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Some Activities of an Amateur

J. RUSSELL SMITH, Director
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My little 8-inch Newtonian is situated on the High Plains of Texas—out where we are blessed with black skies which are very favorable for astronomical observations. However, the high winds and dust storms are quite objectional at times.

The 8-inch aluminized pyrex mirror has an excellent figure and a focal length of 60 inches. A Ramsden ocular of two inch focal length (30X) gives a wide field and is very suitable for viewing wide clusters and comets. It is also very useful in locating and observing certain variable stars. Other powers obtained are 60X, 120X, 180X, 240X and at times I am able to use an ocular of ⅛ inch focal length which gives a power of 480X.

The mount is by Harry Lee Armiger of Detroit. It is all-weather heavy and rigid, which helps to make observing a pleasure in this windy section of the country. The mount is equipped with circles, verniers and slow motion in both right ascension and declination. The hour circle reads to one minute of time and the declination circle reads to 10 minutes of arc. The finder is a 4X achromatic contraption which gives a field of almost exactly five degrees which is quite convenient. The small telescope attached to the 8-inch is a 2½-inch achromatic refractor with powers of 48X, 72X, and 108X. This little telescope is very handy, since it is easily removed and placed on an alt-azimuth tripod, thus affording a portable instrument. The 2½-inch was my first telescope and through the use of it I became acquainted with many interesting spots of the sky.

After my initial attempts at photography with the 2½-inch, I became interested in lantern slide making. As a result, I made over 100 astronomical slides. Most of them were "via" the reproduction method. This group of slides is divided into the following units: lunar, solar system, nebulae, and comets, and miscellaneous. Several hundred slides for the various sciences, which I teach, were also made. The astronomical slides are found to be useful in helping to stimulate interest in astronomy. I find them most useful in teaching general science. (For a brief discussion of my method of arousing interest in astronomy, I refer you to *The Sky* for May 1937, page 28-29). In passing, I should like to mention the fact that the art of lantern slide making is not difficult and good slides can be made by the amateur photographer at a price much less than the cost of commercial slides.

The work of my little observatory is principally the observation of variable stars. However, my time is limited and consequently my observations do not run into large numbers. I also indulge in planetary observations. In June 1937, I made several drawings of the planet Mars. I found that more detail could be seen by observing the planet at about 7:30 P.M., C.S.T. (before sundown). I also found that a power of 120X gave better contrast than higher powers. Better seeing could be had by observing the well-known planet at this time with full aperture than by observing after dark with diaphragmed mirror or eye-end diaphragms. The original drawings were made at the eyepiece while using the slow motion in R.A. to keep the planet in the center of the field. I used a circle 30mm. (1 3/16") in diameter which was drawn with a compass on white paper. The general outline was sketched with a pencil and then worked for detail by using various powers (120X mostly). The penciled surface was rubbed with a piece of cotton in order to give it a more even shading. The circle was then cut out and pasted on black construction paper for photography. By reducing the image in the photographic process, I secured a fairly even and smooth appearance. I also found that photographing the image slightly out of focus gave better results. The markings on one of the drawings were worked out by Thomas L. McDonald of Glasgow, Scotland. The central meridians of the various drawings were figured by Hugh M. Johnson of Des Moines, Iowa. I am very grateful to the above mentioned persons for their help. Should the reader desire to see the results obtained, I refer you to *The Sky*, October 1937, Vol. 1, No. XII, page 25. A print of the drawing for June 10, 1937, was published in the July 1937 issue of *The Texas Observers' Bulletin*. Should anyone be interested in a copy of some of the drawings, please write me.

Photography with the 8-inch has been limited to lunar photos due to the lack of a drive and suitable current for one. However, I am having a B. & L. Tessar IC, f4:5 lens of slightly over six-inch focal length mounted in a metal box with plate holder (4" X 5"). This camera is to be attached to the tube of the 8-inch and I am going to try my hand at stellar photography by driving with manual slow motion. I hope this little lens will prove suitable for comets and meteors. I hope to be able to secure fairly good stellar images by the above method since the focal length of the 8-inch is approximately 10 times that of the camera lens. I also intend to experiment with an unusual type of drive which may be suitable for driving the short focus lens. I should like to hear from amateurs who are interested in drives.

I have tried my hand at several 6-inch mirrors and I have made a complete mount for one. I find this type of work fascinating.

Smyer High School, Hockley County,
Smyer, Texas.

The Trig Micrometer

By D. F. BROCCHI

A contraption christened with this name has been devised to determine the position of a star from two stars of known position. It can be used with any mount, although the equatorial is most suitable for facility of operation and accuracy of results, especially if clock driven. It is not difficult nor expensive to make, requiring only common hand tools and material very likely available in the junk pile. It is not necessary that the three stars be seen in the same field, but if A and B are the reference stars and X the star to be located, each of the distances AB, AX and BX must be less than the diameter of the field.

The instrument consists of a straight bar fixed in the focal plane of the ocular, a full circle dial attached to and concentric with the ocular, and a pointer attached to the telescope and flush with the edge of the dial. The bar should be just wide enough to be seen plainly without artificial illumination. The working edge coincides with a diameter of the field or very nearly so. The other edge is marked with a few notches to indicate that it is not to be used. The dial should be thin, set as far back as practicable, and of the largest size that will clear the nose of the observer. A dial of 2¾" diam., ½" beyond the face of the cap is about right for the average nose. It is graduated at intervals of 2 or 5 degrees and numbered sinistrorsely (counter clockwise) and continuously all the way around. The bar and the dial should be removable, if the ocular is to be used for other purposes, in which case a positive one is more convenient for the placement and removal of the cell carrying the bar. It may be well to arrange bar and dial for a low and a high power ocular, or one of the two may be equipped with permanent bar and dial, if it can be spared from other uses. While low powers have a larger field, high powers facilitate the location of fainter stars. The field can be enlarged, by enlarging the opening in the diaphragm, or this may be removed as a piece of apparatus of doubtful utility. The opening in the cap may also require enlargement for a full view of the enlarged field. The pointer should be on a hinged support to fold out of the way when not in use, and may be made in the form of vernier for very close reading of the dial.

