

THE WASP



The Journal of the Warren Astronomical Society

APRIL, 1972

TABLE OF CONTENTS

	PAGE
COVER STORY.....	2
NEWS ITEMS.....	3
CONSTELLATION OF THE MONTH	4, 5
DID YOU SEE THE MOON	6
THE POET'S CORNER	7, 8, 9
THE ASTOUNDING OBSERVATORY OF BALNIBARBI.....	10
THE OBSERVER'S LIBRARY	11
SOME USEFUL FORMULAE FOR AMATEUR ASTRONOMER	12
OBSERVATIONAL ASTRONOMY	13, 14
Astro-Almanac	15

COVER BY: Ken Wilson, see story on page two

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The W.A.S. holds correspondence (sometimes intermittently) with the following organizations. Others are welcome to join this list:

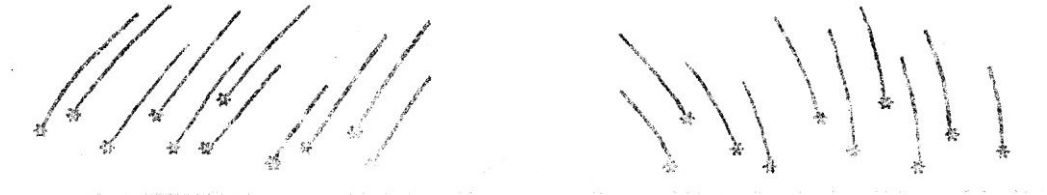
Detroit Astronomical Society, Detroit Observational and Astronomical Association, Jackson Astronomical Society (Mississippi), Kalamazoo Astronomical Society, Astronomical League.

COVER STORY

By

Kenneth Wilson

Our cover this month is a well known block-cut of the famous Leonid meteor shower of 1833. These “shooting stars” were described as falling as “thick as snowflakes”. Hourly rates ranged up to 30,000 meteors an hour, for this shower that was visible over North America from Halifax to the Gulf of Mexico. Many superstitious observers were certain that the final doom of the world had arrived. More scientific observers included a Professor Olmstead of Yale University. He observed that the meteors seemed to originate from a radiant point in the constellation Leo. From this he concluded, correctly, that the meteors must be traveling in parallel paths from a point several thousand miles up above the earth. These were among the first scientific observations of meteors. On the evening following this great shower, a farmer is said to have gone outside to “see if there were any stars left in the sky”. Thirty years later in 1866 a similar Leonid storm was seen. This led to the discovery that the Leonids were associated with debris left in orbit by comet 1866 I that was observed the same year. It was found that every thirty-three years (approx.) the earth, in its orbit, passes through the main swarm of particles left by Comet 1866 I. In between years of the Leonid maximum, Leonids are usually quite sparse. The most recent maximum of the Leonids was in 1966 on the night of November 16th. The most favorable spot for this shower was at Kitt Peak Observatory in Arizona. Observers there saw meteors falling at a rate of up to 150,000 per hour, although accurate became impossible when this point was reached. The more detailed account of this shower that appeared in the August, 1971 W.A.S.P. is bound to make the amateur astronomer’s mouth water. If you can take the cover illustration and imagine five times as many meteors streaking through the sky, your mind’s eye might begin to picture what the people at Kitt Peak saw on the evening of November 16th, 1966. Personally, I would settle for half the amount seen by the bedazzled observers on the cover.



NEWS ITEMS

by

Kenneth Wilson

MONSOONS ON MARS

Photographs of Mars taken by the U.S. space probe Mariner 9 have shown it to be covered by huge, dry, twisting gullies and canyons. These unexpected formations have raised many questions as to their origins.

Bradford A. Smith of New Mexico State University has proposed a theory to answer some of these questions. He believes that during the 25,000 year precession of the polar axis of Mars (now tilted at 48° from perpendicular to its orbital plane), the axis reaches a point where it is at a 90 angle from its orbital plane. When this occurs, both of the Martian polar caps receive equal amounts of sunlight. This could cause the polar caps to simultaneously melt during the summer season, releasing large amounts of water into the atmosphere. This water could cause storms as large as monsoons for periods of up to several millennia. These "monsoons" could account for the eroded features photographed by Mariner 9.

Mars-bound astronauts from earth and L.G.M.'S (Little Green Men) do not have to worry; however, because it will be 10,000 years, until the axis of Mars is tilted enough for the Martian monsoons to begin again.

