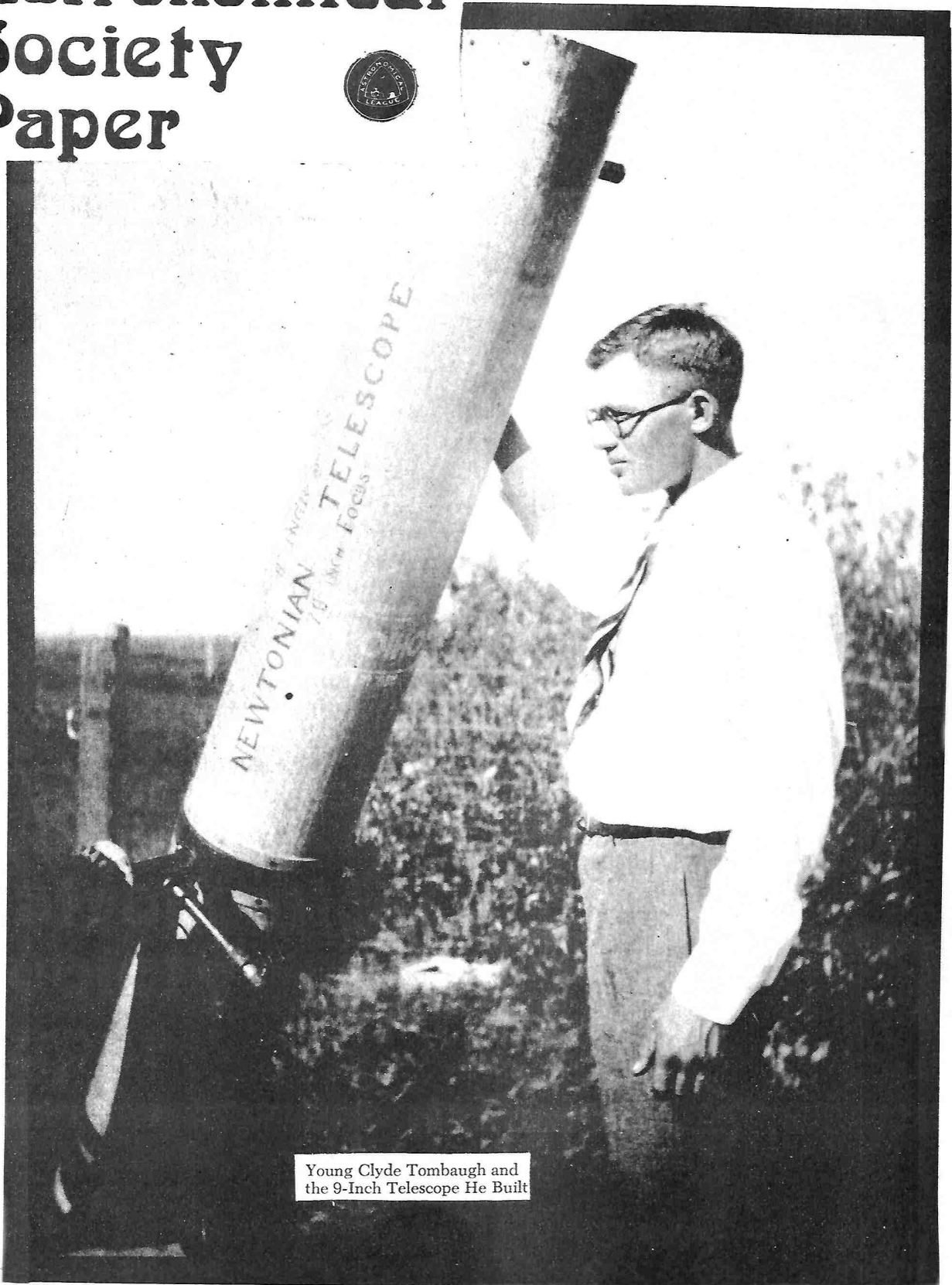


Warren Astronomical Society Paper

April 1976



Young Clyde Tombaugh and
the 9-Inch Telescope He Built

The Warren Astronomical Society (W.A.S.) is a local nonprofit organization of amateur astronomers. Membership is open to all interested persons. Annual dues are as follows: Student K-12 \$3.00, college \$5.00; Senior Citizens \$7.50; Individual \$10.00; Family \$15.00. Add \$6.00 for a one year subscription to Sky and Telescope magazine. Meetings of the W.A.S. are held on the first Wednesday and third Thursday of every month (see Cosmic Calendar).

The Warren Astronomical Society Paper (W.A.S.P.) is published monthly for the membership of the W.A.S. Subscriptions and advertisements are free of charge to all members. Non-member subscriptions and advertisements are available upon arrangement with the editors of the W.A.S.P. Contributions, literary, artistic or otherwise, are always welcome and should be submitted to either of the editors, before the first Thursday of the month deadline.