To locate a star X from two stars A and B, turn the ocular to set the bar successively in contact with stars A-B, A-X, and B-X, and make a note of the direction angle, or simply direction, of each setting indicated by the dial. For close adjustment of the bar, the final turning of the ocular is made with finger and thumb on the edge of the dial. The notes will give the angles of the triangle ABX, and the position of X may be obtained by solving for AX and BX, assuming ABX a plane triangle, or it may be plotted directly on the chart with a protractor. The distance AB is scaled on the chart or calculated from the right angle triangle ABN of Fig. 1, where AN is the difference in declination. If a is the difference in right ascension in degrees, and d the mean declination, of two stars A and B, we obtain the angular measure BN in degrees of arc

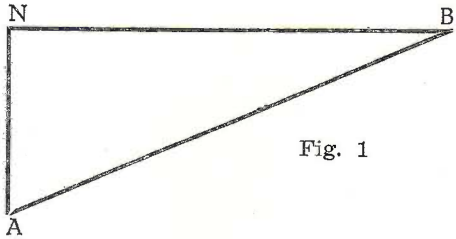

Fig. 1

by the formula

$$BN = a \cos d$$

With the two sides AN and BN known, the hypothenuse AB can readily be calculated.

With an equatorial, only one setting on AB is required for all stars on the same side of it, but with other mounts, if many stars are to be located, a new setting on AB should be made from time to time to reduce the error due to the turning motion of the image.

When it is seen that the angle at X would be too large or too small for the required degree of accuracy, one or two stars already located are used in place of A or B or both, so the angle may be nearer to a right angle.

To avoid confusion in deriving the angles from the notes, the work should be done according to the following rules: (1) Turn the ocular from setting to setting always in the dextrorse (clockwise) direction. Incidentally this direction will prevent unscrewing the cap, if the ocular fits tightly in the tube. (2) Follow the perimeter of the triangle around sinistrorsely (counter clockwise). For example, in Fig. 2 set successively on AB, BX and AX. In Fig. 3 set successively on AB, AX and BX. (3) Set on AB or its substitute with the working edge of the bar facing the interior of the triangle; set on the second side facing the exterior, and on the last side facing the interior. (4) Subtract the direction of AB from that of the second side, and the direction of this from that of the third side. If the subtrahend exceeds the minuend, add 360° to this before subtracting. The differences are interior angles. The third interior angle is the supplement of their sum, and is also equal to the direction of AB plus or minus 180° minus the direction of the third side. Obviously 180° is to be added, if the direction of AB is the lesser of the two.

To be strictly correct, ABX being a spherical triangle, the sum of the three angles is more than the sum of two right angles, but the excess is too slight to be considered for an instrument of this type and triangles with sides limited in extent by the field of a telescope. To make this statement more definite, the excess has been calculated for equilateral triangles having sides of 1, 2, 3, 4 and 5 degrees with the following results: 0° 0′ 27″, 0° 1′ 49″, 0° 4′ 5″, 0° 7′ 15″, 0° 11′ 1″, respectively. Let it be noted furthermore that these are extreme values, the equilateral having a greater excess than any other triangle of the same perimeter.

It will hardly be necessary to mention that the letter X, denoting any star to be located, is replaced in practice by a, b, c, etc. for individual stars.

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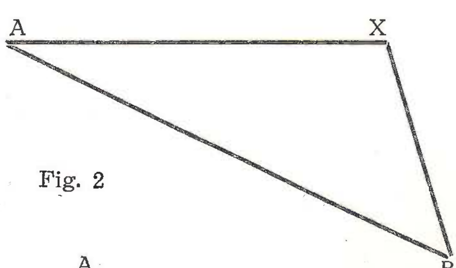

Fig. 2

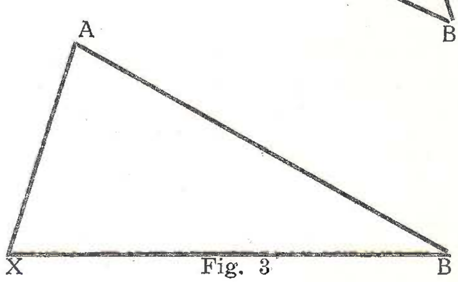

Fig. 3

FLASH!

Milwaukee hereby invites every amateur within 1,000 miles—or beyond—to come to its open house week-end party June 18-19.

There will be opportunities to visit with fellow TN's and stargazers and to inspect the new quarters of the Milwaukee society on the Phillip's farm site. Definite instructions on how to reach the observatory will be published later.

The latch key will be out. Be sure and keep these dates open for us.

Prepare for Palomar!