MESSAGE TO THE STARS

On March 2, 1972 the U.S. launched its first unmanned spacecraft, Pioneer 10, for Jupiter. When it reaches Jupiter, if nothing goes wrong, we will be getting back our first close-up pictures of Jupiter and perhaps one of its satellites. Pioneer 10 will also send back data on such things as the radiation belts and magnetic fields of Jupiter. After collecting and relaying data from Jupiter, the space probe will be catapulted by the slingshot effect of Jupiter's gravity, into interstellar space. It will be the first spacecraft ever to do so.

Perhaps equally interesting, is the message that is to accompany Pioneer 10. Two Cornell astronomers, Carl Sagan and Frank Drake, have designed a 6"x9" aluminum plaque anodized with erosion-resistant gold, on which is etched a message in a universal language that should be understood by any intelligent civilization that finds it. Illustrated on the plaque are: two representative humans, male and female with the male's right hand raised in gesture of friendship; a diagram of our solar system denoting our planet and the representative positions of the other planets; the path of the Pioneer spacecraft on the diagram of the solar system; a diagram of the Pioneer 10 spacecraft for comparative size for the two human figures; a diagram showing the change of an electron in a hydrogen atom from one energy state to another, thus producing a radio wave with a wavelength of 21 cm., which is the basic unit used in binomial notation elsewhere in the plaque; and, a diagram showing (in binomial notation) the pulse rates of certain Pulsars. By calculating how much the pulsars have slowed in their pulse rates and the rates at which these pulses slow, the finders of the plaque could calculate when the spacecraft was launched.

The results of this message will certainly be interesting, especially if Pioneer 10 is returned to earth marked postage due.

HISTORIC NOTE

In his book The Orbs Around Us, published in 1906, Richard Proctor, an English astronomer, tells an interesting story about an astronomer who was almost killed in a freak accident while observing at the Greenwich Observatory. The observer was peering through the telescope while lying in a prone position in an observing couch that was attached to the floor. While concentrating on his observing he did not notice that the clock drive was slowly turning the eyepiece end of the telescope down and slowly pinning him to his seat. By the time he noticed that the pressure on his eye was increasing, it was too late.. He could not move his head, and thus was unable to shut the clock drive off. Luckily his shouts for help were heard and he was freed from imminent serious injury or even death. I don't think the most imaginative novelist could design a more horrible torture for an astronomer.

CONSTELLATION OF THE MONTH

By Frank McCullough

LEO-----The Lion

LOCATION—A line drawn from Pollux in Gemini to γ Cancri, prolonged about 12° , locates the 1st magnitude star, Regulus, in the heart of the Lion.

Regulus lies about 9° east of Cancer and about 12° northeast of Alphard in Hydra.

MYTHOLOGY

Neath her hind feet as rushing his prey
The lordly Lion greets the God of day.

-Aratos

Leo is an extremely ancient constellation. From the earliest time it has been associated with the sun.

According to Pliny, the early Egyptians worshipped the constellation Leo because the Nile inundation occurred, in ancient times, when the sun entered this constellation.

Some believe the Sphinx represents Virgo's head on Leo's body.

The name Regulus, borne by the star α Leonis, means the "Little King". The star was named by Copernicus. It has also been called the "King", the "Mighty", the "Great", the "Hero", the "Ruler".

The early Persians regarded Regulus as one of the four Guardian stars of Heaven, the others being Formalhaut, Aldebaran, and Antares.

Four thousand years ago the longitude of this star was measured in Babylon, and two thousand years later by Hipparchus. Later on, his observations of Regulus and Spica led to his discovery of the precession of the Equinoxes.

The figure of Leo, very much as we have it, appears in all the Indian and Egyptian zodiacs.

FOR the TELESCOPE

The telescopic feature of the constellation is the double star γ Leonis. It is best observed when it is not quite dark, or in moonlight. The colors of the two stars are

yellow and green. This star is a well known binary in very slow motion. A complete revolution can hardly take less than 1000 years!

Regulus has a companion of the 8th magnitude, a little less than 3' of arc distant, which shares the proper motion of its primary. It is a double star with a separation of 3". Miss Clerke mentions its color as "seemingly steeped in indigo". It is a difficult object for a 3" telescope.

Note the double 35 Sextans. 6.3-7.4, Distance 6".

Note the nebula M-65 and M-66, large and brilliant, a double nebula in large telescopes.

