer who likes to "have his mount and eat it too". Frank McCullough suggests that you get someone else to buy the egg for you-that way, and I quote, "The yoke won't be on you!"



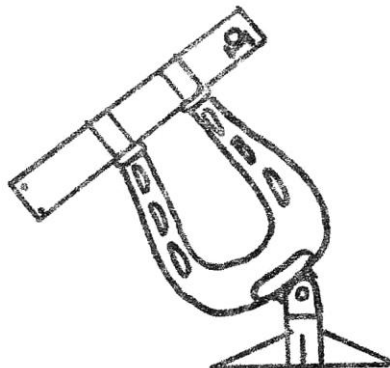
THE GERMAN EQUATORIAL MOUNT-It is rumored that the design for this mounting was smuggled into the country along with plans for the V-2 by a colleague of Werhner Von Braun.



THE FORK MOUNT-A real "meat and potatoes" mounting. You might have to buy the fork in a set; in which case, the spoon will make a fine RFT mirror and you can hack the knife up into flats and knife edges for Foucault tests.



THE PIPE MOUNT - Once you try this mount, you'll never want to quit. I'm told that "Prince Albert" causes the least convection currents, but contacts in the San Francisco Sidewalk Astronomers claim that some of the Mexican imports produce "'far-out sights".



THE HORSESHOE MOUNT-A favorite of many blacksmiths, this mounting will take a lot of horsing around. It was originally designed by Porter, Sidney not Russell (Sidney was Russell's weird brother.)