EDITORS:	Garry Boyd (839-0973)	Raymond Bullock (879-9458)
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The editors of the W.A.S.P. will exchange copies of this publication for other astronomy club publications on an even exchange basis. If your club would like to participate in such an exchange, please contact one of the editors. The Warren Astronomical Society maintains contact, 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 SOCIETY

THE KALAMAZOO ASTRONOMICAL SOCIETY

THE M.S.U. ASTRONOMY CLUB

THE MIAMI VALLEY ASTRONOMICAL SOCIETY

THE OGLETHORPE ASTRONOMICAL SOCIETY

THE ORANGE COUNTY ASTRONOMERS

THE PEORIA ASTRONOMICAL SOCIETY

THE SAINT JOSEPH COUNTY ASTRONOMICAL SOCIETY

THE SUNSET ASTRONOMICAL SOCIETY

Other organizations are invited to join this list.

Club News...

Lou Faix has just completed the renovation of his 10 inch telescope. Lou's new mount is of the fork type, and employs one 8" Fatus gear on the polar axis. I must say lou's new telescope mount certainly reflects his good engineering sense. Now will you take to the convention, Lou!

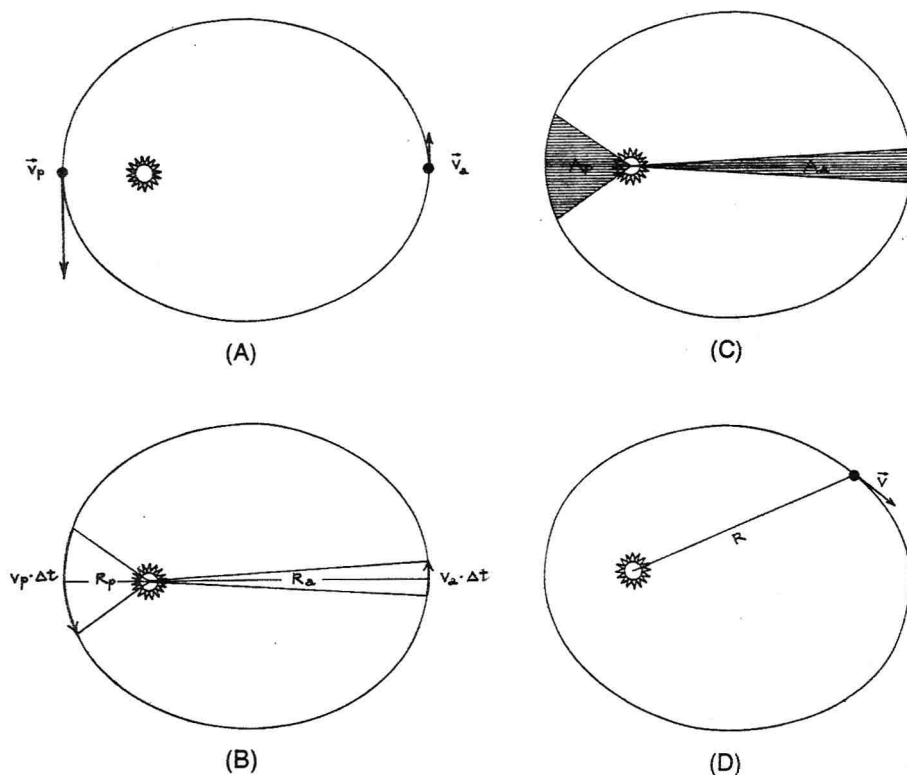
Garry Boyd has just purchased a 16 millimeter Bolex camera, and intends to shoot sunrises and sunsets. "It's quite expensive work", he said, however, the end product is astronomical!

The W.A.S.P. would like to thank Claude McEldery for his contribution to this month's W.A.S.P. Claude's article on Minor Planets is the first ever printed from another club. Claude is an active member in the D.A.S.
Thank you very much.

Don Misson has just purchased a chart recorder, apparently intending to use it in astronomy! Don wouldn't tell me specifically. Misson, we know you have an interest in photometry ...

Well the new mount at Stargate is finished. With the dome control and the whir and click of automatic devices, it really sounds like a professional observatory. Two weeks back, Lou Faix had a group of almost 25 club members. If you're still interested in learning to use the new system call Lou Faix at 781-3338. Also Pete said the new drive should last many, many Moons. Lou said.

"how."



Can you explain this astronomical concept?

Look for the answer in next month's W.A.S.P.!

W. A. S. P. SURVEY RESULTS

Below is a vote by vote account of the results of the W.A.S.P. survey which appeared in all 100 copies of last month's edition. I would like to thank the EIGHT people who showed enough interest to respond. Such support is indeed gratifying.