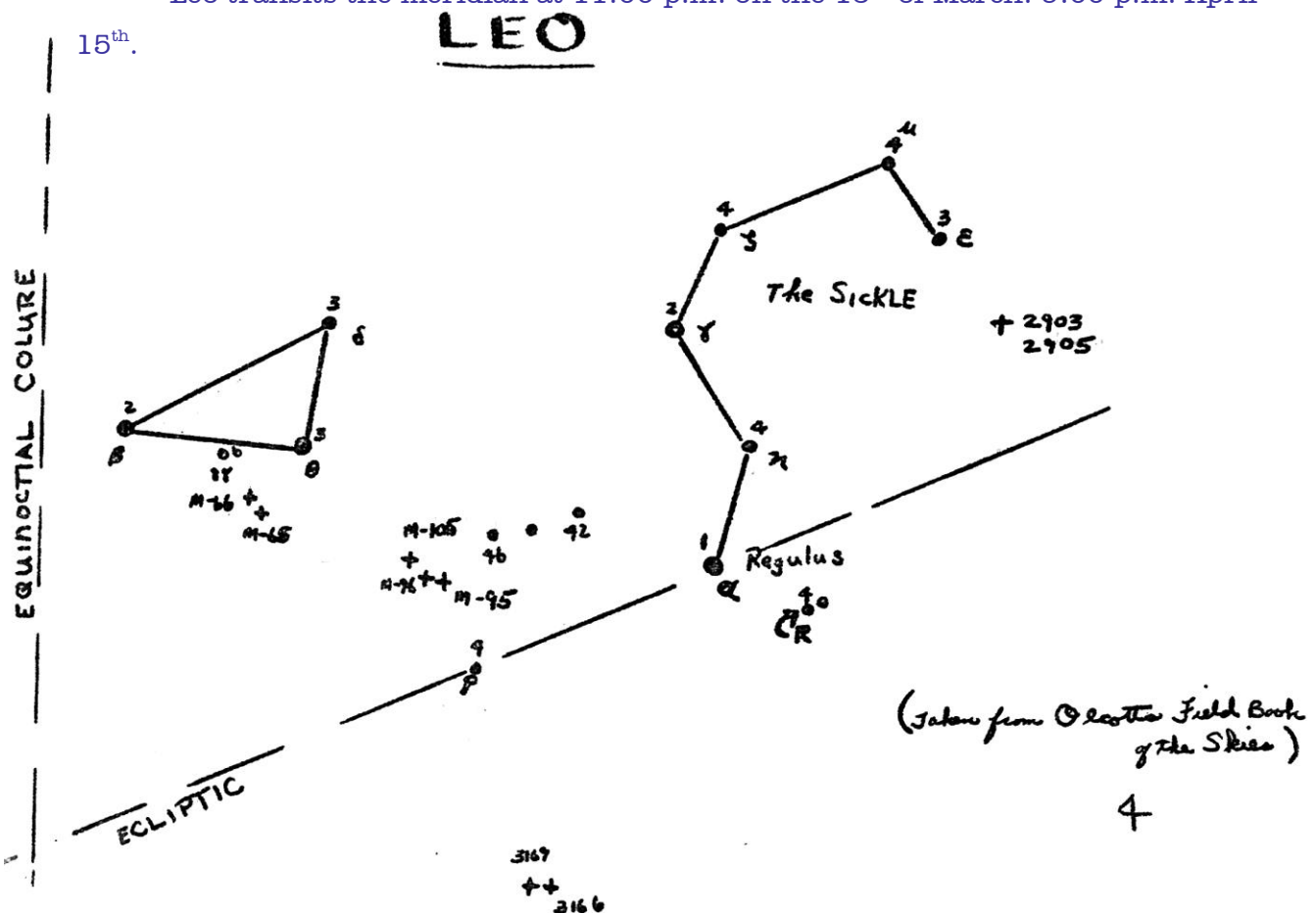
The noted long-period Variable Star, R Leonis, is located on the diagram at the point marked R. It varies from the 5th to the 11th magnitude in 313 days. It is a red star and at maximum is, of course, visible to the unaided eye and well worth observing.

ζ has three companion stars.

ς has two 7th magnitude companions forming a beautiful little triangle

November is a famous month for meteors. A shower known as the "Leonids" radiates from the head of the Lion, marked by the sickle. It is due on the 14th or 15th of the month.

Leo transits the meridian at 11:00 p.m. on the 15th of March. 9:00 p.m. April 15th.



Did YOU see the MOON?!?

On the 26th of February, a gibbous moon revealed many features around sunset. There was just enough contrast at this time to mellow the glow of the moon. The maria was a very distinct feature as was the brighter craters. Tycho was seen glimpsingly.

The moon on the 26th was approximately 240,000 miles from the earth. On March 16th, the moon will be 223,800 miles away. The moon will be only one day old at this time though. Start looking all the way up to first quarter or longer, though within these few days the moon will be moving several thousand miles away.