LEO J. SCANLON

While the 200-inch telescope will not be completed until 1940 (date set by optomistic scientists), it is not too early for most of us to lay our plans and begin saving our money against the day when we will be permitted to see this modern marvel in all its glory on the heights of Palomar Mountain. It is hereby suggested that there be formed "Two-hundred Inch Clubs" in all the large towns throughout the United States ,particularly those in the region east of the Mississippi, the purpose being to encourage the amateur to salt away his stray dimes, nickles, and pennies for the next two or three years so that when the time is propitious. and final arrangements have been completed. we can begin the trek to California Tech and see "Big Bertha" in action. Of course, the astronomers and scientists in charge of the observatory on Palomar have not been consulted as to their views on this proposed mass visit of amateur astronomers, but it is the writer's belief that they would just as soon have us come all at once, rather than in twos and threes, and get the darn thing over with. As a matter of fact, there is little they could do to deter us from coming—who ever heard of anyone asking the owner of an orchard whether or not he would permit a swarm of bees to alight in his trees? It seems to me that the Lowers, our amateur friends in San Diego, could rent out a ball park there for the use of any of us who came by trailer, and we could have a convention to top off our visit to the coast probably ending up in Los Angeles and Hollywood, where it is hoped we can get a more satisfactory view of some stars in that remote cluster. Incidentally, some of them are telescope nuts, too, or did you know?

This idea is given for what it may be worth; it has infinite possibilities. Just imagine a caravan starting from the east, picking up stray thumb-weary amateurs along the dusty road, stopping overnight at Canyon Diablo, Flagstaff, Tuscan, visiting the observatories and tourist sights along the route! Boy, that would be something worth saving and slaving for! Who's with me? The trip from the Atlantic region could not be done in less than a month. We would live on hot dogs and ice cream cones, expect to stay at tourist cabins or camps, and spend a month in the hospital recuperating upon our return . Isn't the prospect grand?

Valley View Observatory,
Pittsburgh, Pa.

Planetary Report No. 28

E. P. MARTZ, Jr., Director, Planetary Section

JUPITER'S GREAT RED SPOT IN 1936; III: In Planetary Reports No's 14 to 16, (*Amateur Astronomy*, October and December, 1936), and in A.A., November, 1936, we recorded observations of the longitude of Jupiter's great red spot (System II), by Messrs. Latimer J. Wilson and Walter H. Haas, and values obtained by the observers of the British Astronomical Association, communicated to the writer by the Rev. T. E. R. Phillips. The values by Wilson and Haas indicated a motion ranging from 142° (Wilson) in June to as much as 151° (Haas) in September of 1936. The British observers, led by B. M. Peek and Rev. Phillips, could not corroborate this gradual shift of position of the marking. and the matter remained controversial. In conversation during 1937, Dr. E. C. Slipher of the Lowell Observatory told me that he had measured his photographs of Jupiter in 1936, and had obtained a nearly constant longitude of about 143° throughout the opposition, thus corroborating the values obtained by the British observers. Rather surprisingly, the well-known German observer, Herr Phillip Fauth, obtained longitudes for the red spot in 1936 ranging from 146°.5 on June 20, to 143°.2 on Sept. 29, a shift of the order of magnitude reported by Wilson and Haas but in the opposite direction! (*Astronomische Nachrichten*, Nr. 6263, 261/23, Jan. 14, 1937.)

With a total of 40 longitude observations by the five different observers from March 16 to Sept. 29, 1936, the writer has undertaken a quantitative examination of the data in an attempt to discover if the contention made by Wilson and Haas of a shift in longitude is justified. The application of normal probability law to such a small number of observations by different observers is perhaps not justifiable, but the opportunity for such an application seemed tempting, and the results obtained are of interest.

It was necessary to make the assumption that all the observers had about equal ability in making longitude determinations. For convenience the 40 observations were divided into nine groups with respect to time, as indicated in the table at the end of this article. Eight of these groups covered consecutive intervals of 20 days each, but as there was an excess of 29 days between the first and last observations, this time interval was used for Group II, in which period no observations were available, so the excess of time interval for that group will not affect the results. The arithmetical mean longitude for the red spot was taken from all the observations available in each group, regardless of who the observers were. Each group mean was weighted by means of the number of observations composing that group. The deviations of the individual weighted longitudes from the weighted mean for the group were then taken. These individual observational deviations were squared and plotted against the probability of each deviation, determined from normal probability law and the respective weights. A true normal probability curve was then superimposed on this graph, and all the observations whose squared deviations from the mean fell outside of the normal probability distribution (which allows only minor accidental errors arising from inherent inaccuracy of the observational methods) were rejected. Nine of the observations were thus considered unfit for use in this determination. These rejected observations were distributed thus: Wilson 3, Haas 3, Phillips 2, Fauth 1—which is about the distribution to be expected considering the fact that approximately the same relative numbers of observations were contributed by the respective observers. Final mean values of the longitude for each time group were then taken and are indicated in the table alongside of the preliminary mean taken before the rejection of the badly discordant observations. The validity of the process was also checked by the application of the principle of least squares to the observational data.

