

COMET WEST IS COMING....!!??



THE
wasp
MARCH '76

THE JOURNAL OF THE WARREN ASTRONOMICAL SOCIETY

THE WARREN ASTRONOMICAL SOCIETY PAPER (W.A.S.P.) IS PUBLISHED BY THE W.A.S., MONTHLY AS A PRIVILEGE OF MEMBERSHIP. THE W.A.S. IS ALSO A CAMPUS CLUB OF MACOMB COMMUNITY COLLEGE-SOUTH CAMPUS, WARREN MICH.



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 \$. , college \$. ; Senior Citizens \$. ; Individual \$. ; Family \$. . Add \$6.00 for a one year subscription to Sky and Telescope magazine. Meetings of the Warren Astronomical Society 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, by and for the membership of the Warren Astronomical Society. 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 or otherwise, are always welcome and should be submitted to either of the editors listed below.

| | | |
|-----------------|-----------------------|----------------------------|
| <u>EDITORS:</u> | Garry Boyd (839-0973) | Raymond Bullock (879-9458) |
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| | Detroit, 48205 | Troy, 48084 |

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 above listed 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 OBSERVATION AND ASTROPHOTOGRAPHIC ASSOCIATION
THE FORT WAYNE ASTRONOMICAL SOCIETY
THE GRAND RAPIDS AMATEUR ASTRONOMICAL ASSOCIATION
THE KALAMAZOO ASTRONOMICAL SOCIETY
THE M.S.U. ASTRONOMY CLUB
THE MIAMI VALLEY ASTRONOMICAL SOCIETY
THE OLGELTHORPE ASTRONOMICAL SOCIETY
THE ORANGE COUNTY ASTRONOMERS
THE PEORIA STRONOMICAL SOCIETY
THE SAINT JOSEPH COUNTY ASTRONOMICAL SOCIETY
THE SUNSET ASTRONOMICAL SOCIETY

Other organizations are invited to join this list.

Cosmic Calendar....

March 1976 Configurations of Sun, Moon, and Planets.

Day: Hour:

| | | |
|----|----|---|
| 2 | | Heinrich Wilhelm Olbers died, 1840 Discovered Pallas |
| 3 | | W.A.S. meeting at Cranbrook, 8pm. Call Carl Noble for details at (573-0937) |
| 3 | 23 | Moon at apogee |
| 4 | 15 | Jupiter 3° South of Moon |
| 8 | 23 | FIRST QUARTER |
| 9 | 14 | Mars 6° North of Moon |
| 11 | 22 | Saturn 5° North of Moon |
| 13 | | Herschel discovered Uranus, 1781 |
| 15 | 20 | Neptune stationary |
| 15 | 21 | FULL MOON |
| 18 | | W.A.S. General Meeting, 8pm. M.C.C.C. room K-306, Call Carl Noble for details at (573-0937) |
| 18 | 15 | Uranus 1° North of Moon |
| 20 | 06 | Vernal Equinox (6:50am. E.S.T.) |
| 21 | | Johann Sebastian Bach born, 1685! |
| 21 | 05 | Neptune 1° South of Moon |
| 22 | 13 | LAST QUARTER |
| 27 | 13 | Saturn Stationary |
| 28 | | Pierre Laplace born, 1749 Nebular hypothesis of formation of solar system. |
| 28 | | Asteroid Pallas discovered by Olbers, 1802 |
| 30 | 12 | NEW MOON |
| 30 | 17 | Pluto at opposition |

for sale

6 inch F/4 Reflector

Coulter Optics, Parks Fiberglass Tube

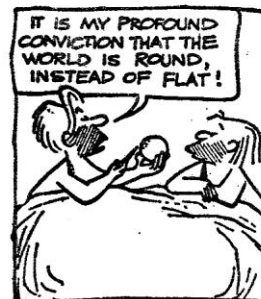
Spiral Focus eyepiece holder,

no mounting, price \$100.00

Bill Whitney 588-1781

B.C.

By John Hart



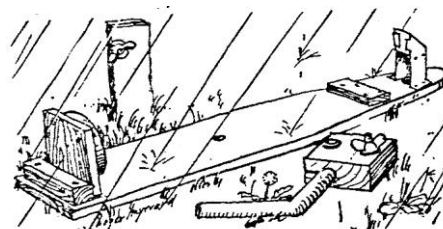
By permission of John Hart and Field Enterprises, Inc.

Club News...

Wayne Erasure has received his 8 inch mirror from Coulter Optical Co. and is anxiously awaiting delivery of his other telescope parts. He has issued a challenge to the club's Celestron owners (Doug, Tim and Ray haven't stopped laughing long enough to give a coherent answer yet!).

Faitus Enterprises has announced that they just accepted another membership. Roger Civic, who is presently constructing a six inch gear drive system, and refurbishing his Pacific mount. Pete stated: "this should bring Faitus out of the RED!" (new membership)

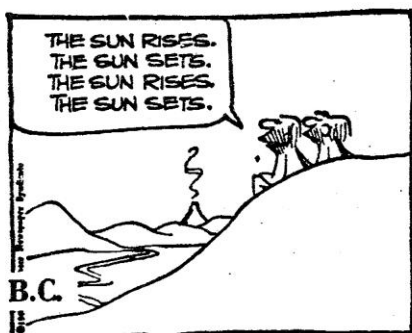
The Observatory Chairman, Lou Faix stated in a phone interview, Stargate should house a better resolving instrument. Lou discussed plans of a Ten inch Bucholder relay system, the telescope employs two transfer lenses in the optical axis between the secondary and primary mirrors. He stated: the investment for the new project would be carried from the old instrument and clock drive. Lou also stated the 12½ inch telescope would stay in operation until the project is complete. Lou is open for suggestions and wants to know your ideas.



The sad end of an early love

The Editors apologize to Tim Skonieczny for mis-printing his name in the February issue. (Perhaps Tim S%&\$#@zny should apologize for having such a complicated name?)

B.C.



I CAN HARDLY WAIT
TILL TOMORROW.

By John Hart



By permission of John Hart and Field Enterprises, Inc.

PLANETARIUM GUIDE

-R. BULLOCK

MAR.
1976



McMATH, Cranbrook. Indian Sky Lore. The program begins with an exploration of the current night sky visible from the Detroit area. Then those same constellations are explained as the many different American Indians saw them. The Indians' "Big Bear" didn't look at all like the one we know today. This program is held in conjunction with the 'Sense of Pride' exhibit now on display. SUNDAY 2, 3, 4 p.m.; WEDNESDAY 4 p.m.; SATURDAY 2, 3, 4, and 7:30 p. m. Observatory open for inspection after Sat. night show. See December 1975 W.A.S.P. for more information.