Also, look for earthshine; they make beautiful slides and prints. Shoot from 1/2 to 2 seconds to record the earthshine.

On the 17th through the 20th the moon will offer a beautiful spectacle with the planets and stars it will pass on its journey around the earth. (Sky and Telescope--- March 1972---Page 200)

Frank McCullough

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East Detroit)

Michigan 48021

The Silver Question

The Sun appeared so smug and bright.
One day, that I made bold
To ask him what he did each night
With all his surplus gold.

He flushed uncomfortably red,
And would not meet my eye.
"I travel round the world," he said,
"And travelling rates are high."

With frigid glance I pierced him through.
He squirmed and changed his tune.
Said he: "I will be frank with you:
I lend it to the moon.

Poor thing! You know she's growing old
And hasn't any folk.
She suffers terribly from cold,
And half the time she's broke."

That evening on the beach I lay
Behind a lonely dune,
And as she rose above the bay
I buttonholed the Moon.

"Tell me about that gold," said I.
I saw her features fall.
"You see, it's useless to deny;
The Sun has told me all."

"Sir," she exclaimed, "how can you try
An honest Moon this way?
As for the gold, I put it by
Against a rainy day."

I smiled and shook my head. "All right,
If you must know," said she,
"I Change it into silver bright
Wherewith to tip the Sea.

He is so faithful and so good,
A most deserving case;
If he should leave, I fear it would
Be hard to fill his place"

When asked if they accepted tips,
The waves became so rough;
I thought of those at sea in ships,
And felt I'd said enough ...

---Oliver Herfora

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Submitted
by
Walter Roudebush

The following three poems are dedicated to

Mrs. Alyea, Mrs. Kalinowski, Mrs. Kwentus,
Mrs. Strong, Mrs. Polus, Mrs. Odell, and
Diane Bargiel (soon to be Mrs. McCullough)
for displaying tolerance and understanding
in the face of overwhelming odds. -W.R.

One Astronomer's Wife

I awake a few hours preceding the dawn
And find my astronomer husband is gone.
I bound out of bed--I cannot have this!
He's doubtless found something that I mustn't miss,
The moon, stars, and planets, the great nebulae,
Are worlds that my husband has opened for me.
Orion and Saturn are friends of us both,
Our telescope brings us a new means for growth.
What a wonderful thing has come into our life!

My husband, I note, is increasingly mine,
As together we go where the galaxies shine.
When he's perched upon Plato's precipitous rim,
He is not there alone--I accompany him.
At predawn and midnight, in front of our house,
I gaze into far, distant space with my spouse;
And while at breakfast we both may be tired,
I'm elated in sharing new knowledge acquired.
Behold lucky me, an astronomer's wife!

---Mrs. Torence M. Cole
Farmington, Mich.

To an Amateur Astronomer's Wife

Come on now, old dear, let's cheer up and smile!
You've married a man who is well worth the while.
His eyes may be glued to a beautiful star---
But it's nicer than sitting bleary eyed at a bar.

In Front yard or backyard, on mountain or knoll,
An astronomer's quite an inquiring soul.
He's happy at his telescope whenever he sees
The dazzling diamonds of the bright Pleiades,

Or a galaxy millions of light years away,
Or a star that exploded one prehistoric day,
Or Jupiter's moons, or Saturn's rings---
To astronomers these are all challenging things.

No wife will be lonely, unhappy, forlorn.
If she'll join with her spouse in the wee hours of morn.
In this science that calls to the greatest of men.
And how proud she will be out -there freezing with him!

---Mrs. Mary H. Gansen
Bloomfield, N.J.
(submitted by Kenneth Wilson)

My astronomer walks with his head in the
Stars
Above the high-rise buildings, the night club
bars,
Above the trees, the mountain tops;
He walks straight up and never stops,
He walks so high it's plain to see
He soon outdistances mere me.
I'm so concerned about mundane things
Like children's colds and bathtub rings,
And if I eat Bread unleaven
Will all my loved ones get to heaven?
These frets concern him least of all
He's sure the sky won't fall,
With telescopes he probes the dark
And makes a note of each new spark;
While I with fingers dig the earth
To give my seedlings womb for birth.
In essence aren't our two goals one?
Whence came the earth? Whence came the
sun?

--Esther L. Goetz (Mrs. Irving A.)
Buffalo, New York

"Pluto and Beyond"

A dark and silent globe, the last frontier
Of solar domination yet revealed
By instruments that probe the cosmic field
Of space and stardust Yet if eyes could peer
Where comets dread to pass and spaceships fear,
Into those lanes that from our view lies sealed,
Another world, more distant still, might yield
Its presence to our gaze, and like a spear
Of stellar wormwood, robbed of all disdain,
Provoke us to a quest in many styles;
A journey to regions unexplored,
A flight where we at last could vision gain
Of our own sun at seven billion miles,
Or claim the utmost planet as reward.