LIKES/DISLIKES	Like	Dis.		Like	Dis.
W.A.S.P. covers	8		A.T.M.	6	1
Cosmic Calendar	7		Consumer Report	5	1
Club News	7		Headlines/Illus.	5	1
Planetarium Guide	4	2	Comics	8	
Sky Calendar	6	1	Articles	8	

WAYS TO REDUCE PRINTING COSTS/INCREASE REVENUE.

Single-space all articles	5 YES 3 NO
Piggy-back articles	5 YES 3 NO
Charge non-members for each issue	5 YES 3 NO
Sell space to advertisers	5 YES 3 NO

COMMENTS.

- "More astrophotography"
- "More articles for the beginning astronomer"
- "Pictures and articles on astronomy"
- "Drop Sky Calendar"
- "Print covers on cheaper grade of paper"
- "More about Observatory (Stargate)"
- "Hear from more people in the newsletter"
- "More technical articles"

What is being done to the W.A.S.P.:

Cosmic Calendar has been dropped, researching for it is very time consuming. Planetarium Guide will probably go. Single-spacing may become more evident.

You want more articles on astrophotography and for beginning astronomers?? Perhaps you'll find someone who will write on those subjects for publication.

THIS WAS more than a simple survey, it was a psychological test. I found out that only EIGHT people out of the club care to support this paper. Considering the hours of work that Garry Boyd and I put into this paper each month, EIGHT responses really motivates me to continue producing.

Effective May 20, 1976; I resign.

I hope Garry will stay on long enough to make use of the changes the survey suggested.

Sorry. Warren Astronomical Society, you failed the test. We both did.

Raymond Bulloch

PLANETARIUM GUIDE

APR.
1976

-R. Bullock



McMath, Cranbrook. Indian Sky Lore. The program begins with an exploration of the current night sky visible from the Detroit area. Those same constellations are explained as the different American Indian tribes saw them. The Indians' "Big Bear" didn't look like the one we know today. SUNDAY 2, 3, 4 p.m.; WEDNESDAY 4 p.m.; SATURDAY 2, 3, 4, 7:30 p.m. HULBERT OBSERVATORY opens for the season. Look through the 1927 6" refractor. Fifteen people per half hour, \$1 per person. Three objects will be shown. CLEAR Saturday nights only. Call 645-3210 for details.



LONGWAY, Flint. Project Viking. The program profiles the flight plan and experiments of the two Viking space probes, designed to land on Mars and conduct geological, meteorological and biological experiments for 90 days. "PROJECT VIKING" will also chronicle the past studies and space probes of Mars. The program concludes with the landing of Viking on the planet. FRIDAY 7:30 p.m.; SATURDAY & SUNDAY 1, 2:30, & 4 p.m. Admission is 25¢ for students, 50¢ for adults. See September 1975 W.A.S.P. for more information.

PROJECT VIKING begins on APRIL 23.



ABRAMS, East Lansing. Women of the Night. It's not what you think! This is a long awaited program focusing on the impact that women have had on astronomy over the past century or so. How is Caroline Herschel related to William? What great discovery did Jocelyn Bell make? There's more to astronomy than Sagan and Hoyle! SUNDAY 2:30 & 4 p.m., FRIDAY & SATURDAY 8* & 10** p.m. MSU Observatory is open, 3rd Saturday. *"Tonight's Sky" follows 8 p.m. show. **Quadrasonic album follows 10 p.m. show. For more information, see the October 1975 W.A.S.P.



CHAFFEE, Grand Rapids. Mars-The Quest For Life. You'll first learn how past observers of Mars were misled by what they saw. Then the historic Mariner photographs are studied, showing a surface of riverbeds and volcanoes. The program ends with the landing of the Viking space craft, and the quest for life it will make. THURSDAYS 8 p.m.; SATURDAYS 3:15 & 8 p.m.; SUNDAYS 2:45 & 4 p.m. Visitors' nights at Veen Observatory resume, on the second Saturday and last Friday of each month through October. For more information, see the November 1975 W.A.S.P.

Astronomy, 1930 Style....

NINTH PLANET DISCOVERED

Clyde Tombaugh was born on a small farm near Streator, Illinois. During his teens, Tombaugh built a nine inch reflector. He constructed his telescope of old farm machinery, this included the drive shaft of a broken down car, and old sections of a worn-out straw spreader.

In November of 1928 Tombaugh made sketches of Jupiter and Mars. Tombaugh was curious as to the quality of his drawings. He decided to send his sketches to the Lowell Observatory in Flagstaff Arizona. His reply was short and to the point, V. M. Sipler said he was much impressed with Tombaugh's drawings. They were excellent in detail and amazingly accurate, he wanted Tombaugh to join the Lowell staff as a photographic assistant.

Tombaugh left his parents farm in January 1929 to seek his new career in astronomy. He had only enough money for a one way ticket to Arizona.