LONGWAY, Flint. Cosmic Dimensions. This program begins with an introduction to the current constellations. Man's attempts to measure distances to the planets and stars is illustrated. The program concentrates on the various methods used to determine cosmic dimensions and concludes with a journey back to the time of the creation of our universe. FRIDAY 7:30 p.m.; SATURDAY and SUNDAY 2:30 and 4 p.m. See September 1975 W.A.S.P. for more information. ENDS MARCH 14TH.



ABRAMS, East Lansing. The History of Science Fiction. A campy look at SI-FI from ancient times to Jules Verne, the most prophetic writer who predicted many modern day inventions, to the making of 2001-A Space Odyssey, to Star Trek. You will be given a ballot with your ticket to vote for your most popular SI-FI writer. Will current writers be as successful as Verne in predicting what is to come? FRIDAY & SATURDAY 8* p.m. & 10** p.m. SUNDAY 2:30 & 4 p.m. *Outdoor observing session follows.

**Quad album release follows. ENDS MARCH 14TH.



CHAFFEE, Grand Rapids. Star of Life. This program is a study of the sun. You'll look back into time to observe the birth of the sun and planets, and bore theoretically into the heart of our sun. Special photography will help in showing prominences, sunspots and flares, and the reaction they cause on Earth: the Aurora Borealis. THURSDAY 8 p. m.; SATURDAY 3:15 and 8 p.m.; SUNDAY 2:45 and 4 p.m. The current sky will be described following the Thurs. and Sat night shows. VEEN OBSERVATORY is closed for the winter. ENDS MARCH 8TH.

EDITORIAL: HOW TO CUT COSTS BUT NOT QUALITY?

The W.A.S.P. costs about \$30.00 to produce each month. We would like to reduce that cost, but we want to know your feelings before we try any new methods. We want to have an uncluttered newsletter, but may have to sacrifice some.

On the last page of this issue you will find a survey sheet. I don't want to make my own feelings known at this time, I just want to explain some of the choices.

PART I LIKES AND DISLIKES. Check the appropriate box for each category.

"b) Headlines/Illus." refers to our large headlines (as at the top of this page) vs. typewritten ones; and our use of illustrations. For "j) Articles" consider the various types of articles: technical; observational reports; humor. You can clarify your feelings in parts II and III. Use the back of the page if you want more room.

PART V. The options.

1. Single space rather than double space. Try to fit onto one page (or 1½) what we now print on two.
2. Piggy-back. If one article ends half-way down the page, should the next one start immediately below it, rather than on a new page (as is now done)?

Part VII. We'd like to know who you are, whatever you say, especially if you'd like to make contributions. Don't be ashamed of what you have to say. All names and replies will be confidential.

You can detach the survey sheet and drop it off in the box provided at the meeting, or mail it in. We want your opinion whether you're a member or not.

Thank you for your cooperation.

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

A handwritten signature in cursive script that reads "Raymond Bullock". The signature is written in black ink and is positioned below the typed name "Raymond Bullock".

STARGATE STATUS

Renovation of the drive system at the Stargate Observatory has been completed and may be installed when this is published. The new gear drives, clutches and control system should provide many years of reliable service. Our gratitude is expressed to Pete Kwentus who was ably assisted by Don Misson, Gary Boyd and Roger Civic.

The right ascension drive features an aluminum "Faitus" 192 tooth pinion gear mated with a brass worm. Secondary reduction gear connects the synchronous Hurst motor through an electromagnetic drive release clutch. At the flick of a switch on the new hand controlled box, a high speed reversible slewing motor is engaged. The manual declination screw has been replaced by a reversible dc motor and another worm and pinion gear set. Speed control for both right ascension tracking and declination slewing can be altered by additional potentiometer on the control box. Seven inch friction plate clutches are installed on both axis for manual override and approximate telescope positioning.

New illuminated setting circles have also been provided on both axes. Light emitting diodes permit the illumination level to be adjusted to the individual observer's preference. The tube assembly has been refinished and now bears the WAS crest. The major optical elements have been cleaned but are in need of re-aluminizing.

Because of the complexities of the new drive and control system networks, the Observatory Chairman, Lou Faix, has directed that all club members must receive instructions on proper operation before they may operate the Observatory alone. Improper operation could seriously damage the new mechanical and electrical equipment. A schedule for instruction programs will be announced in the near future.

THE ASTROPHOTOGRAPHER'S CORNER

by

Larry F. Kalinowski

ANOTHER SUPER COMET??

Those of us who tried valiantly to photograph comet Kohoutek, still cringe every time a prediction on another bright comet comes along. In the public's eye, Kohoutek failed miserably. The fourth magnitude comet was just barely visible to the naked eye in the Detroit metropolitan area. The amateur astronomer managed to get a little more out of the comet because of optical aids.

It's time to cringe again. The comet section of The Association of Lunar And Planetary Observers has mailed me another possible bombshell. The name of this bright visitor from space is West. Comet West (1975n) was discovered on November 5th by Richard M. West, who found it on a photographic plate taken with a Schmidt camera at The European Southern Observatory in La Silla, Chile. Perihelion is expected on February 25th and is to be less than two tenths of an astronomical unit at that time. The magnitude of the comet is predicted to be into the minus values during its closest approach to the Sun and dims rapidly at the approximate rate of two magnitudes a week after it rounds the Sun. An ephemeris for 1975n is included on the next page.

Capturing most comets on film can fall into the realm of deep sky photography, that branch of astrophotography that deals with long guided exposures. However, if Comet West pans out to what is expected of it, a camera and tripod may be all the equipment that is needed.

After a comet closely approaches the Sun, solar radiation helps to produce a long, bright, tail. The more tail that can be captured on film, the more "pleasing" your photograph becomes. With just camera and tripod, thirty-five mm. camera users can take about a fifteen second, wide-open exposure. Fifteen seconds is the maximum length of time a two inch (50mm.) focal length camera lens can expose film before the effect of the Earth's rotation can be recognized upon enlargement. The fifteen second time limit applies only to those objects located near the celestial equator. Exposure time can increase to about thirty seconds near the celestial poles because of the slower apparent rotation at those points.

The exposure time decreases proportionally for longer focal length lenses. A one hundred mm. focal length telephoto lens will have to be satisfied with seven and a half seconds at the equator and fifteen at the celestial pole.

Comet West becomes a morning object after rounding the Sun, so be prepared for some bitter cold mornings. Feel free to reach me at 776-9720 for any additional information you might need concerning this object.