--Wade Wellman
(Submitted by Kenneth Wilson)

~ ~ ~ FOR SALE ~ ~ ~

Contact Walter Roudebush, 264-0644
Diagonal, 1 1/4" minor axis, suitable for 6" f/8;
also rod type holder. Both for \$3.00

Rack and pinion focuser (by Edmund). \$5.00

6" mirror, f/8; needs refiguring, \$10.00

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THE ASTOUNING OBSERVATORY OF BALNIBARBI

Submitted

by

Kenneth Wilson

“At the center of the island there is a chasm about fifty yards in diameter, from whence the astronomers descend into a large dome, which is therefore called ‘Flandona Gagnote’, or the Astronomers’ Cave, situated at the depth of a hundred yards beneath the upper surface of the adamant. In this cave are twenty lamps continually burning, which from the reflection of the adamant cast a strong light into every part. The place is stored with great variety of sextants, quadrants, telescopes, astrolabes, and other astronomical instruments...

“They (the astronomers) spend the greatest part of their lives in observing the celestial bodies, which they do by the assistance of glasses far excelling ours in goodness. For although their largest telescopes do not exceed three feet, they magnify much more than those of a hundred with us and show the stars with greater clearness. This advantage hath enabled them to extend their discoveries much further than our astronomers in Europe. They have a catalogue of ten thousand fixed stars, whereas the largest of ours do not contain above one third part of that number. They have likewise discovered two lesser stars or satellites, which revolve about Mars, whereas the innermost is distant from the center of the primary planet exactly three of his diameters and the outermost, five. The former revolves in the space of ten hours and the latter in twenty-one and a half, so that the squares of their periodical times are very near in the same proportion with the cubes of their distance from the center of Mars, which evidently shows them to be governed by the same law of gravitation that influenced the other heavenly bodies.

“They have observed ninety-three different comets and settled their periods with great exactness. If this be true (and they affirm it with great confidence), it is much to be wished that their observations were made public, whereby the theory of comets, which at present is very lame and defective, might be brought to the same perfection with other parts of astronomy.”

The above quotation is from Part III, Chapter III of Jonathan Swift’s Gulliver’s Travels first published in 1727. With this date in mind, the astronomical data imparted by Swift is amazing. The most startling development foreshadowed by Swift is the discovery of the two Martian moons, Phobos and Deimos, by Asaph Hall 150 years later. Swift’s stated revolution periods of these two moons are also remarkably accurate. The presently accepted periods of Phobos and Deimos are respectively $7^{\text{h}}39^{\text{m}}14^{\text{s}}$ and $30^{\text{h}}17^{\text{m}}55^{\text{s}}$. In this passage Swift also predicts, though inadvertently, the improved efficiency of astronomical telescopes; the compilation of more extensive star charts; and, the verification of Halley’s theory on comets. If this is all mere coincidence, it is a very unlikely one. But, to my knowledge, Jonathan Swift was not an amateur or professional astronomer. So it must be coincidental. At any rate, this should be a lesson to the modern astronomer. The predictions of imaginative writers (such as science fiction, in particular) may not be so far-fetched after all. I also seem to recall a lunatic author of the nineteenth century named Verne, who wrote about rockets to the moon.

THE OBSERVER'S LIBRARY

By
Kenneth Wilson

STAR CHARTS III

Norton's Star Atlas is one of the most widely used set of star charts by both the amateur and professional astronomers. It is constantly referred to by major astronomical texts and journals.

Norton's covers the entire sky in ten, 11"x17" (two page) charts. There are two circumpolar charts and eight five hour wide north to south charts that will easily lie flat for use in the field. Stars are denoted in black on a white background with the Milky Way shown in light green. The charts show approximately 8,000 stars to a magnitude limit of about 6. The Messier, Herschel, N.G.C., etc. objects are also printed in black on the charts. Four other charts show stars in their galactic positions and an index to the main charts in the form of two circumpolar views on the inside front and back covers.

Perhaps the most useful aspect of this atlas is the supplemental information included. In the text that precedes the charts are sections on: abbreviators used; conversion tables for astronomical units; sunrise, sunset, sidereal time, precession, and twilight tables; a glossary of astronomical terms; spectroscopy; the sun; the moon; the planets; observing hints; care and use of the telescope; pronunciation tables; and, conversions of various object designations numbers. In the latest (15th) edition Sky Publishing Corporation has added a lunar map, with over 300 features, and a card with a chart and list of the Messier objects on it.