The table indicates decreasing longitude (i.e., speeding up of the motion of the spot), through groups I-V, and then increasing longitude (i.e., slowing down of the spot) through groups VI-IX. The mean longitudes of all four groups from March 16 to July 7 is 143°.6; and that taken from July 8 to Sept. 29 is 144°.8, the residual being 1°.2. If we take, similarly, the mean longitudes from the group means as uncorrected by the rejection of the nine discordant observations over the same time intervals as above, we find a residual of 1°.1, thus indicating that our rejection of discordant observations did not greatly influence the final result and was justifiable. Now, it would appear that this grouping of all the available observations does uphold the contention of Wilson and Haas that the red spot shifted longitude in a plus direction in 1936. However, Wilson's mean values, as published in Planetary Report No. 14, range from 143°.2 in June to 145°.5 in August, a shift of longitude of 2°.3, twice that indicated from the above analysis of observations by all the observers. The shift indicated by Haas was even greater, being as large as 11°.0 from June to September. Despite these residuals, as we have seen above, the combined observations of five observers (even including those of Wilson and Haas) do not bear out a longitude shift of greater than one-half to one-tenth that indicated by the two latter observers. Further, B. M. Peek, director of the Jupiter section of the B.A.A., has indicated that the probable error of the usual method of longitude determinations for Jupiter is of the order of 1°.2, and may occasionally reach 3°.0 (*Journal of the British Astronomical Association,* February, 1937, p. 153, and *The Observatory,* Sept., 1936, p. 274). The longitude shift of 1°.1 indicated by the combined observations is thus clearly within the scope of the probable error of determination; and the shift of 2°.3, indicated by Wilson, is also probably not in excess of his probable error, since his determinations were often mean values from the longitudes of the ends of the red spot, which he himself recorded as being variable in length. In addition, some of his longitude values were apparently determined from drawings, and would thus have a higher probable error than the transit observations of the British observers. The same considerations apply to Fauth's observed residual. The high residual obtained by Haas is unexplainable by accidental error on the normal probability distribution; and as the early values he obtained in June, 1936, agree in order of magnitude with those of the other observers, it is apparent that some error was introduced in the later, badly discordant, observations. As one would expect observational skill to increase with time and experience, not to decrease, the error was most probably in the time-piece used for his later determinations. Further, his longitudes were all determined from drawings, and the probable error of these was apparently rather high—of the order of 5°.0 of longitude. It may be argued that half of the observations used in the above analysis were affected by a (plus) probable error, and the other half by a (minus) error, thus neutralizing the effect of the errors in the mean residuals, and validating the contention of at least a 1°.2 shift in longitude indicated by the final means. However, the relatively small number of observations available (40), and the inequality of the probable errors of the five individual observers do not appear to justify this assumption.

In conclusion the combined tabulated observations indicate a small motion in a plus direction in longitude for the red spot during the summer of 1936, but a motion whose magnitude is less than, or equal to, the mean probable error; hence, in the opinion of the writer, cannot be considered as representing a real shift in the position of the Jovian marking.

CORRECTION: In *Amateur Astronomy*, February, 1938, the writer presented a "Note on the Predicted Transit of the Hypothetical Planet Vulcan". The times given in this note indicated as: "G.C.T." (Greenwich Civil Time), starting at midnight. It is obvious that this is an error, and that all the times noted should be by: "G.M.T." (Greenwich Mean Time), which starts at Greenwich Mean Noon.

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MEAN LONGITUDES OF JUPITER'S GREAT RED SPOT
March to September, 1936

(A)	(B)	(C)	(D)	(E)	(F)
I	March 16	April 5	2	145°.5	145°.5
II	April 6	May 5	0	(No observations)	
III	May 6	May 26	3	143°.2	143°.2
IV	May 27	June 16	4	142°.0	142°.0
V	June 17	July 7	8	143°.4	143°.8
VI	July 8	July 28	7	143°.8	144°.2
VII	July 29	Aug. 18	6	144°.2	143°.9
VIII	Aug. 19	Sept. 8	8	145°.2	144°.5
IX	Sept. 9	Sept. 29	2	146°.6	146°.6

Explanation of Table

Column: (A) Number of Group with respect to time.
" : (B) Date of beginning of time interval for group.
" : (C) Date of ending of time interval for group.
" : (D) Weight; number of observations in group.
" (E) Mean longitude of Great Red Spot for group. (uncorrected.)
" : (F) Mean longitude of G.R.S. after rejection of discordant observations from all groups.

Variable Star Section

D. W. ROSEBRUGH, Director

RIPPLES

Willows whiten, aspens quiver,
Little breezes dusk and shiver,
On the stream that runs forever,
By the Island in the river
Flowing down to Camelot.—*Tennyson*

Last month we talked about waves and the wave-like changes in the brightnesses of periodic variable stars. These stars were classified as (a) cluster type stars which vary through approximately a magnitude, and complete their cycle in less than a day, (b) cepheids which take several days or weeks from maximum to maximum, and (c) long period variables which take some months or even a year or more per cycle.

The cluster type stars may justly be considered the "ripples" of this grouping, which depends to a considerable extent upon wavelength or length of period from maximum to maximum. This month we will turn our attention to the facts that cluster type, or RR Lyrae type stars as they are sometimes called, have taught astronomers. It must not, however, be considered that what they have already taught is all that can be learned from them. Perhaps greater refinements in our methods of study along the lines suggested in the next three paragraphs may teach us an hundredfold as much as we have already learned.

Radio and wireless waves are now of tremendous importance to mankind. Apparently no one anticipated their existence until Maxwell postulated it on theoretical grounds in his great study "Electricity and Magnetism" made in 1873, Hertz showed their existence experimentally in 1888, and Marconi in 1897 began to put wireless telegraphy on a commercial basis. Possibly some new astrophysical instrument not yet invented may furnish mankind a tool with which to detect new types of star phenomena which are not now suspected. The spectroscope, and perhaps to a lesser extent photography, did this for astronomy in the last century.

Possibly we shall learn more about variable stars through the work of some brilliant mathematical astrophysicist, who may draw unforeseen but sound conclusions from existing data about these stars.

Perhaps further facts on variable stars secured with our existing means may permit more accurate conclusions to be drawn regarding the nature of these stars. The more we learn about a subject the more we find left to learn, and yet the faster we accumulate knowledge.

It is this principle of learning which justifies the continued existence and vigorous growth of the AAVSO since its founding in 1911.