COMET BRADFIELD (1975p)

ALPO COMETS SECTION

T = 1975 Dec. 21.178 ET

 $\omega = 358^{\circ}108$ $\Omega = 270.611$ $i = 70.626$

1950.0

Elements by Brian G. Marsden

 $q = 0.21863 \text{ AU}$

Ephemeris by R.B. Minton

 $m_1 = 8.0 + 5 \log \Delta + 10 \log r$

| | | | | | | | | | | | | | | |
|----|----|-------|-----|------|-------|-------|------|-----|-----|------|--------|------|------|-------|
| 27 | 18 | 32.55 | -10 | 49.9 | 1.163 | 0.301 | 13.0 | 4.1 | 3.1 | 0.33 | -0.521 | 14.6 | -1.4 | 17.43 |
| 28 | 18 | 38.66 | -9 | 49.6 | 1.152 | 0.325 | 15.0 | 3.8 | 3.4 | 0.31 | -0.488 | 14.2 | 0.2 | 17.44 |
| 29 | 18 | 44.72 | -6 | 52.8 | 1.142 | 0.350 | 16.9 | 3.6 | 3.7 | 0.29 | -0.456 | 13.9 | 1.8 | 17.44 |
| 30 | 18 | 50.75 | -4 | 59.1 | 1.132 | 0.376 | 18.8 | 3.5 | 4.0 | 0.27 | -0.425 | 13.7 | 3.3 | 17.45 |
| 31 | 18 | 56.77 | -3 | 8.2 | 1.122 | 0.401 | 20.7 | 3.4 | 4.3 | 0.25 | -0.397 | 13.5 | 4.7 | 17.46 |

1976 JAN

| 1975 JAN | | | | | | | | | | | | | | |
|----------|----|-------|-----|------|-------|-------|------|-----|-----|-------|--------|------|------|-------|
| | R | A | DEC | | DELTA | R | CES | TL | MAG | SLOGD | LOGR | P.A. | ALT | TIME |
| 1 | 19 | 2.80 | -1 | 19.7 | 1.113 | 0.427 | 22.4 | 3.3 | 4.5 | 0.23 | -0.369 | 13.5 | 6.2 | 17.47 |
| 2 | 19 | 8.85 | 0 | 26.6 | 1.105 | 0.453 | 24.2 | 3.2 | 4.8 | 0.22 | -0.344 | 13.5 | 7.6 | 17.47 |
| 3 | 19 | 14.94 | 2 | 10.8 | 1.097 | 0.479 | 25.9 | 3.2 | 5.0 | 0.20 | -0.319 | 13.5 | 8.9 | 17.48 |
| 4 | 19 | 21.06 | 3 | 53.1 | 1.091 | 0.505 | 27.6 | 3.2 | 5.2 | 0.19 | -0.297 | 13.7 | 10.3 | 17.49 |
| 5 | 19 | 27.22 | 5 | 33.5 | 1.086 | 0.531 | 29.2 | 3.1 | 5.4 | 0.18 | -0.275 | 13.8 | 11.7 | 17.50 |
| 6 | 19 | 33.45 | 7 | 12.3 | 1.081 | 0.556 | 30.8 | 3.1 | 5.6 | 0.17 | -0.255 | 14.0 | 13.0 | 17.50 |
| 7 | 19 | 39.72 | 8 | 49.2 | 1.078 | 0.582 | 32.4 | 3.1 | 5.8 | 0.16 | -0.235 | 14.2 | 14.3 | 17.51 |
| 8 | 19 | 46.05 | 10 | 24.3 | 1.075 | 0.607 | 33.9 | 3.1 | 6.0 | 0.16 | -0.217 | 14.4 | 15.6 | 17.52 |
| 9 | 19 | 52.44 | 11 | 57.5 | 1.074 | 0.632 | 35.4 | 3.1 | 6.2 | 0.15 | -0.200 | 14.7 | 16.9 | 17.53 |
| 10 | 19 | 58.88 | 13 | 28.9 | 1.073 | 0.656 | 36.9 | 3.1 | 6.3 | 0.15 | -0.183 | 15.0 | 18.1 | 17.54 |
| 11 | 20 | 5.38 | 14 | 58.2 | 1.074 | 0.681 | 38.3 | 3.1 | 6.5 | 0.15 | -0.167 | 15.4 | 19.3 | 17.55 |
| 12 | 20 | 11.93 | 15 | 25.6 | 1.075 | 0.705 | 39.7 | 3.1 | 6.6 | 0.16 | -0.152 | 15.7 | 20.5 | 17.56 |
| 13 | 20 | 18.54 | 17 | 50.7 | 1.078 | 0.729 | 41.1 | 3.2 | 6.8 | 0.16 | -0.137 | 16.1 | 21.7 | 17.57 |
| 14 | 20 | 25.19 | 19 | 13.7 | 1.081 | 0.752 | 42.4 | 3.2 | 6.9 | 0.17 | -0.123 | 16.6 | 22.9 | 17.58 |
| 15 | 20 | 31.89 | 20 | 34.4 | 1.086 | 0.776 | 43.7 | 3.2 | 7.1 | 0.18 | -0.110 | 17.0 | 24.0 | 17.59 |
| 16 | 20 | 38.63 | 21 | 52.7 | 1.091 | 0.799 | 44.9 | 3.3 | 7.2 | 0.19 | -0.097 | 17.4 | 25.1 | 17.60 |
| 17 | 20 | 45.41 | 23 | 8.5 | 1.097 | 0.822 | 46.2 | 3.3 | 7.3 | 0.20 | -0.085 | 17.9 | 26.2 | 18.0 |
| 18 | 20 | 52.22 | 24 | 22.0 | 1.105 | 0.845 | 47.3 | 3.4 | 7.5 | 0.22 | -0.073 | 18.4 | 27.3 | 18.1 |
| 19 | 20 | 59.05 | 25 | 32.9 | 1.113 | 0.868 | 48.4 | 3.4 | 7.6 | 0.23 | -0.062 | 18.9 | 28.3 | 18.2 |
| 20 | 21 | 5.90 | 26 | 41.2 | 1.122 | 0.890 | 49.5 | 3.5 | 7.7 | 0.25 | -0.050 | 19.4 | 29.2 | 18.3 |
| 21 | 21 | 12.77 | 27 | 47.3 | 1.132 | 0.913 | 50.5 | 3.6 | 7.9 | 0.27 | -0.040 | 20.0 | 30.2 | 18.5 |
| 22 | 21 | 19.64 | 28 | 50.1 | 1.142 | 0.935 | 51.5 | 3.6 | 8.0 | 0.29 | -0.029 | 20.5 | 31.1 | 18.6 |
| 23 | 21 | 26.52 | 29 | 50.5 | 1.154 | 0.957 | 52.4 | 3.7 | 8.1 | 0.31 | -0.019 | 21.1 | 32.0 | 18.7 |
| 24 | 21 | 33.38 | 30 | 48.5 | 1.166 | 0.979 | 53.3 | 3.8 | 8.2 | 0.33 | -0.009 | 21.7 | 32.8 | 18.8 |
| 25 | 21 | 40.24 | 31 | 43.3 | 1.179 | 1.000 | 54.2 | 3.9 | 8.4 | 0.36 | 0.000 | 22.2 | 33.6 | 18.9 |
| 26 | 21 | 47.08 | 32 | 36.6 | 1.192 | 1.022 | 55.0 | 3.9 | 8.5 | 0.38 | 0.009 | 22.8 | 34.4 | 18.10 |
| 27 | 21 | 53.89 | 33 | 26.3 | 1.206 | 1.043 | 55.7 | 4.0 | 8.6 | 0.41 | 0.018 | 23.4 | 35.1 | 18.11 |
| 28 | 22 | 0.67 | 34 | 14.6 | 1.221 | 1.064 | 56.5 | 4.1 | 8.7 | 0.43 | 0.027 | 24.0 | 35.8 | 18.12 |
| 29 | 22 | 7.41 | 35 | 0.0 | 1.237 | 1.085 | 57.1 | 4.2 | 8.8 | 0.46 | 0.035 | 24.6 | 36.5 | 18.13 |
| 30 | 22 | 14.11 | 35 | 43.0 | 1.253 | 1.106 | 57.7 | 4.3 | 8.9 | 0.49 | 0.044 | 25.2 | 37.1 | 18.14 |
| 31 | 22 | 20.76 | 36 | 23.8 | 1.269 | 1.126 | 58.3 | 4.5 | 9.0 | 0.52 | 0.052 | 25.8 | 37.7 | 18.15 |