Despite its many good characteristics, I have found several drawbacks to using Norton's. First, the latest Norton's was published six years ago and much of the data in the text is out of date. For example, Saturn has ten moons instead of nine as Norton's lists; and, the rotation rates of Venus and Mercury have been revised since 1966. This and other outdated information makes another revision of Norton's long overdue. Second, Norton's often designates Messier objects by their seldom used Herschel numbers. It is quite inconvenient for the Messier hunter to convert these numbers before he can find the object on the charts. A good solution to this problem is to go through the atlas and write in the Messier numbers next to the Herschel numbers where they are lacking. Another important drawback is that Norton's fails to distinguish between star clusters, galaxies and nebulae in its chart markings.

In summary then, Norton's Star Atlas is a fine work even if only used, as a reference work because of its completeness. The charts are quite adequate for almost any amateur and the supplemental information is very useful. However, if accurate data is required, don't use Norton's (Refer, instead, to a source such as The Observer's Handbook which is updated yearly).

Norton's is available for \$6.50 from the Sky Publishing Corporation, 49-50-51 bay Street Road, Cambridge, Mass., 02138; and other sources.

ATTENTION!

SEVERAL MEMBERS OF THE W.A.S. ARE PLANNING TO BUILD OSCILLATOR-INVERTERS FOR THEIR TELESCOPE DRIVES. ANYONE INTERESTED IN SUCH A PROJECT PLEASE CONTACT ME, KEN WILSON (268-9337). ALSO, ANYONE WHO HAS ACCESS TO ELECTRONIC COMPONENTS AT LESS THAN RETAIL COST COULD BE AN INVALUABLE ASSISTANCE IN THIS PROJECT. YOUR HELP WOULD BE GREATLY APPRECIATED. PLEASE CONTACT ME AT THE ABOVE NUMBER.

SOME USEFUL FORMULAE FOR THE AMATEUR ASTRONOMER (PART I)

By

Kenneth Wilson

Mathematics has been an important tool of the astronomer since ancient times. Amateur astronomy, however, can be enjoyed with little or no understanding of math. But, from time to time, the amateur may wish to know certain information about his telescope, eyepiece, etc. At such a point mathematical formulae become available. Some of these formulae are often difficult to find, so I have compiled a list below of some of these formulae that have come to my attention. If, at the end of this series of articles, I have left out any important formulae (which I'm sure I will), please let me know and we will publish them.

1.) To find the magnification of a given eyepiece in a given telescope:

$$M = \frac{f_o}{f_e} \quad \text{OR} \quad M = \frac{D}{E} \quad \text{OR} \quad M = \frac{F_e}{F_t}$$

M-magnification, f_o -focal length of objective, f_e -focal length of eyepiece, D-clear diameter of objective, E-diameter of eyepiece exit pupil, F_e -apparent field of eyepiece, F_t -true field angle of the objective.

2.) To find the image size of an objective of a given focal length:

$$I = \frac{f}{57}$$

I-image size in inches, f-focal length of the objective (NOTE: this formula is for an object 1° in diameter).

3.) To find the light gathering power of a given objective in comparison with the Human eye (which equals 1):

$$L = 9a^2$$

L-comparative light gathering power, a-diameter of objective (in inches).

4.) To determine the field of a given eyepiece by letting a star drift in R.A. across the field in the eyepiece and timing the crossing:

$$F = \frac{1}{4} T \cos \delta$$

F-field of the eyepiece, T-time required for the star to cross the field, $\cos \delta$ -the cosine of the declination of the star (NOTE: F is in degrees, T in seconds and δ in degrees).

5.) To find the resolving power of a given objective in seconds of an arc:

$$R = \frac{4.56}{D}$$

R-resolving power in seconds of arc, D-diameter of objective in inches (NOTE: the constant 4.56 was determined, observationally by W. R. Dawes for two 6th magnitude yellow stars. If stars differ in magnitude, resolution may be more difficult. Blue stars are easier and red ones more difficult than yellow stars. Under poor conditions, a constant of 7.8 may be the minimum usable, but constants of as low as 2.8 have been successfully used by some observers.

6.) To find the limiting magnitude of a telescope of a given aperture:

$$M = 8.8 + 5 \log D, \text{ OR } M = 9.9 + 5 \log D$$

M-the limiting magnitude of the telescope, D-the diameter of the objective. The first formula is by Dimitroff and Baker, the second by Frank J. Kelly. Both have been successfully used and individual validity may depend on other variables, such as quality of optics and local sky conditions.