Thus far astronomers have learned from cluster type variables the distances of star clusters, and as a result of this knowledge they have learned, among other things, the approximate distance to the center of our galaxy. The method of determining the distance of a cluster type variable star is simple. Suppose that some night we drive to the top of a nearby hill and look down on our own city or village. We see the street light in front of our house which we know to be 100 watts in size, and to be exactly a mile distant. We see a second street light which appears to be the same brightness. Assuming that all the lights distribute their beams equally in all directions as stars do, this may be another 100 watt bulb a mile away or it may be a 400 watt bulb two miles away, or a 1000 watt bulb 3.16 miles away, or it may be a 50 watt bulb 0.7 of a mile away. If we were told the brightness (wattage) of this second street light we could at once determine its distance. Similarly we note a third street light which we estimate is one magnitude brighter, or 2.52 times as bright as number one. This may be a 250 watt bulb a mile from us or a 1000 watt bulb two miles from us. If we know the exact wattage of any of the street lights which we can see from the hill top and can determine its apparent brightness as compared to the 100 watt bulb in front of our own house, we can determine the distance to the street light in question. In terms of stars this is expressed as follows: If we know the apparent magnitude of a star (Procyon 0.5) and its absolute magnitude (Procyon 2.9) we can determine its distance (Procyon 10 light years or 3.1 parsecs).

The exact relation is that a star of apparent magnitude 1.0 (brightness to eye) with an absolute magnitude of 1.0 (wattage of bulb) is 10 parsecs or 32.6 light years distant (distance to street light). This relation is capable of indefinite extension by the use of the inverse square law as follows: If a star of absolute magnitude is —0.3, it appears as —0.3 magnitude to the eye if it is 32.6 light years away. If it appears 2 magnitudes fainter or 1.7 magnitude it is 2.52 times as far away, because a drop in brightness of two magnitudes corresponds to a decrease in light received to the reciprocal of 2.52 squared. If the star appears as 3.7 magnitude, it is 2.52 squared times as far away; if it appears as 15.7 magnitude it is 2.52 to the eighth power times 32.6 light years away, or approximately 1500 times 32.6 light years or 48,900 light years or 15,000 parsecs. An extra magnitude fainter or 16.7 magnitude in apparent brightness increases the distance by the square root of 2.52 or to about 77,000 light years or about 23,500 parsecs.

Thus far we are on firm and familiar ground. "But", you ask, "what part do the cluster type variable stars play in all this?" Simply this: it has been found that if one can determine the length of the period of a cluster type star from maximum to maximum one can estimate its absolute magnitude with some degree of accuracy. This Luminosity-Period Law for Cepheid variable stars, as given in Dingle's *Astrophysics* published in 1927 may be tabulated as follows: (Note: It is believed that this table has been modified slightly since 1927 perhaps about as shown in the last column in brackets)

Period in Days	Absolute Mag.	
0.25	—0.3	(—0.3)
0.63	—0.3	(—0.3)
1.59	—1.0	(—0.7)
4.0	—1.8	(—1.2)
10.0	—3.2	(—2.0)
25.0	—4.6	(—3.3)
63.2	—6.0	(—4.4)
159.0	—7.0	(—5.8)

This law was discovered by Miss Leavitt of Harvard College Observatory in her studies of the lesser Magellanic Cloud, and by Dr. Harlow Shapley, immediate past-president of the AAVSO, from the study of 11 typical Cepheids in our own galactic system. These latter eleven stars corresponded to the 100 watt street light, in the illustration given above. In other words their distances were determined with some accuracy by statistical methods, and since their apparent brightnesses were known from the photographic plate, their absolute magnitudes could be determined.

And now for an illustration of how this method is applied in practice. This is from the pen of the second vice-president of the AAVSO, Dr. Helen Sawyer Hogg. In the February 1937 Journal of the Royal Astronomical Society of Canada, Mrs. Hogg reports the results of her study on the globular cluster N. G. C. 6402 (M14 in Ophiuchus). When the writer last saw Mrs. Hogg at the David Dunlap observatory in 1936, she kindly showed him some of the 48 photographs of this cluster which she had secured at the Newtonian focus of the 74 inch reflector. In these photos the cluster was perhaps 1½ inches in diameter and the images of the individual stars had to be examined with a strong magnifying glass.

Sixty-one cluster type variable stars were located in N. G. C. 6402. The exact

(continued on page 57)

Meteor Section

J. WESLEY SIMPSON, Director

Unfortunately, there is usually very little to report for the first three months of the year, hence the smallness of this report. It is hoped and expected that with the advent of Spring, warmer weather, and clearer skies, the activity in this field will increase many fold.

Regional Report No. 3801 for Missouri and Southern Illinois

(January through March 1938)

J. WESLEY SIMPSON, Regional Director

The following is a summary of the activity in the Missouri-Southern Illinois region during the first three months this year.

In checking the totals for this period, your writer finds that this is the largest report for such a period in the history of our group. In fact, the totals for this three month period exceeds the total for any six month period (January through June) in our history. Reports from all of our observers are not in as yet and when they are received, our totals should be close to 2,000 meteors. Before the month of April is over, the 40,000 mark will have been reached since we started in 1932.

The explanation for the M-SIO's fine showing so far this year lies in the fact that we had what was probably the largest Quadrantid meteor shower on record, and that some six or eight of our workers are observing with remarkable consistency.

The report is herewith given:

TABLE No. 1 — INDIVIDUAL TOTALS

Observers		Number of Nights	Minutes Observed	Meteors Recorded
Donald D. Zahner	(1)	13	1,240	225
Harry Bruggemann	(2)	4	400	83
Edwin E. Friton	(2)	4	330	204
Joe H. Senne Jr.	(2)	3	240	73
James F. Brady	(1)	2	180	53
M. Weston Tate	(3)	1	195	250
Mary Ellison	(1)	1	120	53
J. Wesley Simpson	(1)	26	3,360	820***
Totals: 8 Observers		34	6,065	1,761

***Includes 8 telescopic meteors. (1) Observers live in Webster Groves, Mo. (2) Observers live in St. Louis, Mo. (3) Observer lives in Alton, Ill.