1976 FEB

| 1975 FEB | R | A | DEC | DELTA | R | CES | TL | MAG | SLOGD | LOGR | P.A. | ALT | TIME | |
|----------|----|-------|-----|-------|-------|-------|------|-----|-------|------|-------|------|------|-------|
| 1 | 22 | 27.35 | 37 | 2.3 | 1.286 | 1.147 | 58.9 | 4.6 | 9.1 | 0.55 | 0.059 | 26.4 | 38.3 | 18 16 |
| 2 | 22 | 33.89 | 37 | 38.7 | 1.304 | 1.167 | 59.4 | 4.7 | 9.2 | 0.58 | 0.067 | 27.0 | 38.8 | 18 17 |
| 3 | 22 | 40.36 | 38 | 13.1 | 1.322 | 1.187 | 59.8 | 4.8 | 9.3 | 0.51 | 0.075 | 27.5 | 39.3 | 18 18 |
| 4 | 22 | 46.75 | 38 | 45.4 | 1.341 | 1.208 | 60.3 | 4.9 | 9.5 | 0.54 | 0.082 | 28.1 | 39.8 | 18 19 |
| 5 | 22 | 53.08 | 39 | 15.9 | 1.360 | 1.227 | 60.6 | 5.1 | 9.6 | 0.67 | 0.089 | 28.7 | 40.2 | 18 20 |
| 6 | 22 | 59.33 | 3 | 44.5 | 1.379 | 1.247 | 61.0 | 5.2 | 9.7 | 0.70 | 0.096 | 29.3 | 40.6 | 18 22 |
| 7 | 23 | 5.50 | 40 | 11.4 | 1.399 | 1.267 | 61.3 | 5.4 | 9.8 | 0.73 | 0.103 | 29.8 | 41.0 | 18 23 |
| 8 | 23 | 11.58 | 40 | 36.7 | 1.420 | 1.287 | 61.6 | 5.5 | 9.9 | 0.76 | 0.109 | 30.4 | 41.3 | 18 24 |
| 9 | 23 | 17.59 | 41 | 0.3 | 1.440 | 1.306 | 61.8 | 5.7 | 9.9 | 0.79 | 0.116 | 30.9 | 41.7 | 18 25 |
| 10 | 23 | 23.50 | 41 | 22.5 | 1.461 | 1.325 | 62.0 | 5.8 | 10.0 | 0.82 | 0.122 | 31.4 | 42.0 | 18 26 |
| 11 | 23 | 29.32 | 41 | 43.2 | 1.483 | 1.345 | 62.2 | 6.0 | 10.1 | 0.86 | 0.129 | 31.9 | 42.2 | 18 27 |
| 12 | 23 | 35.06 | 42 | 2.5 | 1.504 | 1.364 | 62.4 | 6.1 | 10.2 | 0.89 | 0.135 | 32.5 | 42.5 | 18 28 |
| 13 | 23 | 40.71 | 42 | 20.7 | 1.526 | 1.383 | 62.5 | 6.3 | 10.3 | 0.92 | 0.141 | 32.9 | 42.7 | 18 29 |
| 14 | 23 | 46.26 | 42 | 37.5 | 1.548 | 1.402 | 62.6 | 6.5 | 10.4 | 0.95 | 0.147 | 33.4 | 42.9 | 18 30 |
| 15 | 23 | 51.72 | 42 | 53.4 | 1.571 | 1.421 | 62.7 | 6.6 | 10.5 | 0.98 | 0.152 | 33.9 | 43.0 | 18 31 |
| 16 | 23 | 57.09 | 43 | 8.1 | 1.594 | 1.439 | 62.7 | 6.8 | 10.6 | 1.01 | 0.158 | 34.3 | 43.2 | 18 32 |
| 17 | 0 | 2.37 | 43 | 21.7 | 1.616 | 1.458 | 62.7 | 7.0 | 10.7 | 1.04 | 0.164 | 34.8 | 43.3 | 18 33 |
| 18 | 0 | 7.56 | 43 | 34.5 | 1.640 | 1.477 | 62.7 | 7.2 | 10.8 | 1.07 | 0.169 | 35.2 | 43.4 | 18 35 |
| 19 | 0 | 12.66 | 43 | 46.3 | 1.663 | 1.495 | 62.7 | 7.4 | 10.8 | 1.10 | 0.175 | 35.6 | 43.5 | 18 36 |
| 20 | 0 | 17.67 | 43 | 57.3 | 1.687 | 1.513 | 62.7 | 7.6 | 10.9 | 1.14 | 0.180 | 36.0 | 43.5 | 18 37 |
| 21 | 0 | 22.59 | 44 | 7.5 | 1.710 | 1.532 | 62.6 | 7.8 | 11.0 | 1.17 | 0.185 | 36.4 | 43.5 | 18 38 |
| 22 | 0 | 27.42 | 44 | 17.0 | 1.734 | 1.550 | 62.5 | 8.0 | 11.1 | 1.20 | 0.190 | 36.8 | 43.6 | 18 39 |
| 23 | 0 | 32.17 | 44 | 25.9 | 1.758 | 1.568 | 62.4 | 8.2 | 11.2 | 1.23 | 0.195 | 37.2 | 43.6 | 18 40 |
| 24 | 0 | 36.94 | 44 | 34.7 | 1.783 | 1.586 | 62.3 | 8.4 | 11.3 | 1.26 | 0.200 | 37.5 | 43.5 | 18 41 |
| 25 | 0 | 41.42 | 44 | 41.0 | 1.807 | 1.604 | 62.1 | 8.7 | 11.3 | 1.28 | 0.205 | 37.9 | 43.5 | 18 42 |
| 26 | 0 | 45.92 | 44 | 48.5 | 1.831 | 1.621 | 62.0 | 8.9 | 11.4 | 1.31 | 0.210 | 38.2 | 43.5 | 18 43 |
| 27 | 0 | 50.34 | 44 | 54.3 | 1.856 | 1.639 | 61.9 | 9.1 | 11.5 | 1.34 | 0.215 | 38.5 | 43.4 | 18 44 |
| 28 | 0 | 54.63 | 45 | 0.9 | 1.881 | 1.657 | 61.6 | 9.3 | 11.6 | 1.37 | 0.219 | 38.8 | 43.3 | 18 45 |
| 29 | 0 | 58.95 | 45 | 6.4 | 1.906 | 1.674 | 61.4 | 9.6 | 11.6 | 1.40 | 0.224 | 39.1 | 43.2 | 18 46 |