At the observatory Tombaugh photographed areas in Gemini on every clear night, using the 13 inch Ross astro camera. During the day he spent countless hours at the Blink Microscope to compare photographic plates. On January 28th he decided to scan a pair of plates he exposed on Jan. 21, 23 of 1930. He completed only $\frac{1}{4}$ of the total plate by mid-February. On Feb. 18 he began blinking images near the star Delta Geminorum, suddenly he discovered an irregular moving object, it was planet X (Pluto).

For the next hour Dr. Lampland and Dr. Sipler repeated the same checks that Tombaugh had made. They wanted to photograph the area that night to be sure it wasn't a photographic defect on the plate. Tombaugh was so nervous he went to the movies that evening and saw Gary Cooper in The Virginian. A few weeks later news of the discovery of planet X was radioed around the world. Letters and telegrams of congratulations poured into the Lowell Observatory.

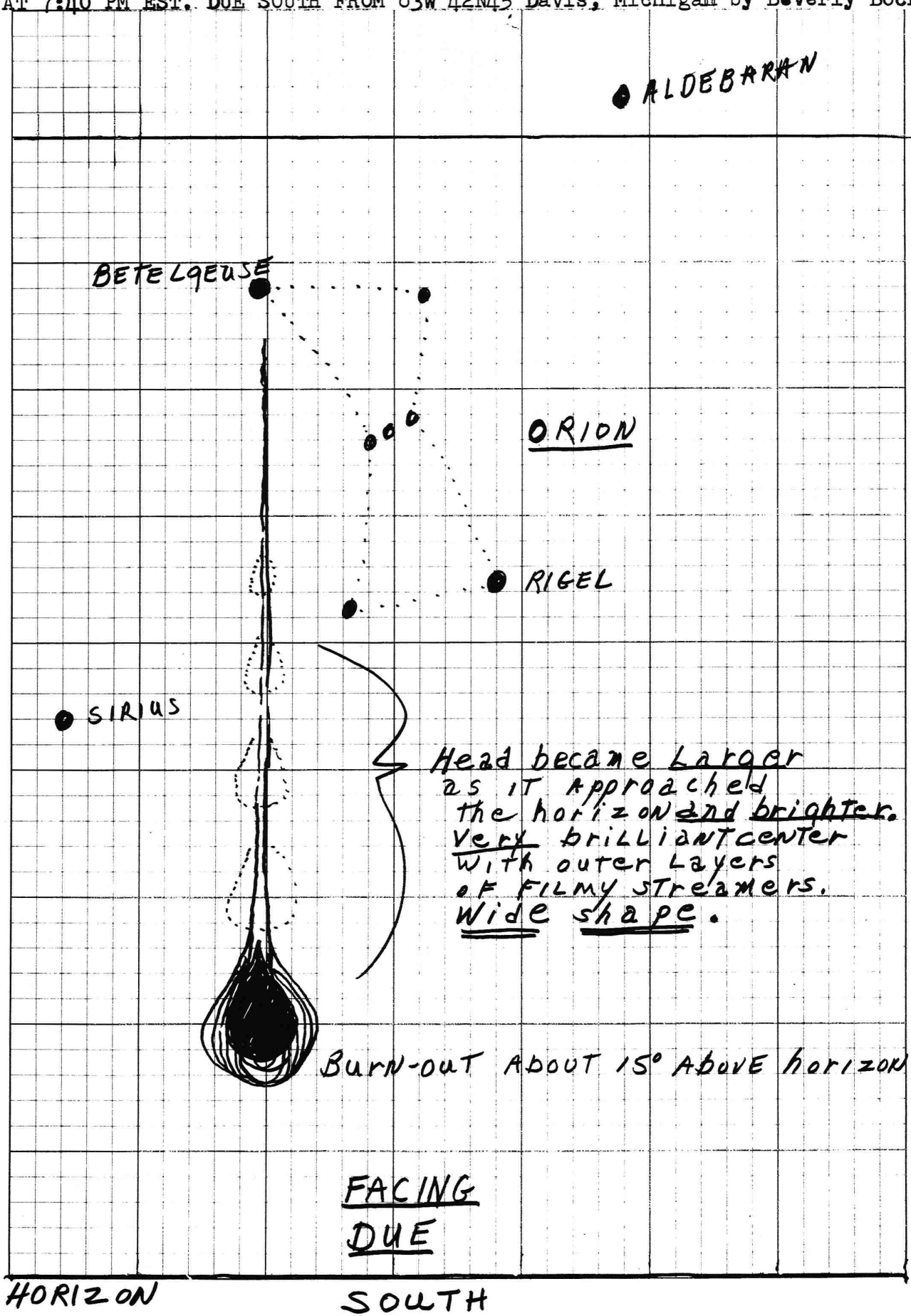
Every day more and more people talked about the new planet. Every evening groups of people gathered outdoors under the stars to scan the sky for the new discovery. Radio announcers and star maps in the newspapers told where to look. All eyes searched for this spot in the heavens where astronomers at the Lowell Observatory in Flagstaff, Arizona, had located our new fellow planet.