TABLE No. 2 — MONTHLY TOTALS

Month	Observers	Nights	Minutes	Meteors	Observed Rate	A.M.S. Rate	K-O
January	8	10	2,265	1,265	33.6	8.0	plus 25.6
February	4	9	1,380	203	8.76	6.0	plus 2.76
March	4	15	2,420	293	7.26	7.0	plus 0.26
Totals:	8	34	6,065	1,761			

The number of nights is not the total of all observers but is the number of different nights on which observations were made.

The K-O is the known or A.M.S. rate for the month minus the observed rate.

Dr. C. P. Olivier Visits St. Louis, Mo.

For many years your writer has corresponded with Dr. Olivier, of meteor fame, but never had the pleasure of meeting this distinguished astronomer until Wednesday, April 13, 1938. When one has the pleasure and privilege of working under such a man, it is of course natural to look forward to the time when you can sit down and discuss your problems face to face. Thus it was quite a gala occasion for St. Louis when he visited us, though he was here on business and had little free time. St. Louis is a rather poor place in which to find astronomical celebrities.

It was exceedingly interesting to hear from the lips of this scientist some of the latest developments and theories, and of the work being done elsewhere in the world. It is with regret that this space is too short for printing some of the discussions.

Milwaukee-Webster Groves Radio Hook-Up

On Thursday, April 14, at 10:15 P.M., L. E. Armfield, representing the Milwaukee group and region, and J. Wesley Simpson, representing the Missouri-Southern Illinois Section, inaugurated a two way radio hook-up between the two cities.

Mr. Armfield talked over amateur radio station W9MKC, in Milwaukee, owned by M. A. Ziehms of that city. Mr. Simpson talked over amateur radio station W9UAE, in Webster Groves, Mo., owned by J. R. Stafford of that city.

A discussion of many topics was made possible by Messrs. Ziehms and Stafford. The connections were easily and quickly made. The QSO was considered by all as being most successful.

The next conference is scheduled for Monday, May 9, at 10:00 P. M., when it is hoped that Ed Martz of planetary fame and Ed Friton, asteroid section leader for the AAAA, can be introduced over the air waves. Tune in on the 75 meter band on May 9 at 10:00 P. M.

Variable Star Section

(continued from page 55)

periods of nine of these were determined and found to lie in the range 0.55 to 0.60 of a day. Referring to the above table it is apparent that their absolute magnitude is —0.3. The mean magnitude of the cluster type variable stars in N. G. C. 6402 is 16.85 as shown on the photographic plate. Referring to the discussion in the paragraph preceding the table, a star of —0.3 absolute magnitude which appears as 16.7 magnitude on the photographic plate is 77,000 light years or about 23,500 parsecs distant. The unadjusted observations therefore indicate that N.G.C. 6402 is 23,500 parsecs distant. However, the paper discusses the probability that N.G.C. 6402 is dimmed about 1.26 magnitudes by absorption of light in space in that direction. If the magnitudes of the cluster type variable stars as shown on the photographic plate would have been about 1.26 magnitudes brighter, i.e. about 15.6 magnitude instead of 16.85, and if it had not been for interstellar absorption of light, the distance of the cluster type variable stars would be less than 15,000 parsecs, probably about 14,000 parsecs. After some discussion Dr. Hogg tentatively places the distance of N. G. C. 6402 at 12,000 parsecs.

Notes on Observations

Ferdinand Hartmann reports that Mira (*o* Ceti) reached 8.3 on 946. It is now lost in the sunset. R Aur 050953 jumped rapidly from 114 on 929 to 86 on 951. It is now bright enough for easy observation with the red color filters and red charts. T Orionis 053005a was practically constant at about 10 mag. all February, but by 979 it had dropped to 10.9. SU Tau 054319 appears to have been fairly constant at about 9.5 during February and March and S Aur 052034 has been about 101 during the same period. Mr. Hartmann caught Z Cam at 113 on 925. 115158 Z UMa is now (979) about 73; this star and R CrB will be favorably placed for beginners for some months. 210868 T Ceph is rising, having reached 106 on 950. When last seen, 233815 R Aqr was declining, having reached 91 on 931.

General Notes

The following comments from George Herbig, 2016 Ewing St., Los Angeles, are of more than usual interest: the 18-inch Schmidt camera now on Mt. Palomar has been so successful that a 48-inch camera has been decided upon. The following data show a comparison of the existing 18-inch camera and the proposed 48-inch.

	18-inch	48-inch
Focal length	36″	120″
Mounting	Fork	Fork
Guiding telescope	8″ refl.	10″ refl.
Photogr. field	10 degr.	6½ degr.
Mirror diameter	26 inch.	72 inch.

Mr. Herbig also says that the dome for the 200-inch is completed and the first parts of the mounting are expected to arrive this summer. The big mirror is approximately a year ahead of schedule.

The Los Angeles amateurs are considering the possibility of moving their clubhouse into the hills at the edge of the city. They hope that their 15-inch reflector will show them 16th magnitude stars in the clear atmosphere of the suburbs.

On March 25 the members of the Poughkeepsie Astronomical Club who were observing variable stars and meteors at the Vassar College observatory, through the courtesy of Dr. Maud W. Makemson, Director, saw a beautiful but transitory aurora. At about 8:30 E.S.T. Polaris was surrounded by a beautiful rosy glow, the color of a dark red peony, and beneath it white curtains of light shimmered. In about five minutes this display diminished to a few scattered streamers of white light. About 8:45 a beam of light spread across the sky from the east southeastern horizon to the west north-western horizon, passing slightly south of the zenith. This beam was about three degrees in width throughout its entire length of nearly 180 degrees and it remained practically motionless for perhaps 20 minutes. Beta Leonis was slightly obscured by the brilliance. About 9:10 this beam largely disappeared but the center part broke into striations which formed an active corona about 15 degrees south of the zenith.