COMET WEST 1975n

T = 1976 Feb. 25.1990 ET

 $\omega = 358.4198$ $\Omega = 118.2262$ $i = 43.0601$

1950.0

Elements by Brian G. Marsden

 $q = 0.196626$ AU

Ephemeris by Charles S. Morris

 $\text{mag.} = 7.0 + 5 \log D + 10 \log R$

| | | | | | | | | | | | | | | |
|----|----|-------|----|------|------|------|-----|-----|-----|------|-------|-------|------|-------|
| 27 | 22 | 46.20 | -3 | .6 | .807 | .209 | 6.4 | 2.5 | .3 | -.44 | -.6A1 | 24.3 | -6.2 | 18 44 |
| 28 | 22 | 37.27 | -1 | 10.4 | .708 | .224 | 7.4 | 2.3 | -.0 | -.49 | -.650 | 356.1 | -6.9 | 5 37 |
| 29 | 22 | 28.25 | 0 | 27.5 | .794 | .244 | 9.3 | 2.0 | .3 | -.50 | -.613 | 336.9 | -3.7 | 5 35 |

MAR. 1976

| | R | A | DEC | DELTA | R | CES | TL | MAG | SLOGD | LOGP | P A | ALT | TIME | |
|----|----|-------|-----|-------|-------|-------|------|-----|-------|------|-------|-------|------|------|
| 1 | 22 | 19.57 | 1 | 52.8 | .796 | .267 | 11.8 | 1.7 | .7 | -.50 | -.573 | 324.9 | -6.6 | 5 34 |
| 2 | 22 | 11.45 | 3 | 6.4 | .801 | .292 | 14.3 | 1.6 | 1.1 | -.48 | -.535 | 317.1 | 2.2 | 5 32 |
| 3 | 22 | 4.01 | 4 | 9.5 | .810 | .318 | 16.8 | 1.5 | 1.5 | -.44 | -.407 | 311.6 | 4.8 | 5 31 |
| 4 | 21 | 87.25 | 5 | 3.9 | .821 | .345 | 19.1 | 1.4 | 1.9 | -.43 | -.462 | 307.4 | 7.1 | 5 29 |
| 5 | 21 | 51.15 | 5 | 50.9 | .833 | .373 | 21.4 | 1.4 | 2.3 | -.40 | -.429 | 304.1 | 9.3 | 5 28 |
| 6 | 21 | 45.66 | 6 | 31.8 | .845 | .400 | 23.4 | 1.4 | 2.6 | -.34 | -.398 | 301.4 | 11.2 | 5 26 |
| 7 | 21 | 40.71 | 7 | 7.7 | .859 | .427 | 25.4 | 1.4 | 2.9 | -.33 | -.369 | 299.1 | 13.0 | 5 25 |
| 8 | 21 | 36.25 | 7 | 19.5 | .872 | .455 | 27.2 | 1.4 | 3.2 | -.30 | -.342 | 297.1 | 14.6 | 5 23 |
| 9 | 21 | 32.21 | 8 | 7.8 | .886 | .482 | 29.0 | 1.4 | 3.5 | -.26 | -.317 | 295.3 | 16.2 | 5 22 |
| 10 | 21 | 28.56 | 8 | 33.3 | .900 | .509 | 30.7 | 1.5 | 3.8 | -.23 | -.294 | 293.7 | 17.6 | 5 20 |
| 11 | 21 | 25.24 | 8 | 56.3 | .914 | .535 | 32.2 | 1.5 | 4.1 | -.20 | -.272 | 292.2 | 18.9 | 5 19 |
| 12 | 21 | 22.21 | 9 | 17.4 | .927 | .561 | 33.8 | 1.5 | 4.3 | -.16 | -.251 | 290.8 | 20.2 | 5 17 |
| 13 | 21 | 19.43 | 9 | 36.8 | .941 | .587 | 35.2 | 1.6 | 4.5 | -.13 | -.231 | 289.6 | 21.4 | 5 16 |
| 14 | 21 | 16.88 | 9 | 54.8 | .954 | .613 | 36.6 | 1.6 | 4.7 | -.10 | -.212 | 288.4 | 22.5 | 5 14 |
| 15 | 21 | 14.53 | 10 | 11.6 | .966 | .639 | 38.0 | 1.6 | 4.9 | -.07 | -.195 | 287.3 | 23.5 | 5 12 |
| 16 | 21 | 12.34 | 10 | 27.3 | .979 | .664 | 39.3 | 1.7 | 5.1 | -.05 | -.178 | 286.2 | 24.6 | 5 11 |
| 17 | 21 | 10.32 | 10 | 42.2 | .991 | .689 | 40.6 | 1.7 | 5.3 | -.02 | -.162 | 285.2 | 25.5 | 5 9 |
| 18 | 21 | 8.42 | 10 | 56.4 | 1.003 | .713 | 41.8 | 1.7 | 5.5 | .01 | -.147 | 284.2 | 26.5 | 5 7 |
| 19 | 21 | 6.64 | 11 | 9.8 | 1.014 | .738 | 43.1 | 1.8 | 5.7 | .03 | -.132 | 283.3 | 27.4 | 5 6 |
| 20 | 21 | 4.96 | 11 | 22.8 | 1.025 | .762 | 44.3 | 1.8 | 5.8 | .05 | -.118 | 282.4 | 28.3 | 5 4 |
| 21 | 21 | 3.38 | 11 | 35.2 | 1.036 | .786 | 45.5 | 1.9 | 6.0 | .08 | -.105 | 281.6 | 29.1 | 5 2 |
| 22 | 21 | 1.87 | 11 | 47.2 | 1.046 | .809 | 46.6 | 1.9 | 6.1 | .10 | -.092 | 280.7 | 30.0 | 5 1 |
| 23 | 21 | .43 | 11 | 58.9 | 1.056 | .833 | 47.8 | 1.9 | 6.3 | .12 | -.079 | 279.9 | 30.8 | 4 59 |
| 24 | 20 | 59.05 | 12 | 10.2 | 1.065 | .856 | 48.9 | 2.0 | 6.4 | .14 | -.068 | 279.1 | 31.6 | 4 57 |
| 25 | 20 | 57.72 | 12 | 21.2 | 1.075 | .879 | 50.0 | 2.0 | 6.6 | .16 | -.056 | 278.4 | 32.4 | 4 56 |
| 26 | 20 | 56.43 | 12 | 32.0 | 1.083 | .902 | 51.2 | 2.0 | 6.7 | .17 | -.045 | 277.6 | 33.2 | 4 54 |
| 27 | 20 | 55.17 | 12 | 42.6 | 1.092 | .924 | 52.3 | 2.1 | 6.8 | .19 | -.034 | 276.9 | 33.9 | 4 52 |
| 28 | 20 | 53.95 | 12 | 52.9 | 1.100 | .947 | 53.4 | 2.1 | 6.9 | .21 | -.024 | 276.2 | 34.7 | 4 50 |
| 29 | 20 | 52.76 | 13 | 3.1 | 1.108 | .969 | 54.5 | 2.1 | 7.1 | .22 | -.014 | 275.5 | 35.4 | 4 49 |
| 30 | 20 | 51.58 | 13 | 13.1 | 1.116 | .991 | 55.6 | 2.2 | 7.2 | .24 | -.004 | 274.8 | 36.2 | 4 47 |
| 31 | 20 | 50.42 | 13 | 22.9 | 1.123 | 1.013 | 56.6 | 2.2 | 7.3 | .25 | .005 | 274.1 | 36.9 | 4 45 |