"And that's the way it was"

These few minutes of astro-american history is brought to you by the W.A.S.P.

**9th Planet, 'X,'
Is Found by
U.S. Scientists**

NAKED EYE OBSERVATION OF LARGE METEOR SIGHTED FEBRUARY 22, 1976
AT 7:40 PM EST. DUE SOUTH FROM 83W 42N 15 Davis, Michigan by Beverly Bock



PART II: IN THE BEGINNING

by: Frank R. McCullough

Well, now we continue where we left off last month. Astronomy had become my full fledged hobby and I could not get enough - fast enough. I recall the month of January when my scope was not even two weeks old, and I had only seen the moon. I did not know where or what to look for, and the only guide I had was *Star Time* in the Detroit News. I remember reading, "the bright object near the moon tonight is the planet Jupiter." Wow! Here was to be my second object.

That evening I went on a hayride with the sky being very clear, and as the wagon made its way back to the barn, the moon was starting to rise. But still no Jupiter. A few minutes later a bright star broke the horizon. This had to be Jupiter. I figured by the time I got home it would be well up to observe. It was three o'clock in the morning~ and the star was nearly overhead. Yes, I was sure this was Jupiter. I assembled the telescope and set it pointing upward, and got the star in my finder. Looking in the scope was the most breath-taking sight! Here was a ball with four white specks, two on each side. I remember the moon was so close that the sky was a light blue. I looked closer and saw two dark belts and a dark polar area. I was looking at the largest planet in our solar system! I swept west and gazed at that big bright beautiful moon. I was froze, and as I went in I remember a dark haze which lingered in my right eye.

Another first object for my scope was on an evening when I should have been studying for my exam, but went outside instead to observe in 10 degree weather. For some strange reason, I looked at every fairly bright star to see if I could find something of interest. But if you've seen one star, you've seen them all. I looked southwest through some trees and a somewhat bright star lingered out there with a steady dull light. There really was no reason why I should have turned my scope in that direction, but it bugged me, so I looked. What was this - a ball? It had to be a planet. Was it Uranus, Neptune, Venus? What was it? Then I saw a fine line running on either side. It wasn't ... but it was ... Saturn, with a dull yellowish glow! Frank chalks up another major discovery.

I remember my first look at the sun. I set my scope up on the sun porch, and opened the door so I could stay warm and still observe.

And so my early observations came to a close. The planets and moon were my nightly companions, and there was so much else up there. Yet I knew nothing of the constellations and how to find other objects. I bought a book called "Stars", a little paperback, and started learning on my own. I soon moved, and my advancement with finding nebulae and galaxies was still nowhere to be found. I looked and swept, and bought magazines, and saw glorious pictures showing where, near certain constellations, these objects could be found. I turned up nothing. The great "realm of the galaxies" ... I looked, expecting to see swarms of galaxies. Nothing but frustration. But why wasn't I seeing anything as I looked up into a mint green sky?!?

In high school I met a special friend who I owe a lot to as far as leading me into the right direction in astronomy. He had a two inch refractor and wanted to get together to observe. We talked astronomy and got to be very close buddies. One day he told me of finding out that a Mr. Trott was head of a group called the "Warren Astronomical Society." He had called, and was referred to a Mr. Alyea. The group met at Warren Lincoln High School. He asked if I would like to go to a meeting. Needless to say, I accepted the invitation.

I was thrilled. I thought school would never end that day, and he got permission to use his parents' car. We left with much gusto. I had pictures of my 4½" reflector, which I was sure still was the fifth largest telescope in Michigan. It definitely was bigger than my buddy, Dave Atnip's 2" refractor. Oh, how I would boast, but of course still be modest, about the large size of my instrument. When we got there, we could not find the room. But by the time we hit the second floor, we asked some kids who were running track in the hallways, who told us to see the janitor, who lead us to the room.

We walked inside and there were about 12 people milling in the center of the room. Some were carrying large hunks of glass, and talking to a distinguished gentleman with grey hair, as he held the glass up to the light, while a younger boy waited for a reply from this man. Straight ahead was a man, short hair cut, pleasant looking, standing behind the teacher's desk. This must be the gentleman we should introduce ourselves to. The first thing I felt was being out of place. Just finding that these people were friendly would be a big help. He seemed to notice our hesitancy, because he broke his conversation and asked if we were here for the astronomy meeting. We said, yes, of course, and he welcomed us. We chatted for a short while, and then he told us to make ourselves at home as he got everyone quiet to start the meeting.