(TO BE CONTINUED)

OBSERVATIONAL ASTRONOMY

By Frank McCullough

(CERES)

This month I am going to break away from my messier objects to talk about my photographic venture of the asteroid Ceres (Minor Planet No. 1).

I have taken pictures 7 Out of 43 days averaging a feeble 12% on clear nights. My first pictures came on February 8th at 12:50 a.m. The exposures were 10, 15, and 20 seconds with my 55m.m. lens opened up to f1.8. My latest picture came on the 7th of March at 12:10a.m. Exposures were increased to 35 and 40 seconds.

I kept these exposures because anything less will make the asteroid observable only to the viewer if he or she is one or two feet away. Anything less than 15 seconds will make it nearly impossible to impossible to find.

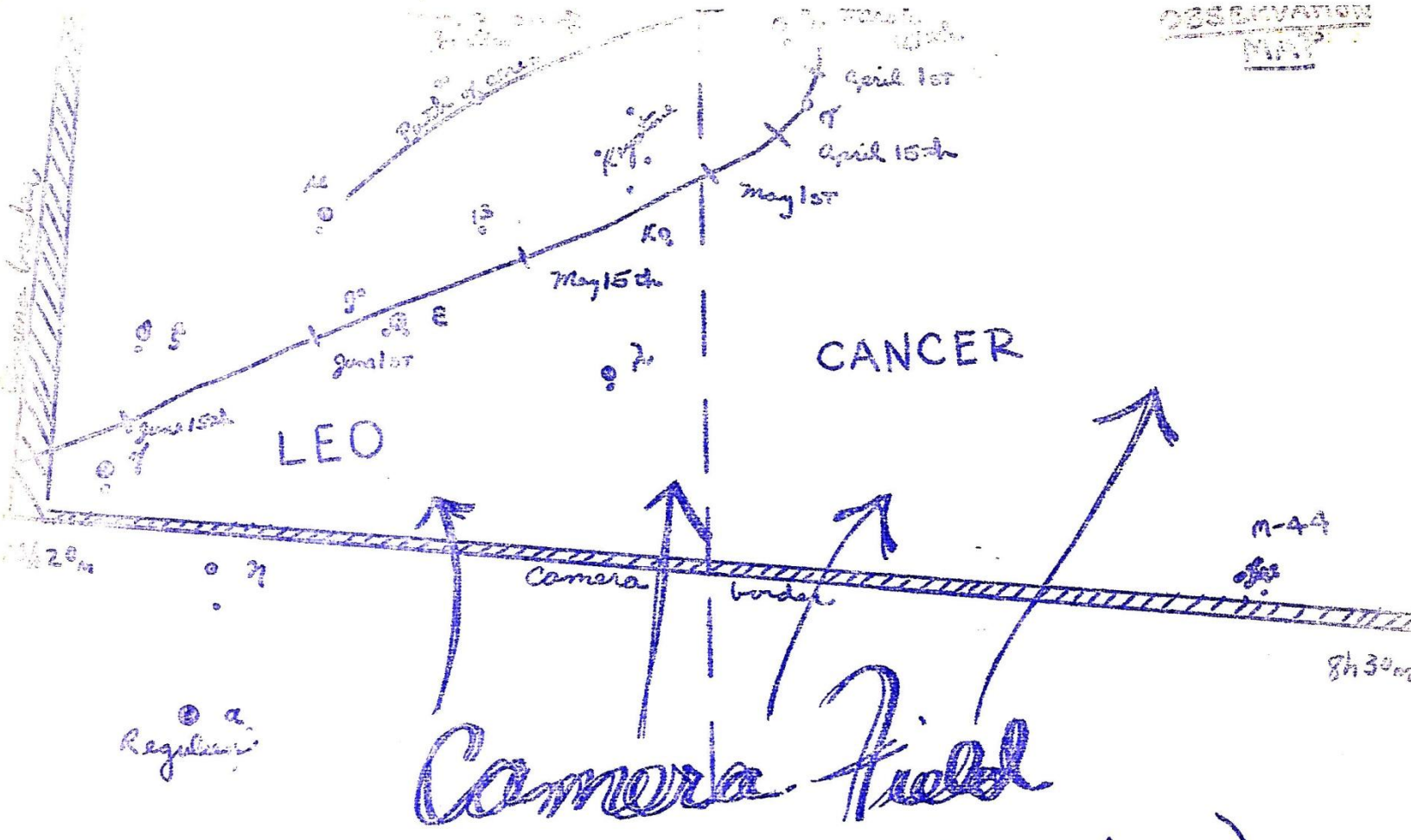
Now you may ask how much trailing do you get with a fixed camera? Well you get some, but surprisingly very little even projected from a considerable distance. Now you can see the asteroid!