APR. 1976

| | R | A | DEC | DELTA | R | CES | TL | MAG | SLOGD | LOGR | P A | ALT | TIME | |
|----|----|-------|-----|-------|-------|-------|------|-----|-------|------|------|-------|------|------|
| 1 | 20 | 49.26 | 13 | 32.6 | 1.130 | 1.034 | 57.7 | 2.2 | 7.4 | .27 | .015 | 273.4 | 37.7 | 4 44 |
| 2 | 20 | 48.12 | 13 | 42.2 | 1.137 | 1.056 | 58.8 | 2.3 | 7.5 | .28 | .024 | 272.7 | 38.4 | 4 42 |
| 3 | 20 | 46.98 | 13 | 51.7 | 1.143 | 1.077 | 59.9 | 2.3 | 7.6 | .29 | .032 | 272.1 | 39.1 | 4 40 |
| 4 | 20 | 45.84 | 14 | 1.0 | 1.149 | 1.098 | 61.0 | 2.3 | 7.7 | .30 | .041 | 271.4 | 39.8 | 4 38 |
| 5 | 20 | 44.70 | 14 | 10.2 | 1.155 | 1.119 | 62.0 | 2.4 | 7.8 | .31 | .049 | 270.8 | 40.5 | 4 37 |
| 6 | 20 | 43.55 | 14 | 19.3 | 1.161 | 1.140 | 63.1 | 2.4 | 7.9 | .32 | .057 | 270.2 | 41.3 | 4 35 |
| 7 | 20 | 42.39 | 14 | 28.3 | 1.166 | 1.160 | 64.2 | 2.4 | 7.9 | .33 | .065 | 269.5 | 42.0 | 4 33 |
| 8 | 20 | 41.22 | 14 | 37.2 | 1.172 | 1.181 | 65.3 | 2.5 | 8.0 | .34 | .072 | 268.9 | 42.7 | 4 32 |
| 9 | 20 | 40.04 | 14 | 46.0 | 1.177 | 1.201 | 66.4 | 2.5 | 8.1 | .35 | .080 | 268.3 | 43.4 | 4 30 |
| 10 | 20 | 38.85 | 14 | 54.6 | 1.181 | 1.222 | 67.5 | 2.5 | 8.2 | .36 | .087 | 267.6 | 44.1 | 4 28 |
| 11 | 20 | 37.64 | 15 | 3.2 | 1.186 | 1.242 | 68.6 | 2.6 | 8.3 | .37 | .094 | 267.0 | 44.8 | 4 26 |
| 12 | 20 | 36.41 | 15 | 11.6 | 1.190 | 1.262 | 69.6 | 2.6 | 8.4 | .38 | .101 | 266.4 | 45.5 | 4 25 |
| 13 | 20 | 35.16 | 15 | 20.0 | 1.195 | 1.281 | 70.7 | 2.6 | 8.4 | .39 | .108 | 265.8 | 46.2 | 4 23 |
| 14 | 20 | 33.99 | 15 | 28.2 | 1.199 | 1.301 | 71.8 | 2.7 | 8.5 | .30 | .114 | 265.1 | 47.0 | 4 21 |
| 15 | 20 | 32.59 | 15 | 36.3 | 1.203 | 1.321 | 72.9 | 2.7 | 8.6 | .40 | .121 | 264.5 | 47.7 | 4 20 |
| 16 | 20 | 31.28 | 15 | 44.3 | 1.206 | 1.340 | 74.0 | 2.7 | 8.6 | .41 | .127 | 263.9 | 48.4 | 4 18 |
| 17 | 20 | 29.93 | 15 | 52.1 | 1.210 | 1.360 | 75.1 | 2.8 | 8.7 | .41 | .133 | 263.3 | 49.1 | 4 16 |
| 18 | 20 | 28.56 | 15 | 59.9 | 1.213 | 1.379 | 76.3 | 2.8 | 8.8 | .42 | .140 | 262.6 | 49.8 | 4 15 |
| 19 | 20 | 27.17 | 16 | 7.4 | 1.216 | 1.398 | 77.4 | 2.8 | 8.8 | .43 | .145 | 262.0 | 50.6 | 4 13 |
| 20 | 20 | 25.74 | 16 | 14.9 | 1.220 | 1.417 | 78.5 | 2.8 | 8.9 | .43 | .151 | 261.4 | 51.3 | 4 11 |
| 21 | 20 | 24.28 | 16 | 22.2 | 1.223 | 1.436 | 79.6 | 2.9 | 9.0 | .44 | .157 | 260.7 | 52.0 | 4 10 |
| 22 | 20 | 22.79 | 16 | 29.3 | 1.226 | 1.455 | 80.7 | 2.9 | 9.0 | .44 | .163 | 260.1 | 52.7 | 4 8 |
| 23 | 20 | 21.27 | 16 | 36.3 | 1.228 | 1.473 | 81.9 | 3.0 | 9.1 | .45 | .168 | 259.4 | 53.4 | 4 6 |
| 24 | 20 | 19.72 | 16 | 43.1 | 1.231 | 1.492 | 83.0 | 3.0 | 9.2 | .45 | .174 | 258.8 | 54.2 | 4 5 |
| 25 | 20 | 18.13 | 16 | 49.7 | 1.234 | 1.511 | 84.2 | 3.0 | 9.2 | .46 | .179 | 258.1 | 54.9 | 4 3 |
| 26 | 20 | 16.51 | 16 | 56.2 | 1.236 | 1.529 | 85.3 | 3.1 | 9.3 | .46 | .184 | 257.4 | 55.6 | 4 2 |
| 27 | 20 | 14.86 | 17 | 2.4 | 1.239 | 1.547 | 86.5 | 3.1 | 9.3 | .47 | .190 | 256.8 | 56.3 | 4 0 |
| 28 | 20 | 13.17 | 17 | 8.4 | 1.241 | 1.565 | 87.6 | 3.1 | 9.4 | .47 | .195 | 256.1 | 57.0 | 3 59 |
| 29 | 20 | 11.44 | 17 | 14.2 | 1.244 | 1.584 | 88.8 | 3.2 | 9.4 | .47 | .200 | 255.4 | 57.7 | 3 57 |
| 30 | 20 | 9.68 | 17 | 19.8 | 1.246 | 1.602 | 89.9 | 3.2 | 9.5 | .48 | .205 | 254.7 | 58.5 | 3 56 |