The evening proceeded with the business session, which I knew nothing about and I guess I really didn't care to, because I was still an outsider. They showed a NASA movie which was very stimulating, and revived me from the business part. Mr. Polus (the gentleman we had talked to) showed some moon pictures he had taken on 8x10 black and white, and then Mrs. Alyea told of the coming camp-out to be held on the first quarter moon at Bald Mountain. This sounded like great fun, and Dave and I both agreed we would definitely like to attend.

A question was asked. Where do you look to find the Ring Nebula, and can you find it in an amateur instrument? Mr. Polus was a little hesitant to answer, but the young gentleman with the grey hair strode up to the chalkboard and drew a constellation named Lyra, the Harp. He showed how between these two stars the Ring was to be found. He even drew a little "donut" to show how it looked. My first question was raised, "What size telescope should you use to find this object?" He answered that a 6" was a big enough telescope to pick it up in. CRUSH! I felt sick in the stomach. Here were kids carrying 6" mirrors in their hands, and the President is taking pictures through an 8" telescope. I find out my telescope, the biggest in the Wards' catalogue, is nothing but a toy.

How do you tell your mother and yourself you don't have the fifth largest telescope in Michigan?

One nice thing did happen to end the evening. They had a 12½" Cassegrain on the roof of the high school. We had refreshments and went upstairs into the W.A.S. observatory, a great giant dome with a giant telescope. Someone pushed a button and the slits opened up. This was the frosting on the cake. I had to look. We saw Mars that evening, which boiled in the evening air, but I was not disappointed. I blabbered all the way home. It was a thrill! The next meeting was in two weeks. I had three things to look forward to: 1) the end of two weeks, 2) the camp-out, and 3) I would defy the laws of nature - I would find the Ring Nebula in my Tasco 4½" telescope!

So we now end Part Two of this thrilling story. You now should realize what a green amateur I was, and what simple little things can bring you the most exciting and memorable feelings. And how even the person who works and has been involved in a club for some time, has gone at one time in his or her life, through the basics and beginnings of astronomy and a club. And knows how it is to be a stranger, just needing a friendly "hello" and welcome, and making you feel you belong.

The learning and friendship of other people came with time. To my friend, Dave, who made only three or four meetings after that, I say "thank you" for giving me the break I needed to get my ambition towards astronomy on the right track. For Dave, his hobby turned out to be singing in churches with a girl he was going to marry, and furthering himself in religion. Me, well, I went "Coo-coo for Co-Co-Puffs."

NEXT MONTH . . PART III: The Camp-out.

Bald Mountain excursions with Dave.

I find the Ring Nebula!

A.T.M. for the Frantic Fringe!

"A Foucault-apparatus based on the principle of kinematical design."