74 So. Randolph Ave.,
Poughkeepsie, N. Y.

Calendar of Events

GEORGE DIEDRICH

(All Time C. S. T.)

PHENOMENA OF JUPITER'S SATELLITES

(In C.S.T.)

MAY, 1938

Day	Time	Sat.	Phenom.
2 Mon.	2:57 A.M.	II	E D
4 Wed.	1:55 A.M.	I	T e
4 Wed.	3:04 A.M.	II	T e
7 Sat.	2:33 A.M.	IV	E D
10 Tue.	3:00 A.M.	I	E D
11 Wed.	1:34 A.M.	I	T i
11 Wed.	2:32 A.M.	I	S e
11 Wed.	2:53 A.M.	II	T i
11 Wed.	3:02 A.M.	II	S e
16 Mon.	12:58 A.M.	IV	T i
18 Wed.	2:09 A.M.	I	S i
18 Wed.	2:46 A.M.	II	S i
24 Tue.	1:30 A.M.	IV	E R
26 Thu.	1:17 A.M.	I	E D
27 Fri.	12:47 A.M.	I	S e
27 Fri.	2:07 A.M.	I	T e
27 Fri.	3:12 A.M.	III	E D
29 Sun.	12:19 A.M.	II	T e
31 Tue.	2:04 A.M.	III	T e

JUNE, 1938

Day	Time	Sat.	Phenom.
2 Thu.	3:11 A.M.	I	E D
3 Fri.	12:24 A.M.	I	S i
3 Fri.	1:43 A.M.	I	T i
3 Fri.	2:29 A.M.	II	E D
3 Fri.	2:40 A.M.	I	S e
5 Sun.	12:02 A.M.	II	T i
5 Sun.	12:11 A.M.	II	S e
5 Sun.	2:53 A.M.	II	T e
7 Tue.	12:39 A.M.	III	S e
7 Tue.	2:26 A.M.	III	T i
10 Fri.	2:18 A.M.	I	S i
10 Fri.	3:06 A.M.	IV	O D
10 Fri.	11:33 P.M.	I	E D
11 Sat.	11:56 P.M.	II	S i
12 Sun.	12:18 A.M.	I	T e
12 Sun.	2:34 A.M.	II	T i
12 Sun.	2:48 A.M.	II	S e
14 Tue.	1:03 A.M.	III	S i

(Satellites eclipsed on west side of the planet)

Explanation of symbols:
E—Eclipse T—Transit
S—Shadow O—Occultation
D—Disappearance
i—ingress e—egress

MAY, 1938

6. Fri.—First quarter at 3:24 P. M.
7. Sat.—Venus in conjunction with Mars at 6:00 P. M. Venus only 0° 2′ north. (For comparison—components of the double star Epsilon Lyrae are about 4′ apart.)

13-14 Fri.-Sat.—Total Eclipse:
Moon enters penumbra—Fri. at 11:44 P. M.
Moon enters umbra—Sat. at 12:57 A. M.
Total eclipse begins—Sat. at 2:18 A. M.
Middle of eclipse—Sat. at 2:44 A.M.
Total eclipse ends—Sat. at 3:09 A. M.
Moon leaves umbra—Sat. at 4:31 A. M.
Moon leaves penumbra—Sat. at 5:43 A. M.
Magnitude of the eclipse =1.102 (Moon's diameter = 1.0)

19. Thu.—Greatest elongation west of Mercury, 25° 37′.
22. Sun.—Last quarter at 6:36 A.M. Quadrature of Jupiter and the sun.
29. Sun.—New moon at 8:00 A. M. Total eclipse of the sun—invisible in North America.
30. Mon.—Conjunction of Mars and the moon at 11:54 A. M. Mars 3° 20′ north.
31. Tue.—Venus in conjunction with the moon at 9:52 A. M. Venus 5° 6′ north.

JUNE, 1938

4. Sat.—First quarter at 10:32 P. M.
12. Sun.—Full moon at 5:47 P. M.
15. Wed.—Venus at greatest heliocentric latitude north. Its position is R.A. 7^h 52^m, Dec. 22° 50′ north.

(Data from the *Handbook of The Royal Astronomical Society of Canada*)
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Chicago Amateur Astronomical Association

MAX M. FEINSILBER, Secretary

At the April 3 meeting of the association John Sharp gave a talk on astronomical phenomena to be observed during the remainder of the year . His talk showed a great amount of preparational effort and was interestingly given. A short discussion followed.

At four o'clock the group attended the regular Sunday lecture in the planetarium. This was in keeping with our new policy to attend at least one lecture a year given by the planetarium staff.

Now a look into the future. Our tentative plans are a visit to the Dearborn Observatory at Evanston, Ill., a trip to Milwaukee to view their new observatory, and a visit to Joseph Boehm's Lake Geneva home at his invitation. With these outings on the program, we look forward to a successful and certainly an enjoyable summer program.

We wish to welcome into our fold a new member, H. M. Robinson, Chicago, Ill., who joined us at our last meeting.

Our meetings at Mr. Callum's home are continuing with great success. We have this month added another meeting to our list. We wish to thank J. A. Wingard, Oak Park, Ill., for the use of his home and yard for this purpose.