MAY 1976

| | R | A | DEC | DELTA | R | CES | TL | MAG | SLOGD | LOGR | P A | ALT | TIME | |
|---|----|-------|-----|-------|-------|-------|------|-----|-------|------|------|-------|------|------|
| 1 | 20 | 7.88 | 17 | 25.1 | 1.249 | 1.620 | 91.1 | 3.3 | 9.5 | .49 | .209 | 254.0 | 59.2 | 3 54 |
| 2 | 20 | 6.05 | 17 | 30.2 | 1.251 | 1.638 | 92.3 | 3.3 | 9.6 | .49 | .214 | 253.2 | 59.8 | 3 53 |
| 3 | 20 | 4.18 | 17 | 35.0 | 1.254 | 1.655 | 93.5 | 3.3 | 9.6 | .49 | .219 | 252.5 | 60.5 | 3 51 |
| 4 | 20 | 2.28 | 17 | 39.5 | 1.256 | 1.673 | 94.6 | 3.4 | 9.7 | .49 | .223 | 251.8 | 61.2 | 3 50 |
| 5 | 20 | .34 | 17 | 43.8 | 1.258 | 1.691 | 95.8 | 3.4 | 9.7 | .50 | .228 | 251.0 | 61.8 | 3 48 |
| 6 | 19 | 58.36 | 17 | 47.7 | 1.261 | 1.708 | 97.0 | 3.5 | 9.8 | .50 | .233 | 250.2 | 62.5 | 3 47 |

A.T.M. for the Frantic Fringe!

"Making a Coronagraph to view the prominences of the sun." Garry Boyd

The natural fascination of watching things that move may largely explain the amateur astronomer's dream of owning an instrument that makes prominences visible. Because the prominences are so large by terrestrial standards, they appear to move lazily. But like the slow movement of the hour hand of a clock, their transformations can easily be perceived over a matter of minutes. When recorded by time lapse photography, and then projected as a motion picture, prominences are an awesome spectacle of nature. Henry Paul of Norwich, N.Y., chemist and amateur astronomer, has written: "Spine-tingling excitement tinged with awe usually accompanies the first viewing of an eruptive prominence. These millions of tons of glowing gas often stream back in graceful arcs to the surface as if drawn by a huge magnet."

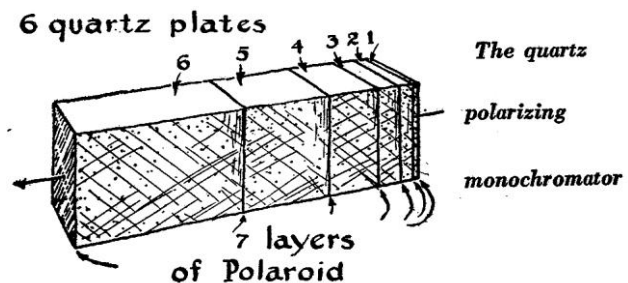
A good spectrohelioscope requires 17 optical surfaces and original diffraction grating (a replica grating will not work). This doubtless explains why so few amateurs have built these instruments.

Paul's exciting experience came not out of a spectrohelioscope but from a newer instrument called the coronagraph. Where the spectrohelioscope sorts out the red light of hydrogen by means of a diffraction grating, the coronagraph does so with a remarkable selective filter known as the quartz polarizing monochromator. In general the coronagraph is the better instrument. One astronomer who began as an amateur telescope maker and has used both instruments says that the views with the coronagraph are enough to make a spectrohelioscope man feel that his life has been wasted. Another calls this an understatement. The older instrument does enjoy some advantages. It is superior, for example in its capability to be adjusted to filter light of any color.

Three amateurs are known to have built coronagraphs using the monochromator: one such amateur after several years, accomplished it in a kitchen without machine tools. Walter J. Semerau of N.Y., who was aided by Paul's published instructions in *Amateur Telescope Making* book three and directly by Paul. After Using his instrument for a year Semerau writes: "My coronagraph performs beyond all my expectations. Building it was the most fascinating fun I have ever had."

At the bottom of the coronagraph tube a pair of right-angle prisms jackknives the light beam from the long-focus objective. (see drawing) Hence what appears to be two parallel tubes is in effect a very long single tube folded for the sake of convenience. In one part of the tube the light passes through a rectangular box containing the quartz polarizing monochromator. The monochromatic light emitted by the prominences is passed upward into the eyepiece by a reflex mirror. Light of other colors is absorbed by the filter and dissipated in the form of heat. The light can be directed into either of two cameras by moving a small lever attached to the mirror. The instrument can thus serve as either a coronascope or a coronagraph. The arrangement enables the observer to view prominences up to the instant when he wishes to make a photograph. The drawing shows a 35-millimeter camera in place. It may be replaced by a 16-millimeter time-lapse camera.

The business end of the coronagraph is the quartz polarizing monochromator. Though it is a filter, the term is misleading because it suggests simple glass or gelatin filters. Even the best of these would transmit a band of color much too broad. The filter must exclude all light waves which do not fall within a single hydrogen line—a band of



about three to seven Angstrom units in the 3,750 Angstroms of the visible spectrum. To accomplish this the quartz polarizing monochromator sends the light through a stack of six or more quartz plates. At the top and bottom of the stack and between each pair of plates are sheets of Polaroid. In addition to this filter the coronagraph requires a cone of metal (the circular Bottom of which eclipses the sun in the instrument), a field lens, a diaphragm, a lens to send the rays parallel through the quartz plates and another lens to focus the emerging rays.

Since the filtered light of a prominence is narrowly monochromatic, the objective lens of the coronagraph need not be corrected for color. In fact a single-element lens works better than an achromat. The lens must be superlatively free of bubbles, striae, dirt, dust and even microscopic scratches which would diffract light. A reflecting telescope cannot be used because irregularities in the metal reflecting surface diffract light.