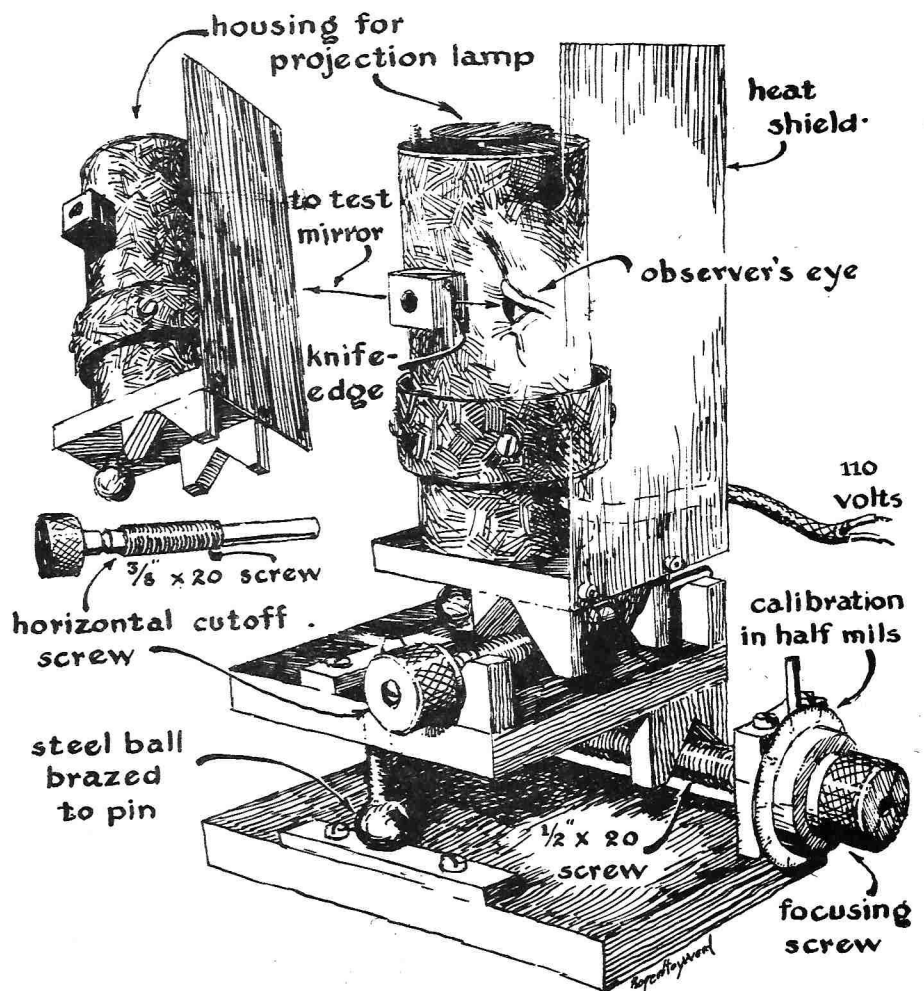
Garry Boyd

In making a reflecting telescope the amateur first grinds one disk of thick glass on top of another with successively finer grades of abrasive between. The grinding action is such that the upper disk of the pair develops a slightly concave spherical surface. This surface is polished on a lap of filtered pitch charged with rouge and then, by continued polishing, deepened toward the center just enough to transform the sphere into the desired paraboloid.

In most small telescopes the difference between the sphere and paraboloid amounts to only a few millionths of an inch. For measuring such fine dimensions the amateur uses a remarkably primitive instrument first suggested by the French physicist Léon Foucault. Basically the device consists of an artificial star and the edge of a knife. Foucault's star was merely a pinhole illuminated by a candle. Rays from a pinhole situated adjacent to the center of curvature of a spherical mirror come to focus at a point directly

opposite the pinhole on the other side of the mirror's optical axis. When the eye is placed behind the focus, the spherical figure appears flat. If a knife-edge is passed through the focus, the disk darkens uniformly. But any departures from the true sphere deflect the rays so that the departures appear as hills or valleys magnified about 100,000 times. Most amateurs prefer to work with more sophisticated versions of Foucault's apparatus, although the truly patient fellow can get along with the classic setup. C.N. Fallier of N.Y. built a kinematic version of the instrument.

(over)



An amateur's apparatus for the Foucault knife-edge test

A.T.M.

"Like numerous other amateurs," he writes, "I have read reams of literature on grinding, polishing and figuring mirrors for reflecting telescopes. While most of these papers have been manifestly clear as to the mirror itself, the Foucault knife-edge tester is invariably dismissed as a rudimentary device usually described as a tin can with a lighted pinhole and a movable knife-edge fitted to a hand-drawn scale.

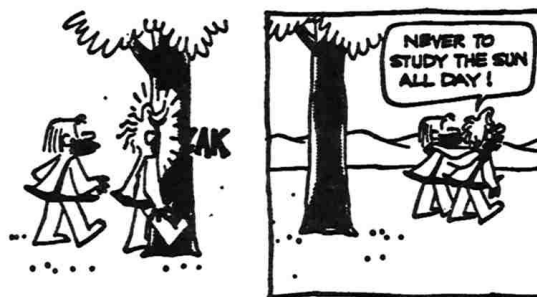
"After many attempts (with as many failures) to make accurate measurements with such home built testers, I decided to make the job easier for myself. My design uses a light bulb, pinhole and knife-edge, and so does not depart in essentials from Foucault's arrangement. But I have combined them in a stable mechanical assembly which is convenient to use, easy to make, and which yields highly reproducible measurements.

"The device resembles the compound rest of a lathe but is based on the principle of kinematical design described by John strong in his Procedures in Experimental Physics. This principal states that a body must have at least six minus n points in contact with a second body if it is to have only n degrees of freedom. The screw for advancing the carriage in the direction of the mirror has been accordingly provided with five points of contact with respect to its reference body, the base. This is accomplished by beveling one arm of one of the two V-notches in which the screw rides. The bevel engages the annular V-groove of the screw shaft and accounts for two contacts. The un-beveled arm of the same V-notch makes the third contact with the screw. The flat arms of the remaining V-notch provide the remaining two for a total of five contacts. Thus the screw has one degree of freedom, that of rotation.

"The only machine work involved in its construction was the removal of threads. All other work was accomplished with a hacksaw, file and drill. The light source is a conventional incandescent bulb of the type used in sound heads of 16mm movie projectors. The beam is deflected at a 90° angle by a prism beam splitter. A piece of ground glass is mounted between the lamp and pinhole to prevent a magnified image of the lamp filament from appearing at the focus."

B.C.

By John Hart



By permission of John Hart and Field Enterprises, Inc.

Minor Planets...

By Claude McEldery – March 10, 1976

Observing Minor Planets

For several years now I have been engaged in observing Minor Planets, also known as asteroids. It was expressed to me that an article on observing these objects might be of interest to some of you observers out there.