I have had some say they were going to take pictures of it with a clock drive. This is great and should yield excellent results. Myself, I have become considerably lazy and impatient with the cold. It is much easier to run out with your camera and tripod and run right back when you're through rather than lugging a telescope mount, unwinding and rewinding your extension cord and hauling everything back to the garage or wherever you keep it. The one night I attempted to track it with clock drive was when it was 6 above zero. I was defeated quickly!

I would like help on this project, so if you are interested please consult with me.

M
OBSERVATIONAL
P

(next page)



Camera Field

(Use Anscochrome 500 or High Speed Ektachrome)

more precise map in February 1972 **S&T** page 132

- * Pointers - Two stars used to track the asteroid } must get familiar with these groupings.
- * Keystone - 4 stars resembling Keystone in Hercules

The W.A.S.P. Uncover the Good Old Days
will return next month.
J.M.

ASTRO-ALMANAC

By

Kenneth Wilson

MOONS OF

APR. / JUPITER¹ /

EVENT

1	1034d	Lunar Apogee (252,350mi.) at 2 ^h , Opposition of Juno at 2 ^h , Saturn 3° S. of Mars at 2 ^h
2	20134	
3	01234	Moon 6° S. of Neptune at 10 ^h , Moon .6° N. of Antares at 16 ^h
4	30244	
5	32014	Opposition of Uranus at 19 ^h
6	3214	Moon 2° S. of Jupiter at 0 ^h , Last Quarter at 18 ^h 44 ^m
7	30124	Greatest elong. (46°) of Venus at 19 ^h .
8	14023	Saturn 5° S. of Venus
9	42013	Twilight begins: 3:43-ends: 20:23 L.M.T.
10	41023	
11	4032d	Mercury at descending node, Aldebaran 7° S. of Mars at 22 ^h
12	43201	Moon 5° N. of Mercury at 11 ^h , Mercury Stationary at 17 ^h
13	43210	New Moon at 45 ^h 31 ^m
14	43012	Lunar Perigee (222,000mi.) at 1 ^h , Venus 9° N. of Aldebaran at 21 ^h
15	41023	Mercury at 0 ^h 15 ^m +0°48', Venus at 4 ^h 34 ^m +3°44'(mag.-4.0), Mars at 4 ^h 42 ^m +23°20'(mag.+1.7), Jupiter at 18 ^h 35 ^m -22°53'(mag.-1.9), Saturn at 4 ^h 10 ^m +19°24'(mag.+0.4), Uranus at 13 ^h 0 ^m -5°37', Neptune at 16 ^h 13 ^m -19°27'
16	24013	Venus at greatest hel. lat. (?), Moon 3° N. of Mars at 23 ^h
17	1043*	
18	01324	
19	3204*	Twilight begins: 3:20-ends: 20:40 L.M.T.
20	32104	First Quarter at 7 ^h 45 ^m
21	30124	Maximum of Lyrid meteor shower (19-23) radiant: 18 ^h 1 ^m +33°-at 21 ^h
22	10324	Mercury at aphelion, Mars 3° S. of Venus at 15 ^h
23	20134	
24	1043*	Jupiter stationary at 20 ^h
25	40132	
26	4320*	Moon 6° S. of Uranus
27	4320d	
28	43012	Lunar apogee (225,550mi.) at 5 ^h , Mercury at greatest W. elong. (27°)
29	4102*	Twilight begins: 2:58-ends: 20:59 L.M.T.
30	42013	Moon 6° S. of Neptune at 15 ^h , Moon .7° N. of Antares at 12 ^h (Occultation)

¹"O" represents the disc of Jupiter, "d" means the moon is on Jupiter's disc, * means the moon is in shadow or behind the disc. The configurations are for the inverting telescope at 5h E.S.T. (All the above listed times, unless otherwise noted, are in 24 hour Eastern Standard Time.)

ASTROPHOTOGRAPHERS

Save time and film. Twenty-page booklet (8½ by 11 in.) contains exposure data for the sun, moon and planets, and has a recently expanded eclipse section. Fifteen exposure guides list shutter speeds for all films (4 to 2000 ASA) and f ratios (1.4 to 256.0). Includes instructions for first focus, afocal, negative and positive projection telescope photography. Send \$2.00 to Larry F. Kalinowski, 15674 Flanagan Ave., Roseville, Mich. 48066. Phone (313)-776-9720. SPECIAL OFFER: \$1.00 off regular price of \$2.00 for all Warren Astronomical Society Members.