The quartz polarizing monochromator has other demands. It is an incurable thermometer watcher. It misbehaves unless the temperature is held constant within about one degree of a predetermined value, usually between 100 and 125 degrees Fahrenheit. This is usually done by heater bulbs, a fan and a thermoswitch.

The filter elements 1 through 6 (see drawing first page) are birefringent plates of crystal quartz. Each crystal is ground to a thickness one half that of the preceding element. Both surfaces are parallel to the crystal's optic axis.

Each element receives plane-polarized light through a sheet of Polaroid film sandwiched between the quartz plates and splits it into two components of equal intensity which traverse the crystal at slightly different velocities. When the component rays emerge from the crystal, their combined polarization is altered in a manner depending on the wavelength.

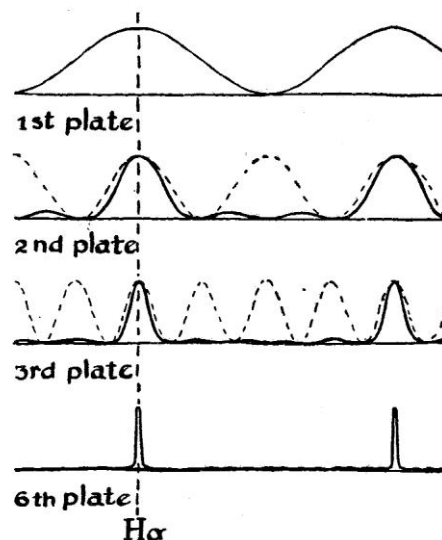
A six-element filter, ideal for observing prominences, has a total thickness of about 4½ inches. It is best used on a refracting telescope, preferably with a simple lens objective, with an occulting disk covering the image of the sun in the focal plane. A small lens projects an image of the prominences around the occulting disk on an eyepiece or camera.

The constructing of the filter and optical system of the coronagraph is well within the capabilities of an experienced a.t.m. The essential details of design and construction are given by Paul in Amateur Telescope Making book 3.

Semerau writes: "The Coronagraph can be built at a cost for materials of \$150 to \$200. Time of construction will be longer than for a telescope because it will take extra time to become acquainted with the special techniques of grinding, polishing, testing and orienting crystal quartz."

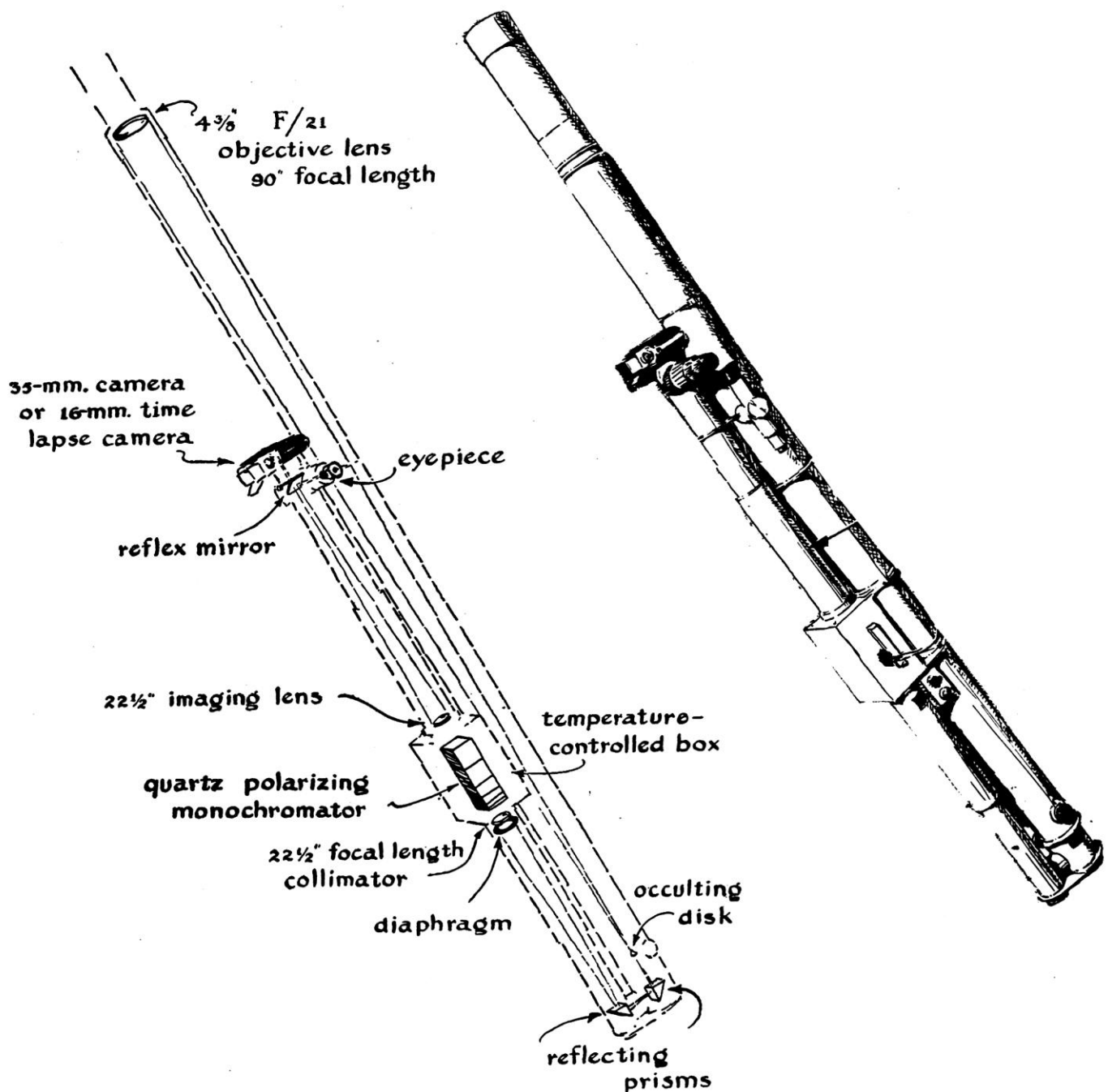
Just because some amateur telescope makers have no advanced degree in physics, they imagine they can't do the job and thereby miss a front seat at one of nature's best shows. A number of experts have commented favorably on the performance of Semerau's instrument. He claims that it cannot be credited to his formal education, for it stopped with the ninth grade.

Some simple facts about the performance of the coronagraph dictate that clear blue skies, preferably after a rain, with temperature not above 72 degrees, will give finest observing and photography. From mid July to mid-September observing must be done before 10a.m. while the Earth is still cool. After mid-morning the heat from city streets and industry makes observing impossible. Observing is generally bad during December, January and February, when the sun is low and the light must pass through a thicker



layer of smoke and haze. Prominences are just barely visible on a cool day if the sky is gray-blue or hazy.

Below is the Semerau coronagraph, built through the instruction of E. Paul Amateur Telescope Making book three.



The optical system of the coronagraph