If you want to be serious about watching these objects it would be best to obtain a good star atlas such as *Atlas Eclipticalis*, in which stars to $9\frac{1}{2}$ magnitude are plotted. With an atlas of this type you can plot positions of asteroids that you find with great precision. Of late, after much practice and refinement of my methods I have been able to measure positions to an accuracy of 3' declination and $\frac{3}{10}$ minute of right ascension. For positional monitoring of Minor Planets I think this quality of the observed positional data should be strived for. Don't let this scare you from observing them though.

Positional data on Minor Planets is one area where Amateur Astronomers can play an important part in the field of astronomy. It is seldom that the large observatories of the world have time to devote to Minor Planets unless they are of unusual interest. By monitoring these objects, amateurs can alert astronomers to errors in the published ephemerides, published magnitudes, or other data that can only come from observations. In the past, amateurs have reported important information on light variations and rotation periods of Minor Planets. If you would like to become a part of this program I suggest you consider joining the Minor Planets Section of the Association of Lunar and Planetary Observers (A.L.P.O.). For a \$3.00 fee you get to become a member of the section and receive the quarterly news bulletin. If you think you would be interested send \$3.00 to: Professor Richard G. Hodgson, Dordt College, Sioux Center, Iowa 51250.

Another publication that is very useful is "Tonight's Asteroids". In "Tonight's Asteroids", published bi-monthly, Dr. Gunter has plotted Minor Planet positions in the sky on Hans Vehrenberg's Photographic Star Atlas and shows the path of the asteroid in question for perhaps two months near the

By Claude McEldery - March 10, 1976
Observing Minor Planets (Continued)

time of opposition. This publication is free for a long, stamped, self addressed envelope. If you don't know where to find the asteroid, these charts are a must. Send your long, self addressed, stamped envelope to: Dr. J.U. Gunter, 1411 North Mangum Street, Durham, North Carolina 27701. He will send you his next issue which will also contain a lot of information about the minor planets; such as names, orbital information, size, shape, etc.. He even gets into the Greek Mythology of some of the names. That is practically a whole field in itself. He also supplies tracking charts and other information on comets such as Comet West (1975n). This is one of the best bargains left in this old world of ours. The next issue will be coming out towards the end of April.

In regards to equipment that you need the following is recommended. I suggest at least a 6" telescope. However, a few can be seen with only binoculars. 1 Ceres and 4 Vesta belong to this group. Vesta can be as bright as 5.6 M_v while Ceres can reach 6.5 M_v near a perihelion opposition. These asteroids won't reach opposition again until 1977.

I suggest you begin by looking for 3 Juno, which is located in the constellation Leo for the next few months. 3 Juno has a diameter of approximately 140 miles, and orbital period of 4.36 years, and inclination to Earth's orbit of 13 degrees, and a rotational period of 7 hours 12.8 minutes. It was discovered in 1804 September 1 at Lilienthal, Germany, by Karl Ludwig Harding (1765-1834).

This year opposition fell on Feb, 29th at which time it shown at 9.1 M_v . In the beginning of April it will be approximately 9.5 M_v . On April 2nd look in Leo about $5\frac{1}{2}^\circ$ southeast of Regulus. If you have a star atlas with 44 Leo (6 M?) on it you are in luck. Put your scope on 44 Leo, preferably with a 1° field of view, and 3 Juno should be in your field of view for approximately 2 days either side of this date. Juno will pass to the east of this star traveling northwest. If you put 44 Leo on the western edge of your field of view you should be able to pick it up a day or two earlier. Likewise you can follow it a couple of days longer if you put 44 Leo at the south edge of your field of view after April 2nd. On April 22nd it will be about 2/3rds of the way from Regulus to 3.8 magnitude Rho

By Claude McEldery - March 10, 1976
Observing Minor Planets (Continued)

Leo. Its coordinates on that date are 10h 21.9m, +100 37'; and shining at 9.9 M_v . Good Luck!

If you have success with 3 Juno, there are about 4 more Minor Planets that will reach opposition magnitudes greater than 10 this year. So if you miss this one you will have another chance.

It demands a lot of patience, and don't expect success the first day. These asteroids are completely star like in appearance so it takes a few days of tracking to be certain you have it. If you want to develop your skills as an observer though, I highly recommend it. Good luck, and happy asteroiding.

Construction of URANIBORG started 400 years ago in 1516. This was to be Tycho Brahe's great observatory, where he would spend the next 20 years observing the heavens. URANIBORG was built on the Danish island of Hveen, under the Patronage of Frederick II. Frederick's successor, Christian IV, found Tycho to be so arrogant and extravagant, he withdrew his support. In 1591 Tycho was forced to leave Denmark. He went to Prague where he spent the rest of his life going over the data he'd accumulated. One year before his death he found an assistant, a man named Johan Kepler.