6602 S. Francisco Ave.,
Chicago, Ill.

Optical Division of AAA

HAYDEN PLANETARIUM NEW YORK CITY

R. WALLACE, Correspondent

After sending our report for March *Amateur Astronomy*, your correspondent was about to wire his Mexican bull ranch to unleash Rufus, for frankly he wondered what specifically to report on. In this frame of mind he sauntered into the workshops one cold evening and was flabbergasted at the sight. For an instant he thought he had stumbled into the workshops of the 200-inch. Here and there were tables with improvised desk lamps and men working on or pouring over large sheets of paper with slide rules and intricate mechanical instruments. Others were referring to stock gear catalogs. Others were up to their ears in calculus. Others again were grinding or polishing their mirrors. Through the haze of smoke from Lady Nicotine it all looked spooky. It wasn't long before I ascertained the why and wherefore. They were all engaged in planning the mount and putting finishing touches on the observatory for the 21-inch mirror which has been wheeled downstairs for further treatment now that depth has been reached. Then there was another group centered around a terrain map of New York State plotted into sections showing elevations etc. The entire scene looked like the subterranean headquarters of a military expedition ready to telegraph orders to drop some eggs on this or that section! Not at all. The boys were trying to locate a site for the observatory. Last week end some of them set out to look over likely spots and get prices on mountain tops!

With all this activity I began to wonder whether I should have joined a kindergarten astronomical association. My investigation showed that we have members who are trained and qualified machinists, pattern and casting makers, authorities on celestial photography, civil engineers, surveyors, architects, builders etc. While coming out of my trance a member walked in with some books under his arm, and one of them had to do with cosmic rays! I came to the conclusion that we had talent that could handle far bigger jobs than our 21-inch. You can take it from me that our observatory and our contributions to the science will be news!

The sides of the 21-inch mirror in our shops are now being rounded by an ingenious invention of one of our members. There are really 32 sides to this pyrex disk, and the machine—a Rube Goldburg contraption!—is doing a past criticism job.

On April 5 we accepted an invitation from the Rev. Joseph Lynch of Fordham University to visit the seismograph laboratories and see particularly the Benioff seismograph which magnifies earth tremors 100,000 times and makes photographic records of them! Selah!

Hayden Planetarium,
New York City.

Norwalk Astronomical Society

MARY C. HAMILTON, Secretary

The regular April meeting was postponed until the 7th when the college students could attend.

Again the members brought clippings which suggested subjects for discussion.

The subject for the next meeting, May 26, is meteors and we are planning to assemble outdoors and perhaps see a few. We hope for a clear evening.

More interest in astronomy has been shown by the people of this town since last November, when the subject chosen for children's book week at the public library was "The Stars."

4 Union Park,
Norwalk, Conn.

Tri State News Notes

AMATEUR ASTRONOMERS' ASSOCIATION OF PITTSBURGH

CHESTER B. ROE, Correspondent

Nearly 60 members of the Pittsburgh group attended the April meeting on the eighth at the downtown Y.M.C.A. A part of our summer schedule was discussed, and tentative plans were made for our annual visit to Allegheny Observatory.

Dr. Pendray of interplanetary rocket fame was in Pittsburgh to lecture regarding the progress of rocket research. According to Dr. Pendray, the future of interplanetary communication by rocket is far from being an actuality. All he hopes to attain within the next generation is mail service between Europe and America.

Norbert Schell of Beaver Falls, reported that work on his 10-inch cassegrain has reached the machine-work stage. Mr. Schell also hopes to form a branch of our organization at Beaver Falls as several interested amateurs live in his district.

Next door to our meeting room a group of children rehearsed for an Easter program, so our speaker's talk was punctuated with "strains" of music. However, Wm. P. Wieman, an electrical engineer and a member of our group, succeeded in bringing to us many interesting facts regarding the effects of electric energy and magnetic forces on atoms.

On Friday, April 1, V. E. Mayer of Indianapolis, Ind., arrived in town with two friends to discuss with J. W. Fecker the contract for a correcting lens for the 36-inch reflector being built by the Indianapolis group for Dr. Goethe Link of that city. After the session with Mr. Fecker, Mr. Mayer was entertained in and by the cellars, basements and other miscellaneous workshops of our members.

Bad weather halted most of the observing programs, yet a few variable observations were sent in.

Valley View Observatory,
N. S. Pittsburgh, Pa.

Milwaukee News Notes

M. N. FISHER, Correspondent

"Astronomy what ain't so—a review of some of the stuff taught 35 years ago and how it looks now, with some thoughts on how the stuff the profs teach now may look a few years hence."

With that lively topic before him, Herbert W. Cornell gave the Milwaukee society a well-filled, entertainingly factual hour on April 7.

At the turn of the century the capture theory of comets was "in." Comets, so it was thought, came from mysterious realms of space. (Today we say they are members of the solar system).

Planets had families in those days, too. Neptune, for example, was supposed to have six. (But if Neptune COULD have six comets, why then, on the same basis of heavenly mechanics, Jupiter would have to have three million!)

The contraction theory of the sun's energy was likewise "in," with the sun supposedly contracting 250 feet a day. The earth was assumed to be 20 million years old. (Atomic disintegration in the sun and an earth age of the order of 2,600 million years are the accepted theories of today.)

Oh, yes, Jupiter was a semi-sun, a tremendously hot, semi-molten affair.

"The farther outward in space we go," said Mr. Cornell, "the worse it gets."

Thus, space was populated with cold, dark invisible stars. The obscuring matter in Sagittarius was a corridor down which to get a glimpse of space beyond. Novae were two stars colliding. ("The collission theory seems the most absurd of all.")

Yet the "fiercest theory" Mr. Cornell said, involved the causes of variable stars —not pulsation but, in magnificent Fourth of July fashion, the collision of two meteor streams. Nebulae were "fire mist." The nebular hypothesis was considered true.

Theories, however, are often discarded like old shoes. What will be the "ain't sos" of the future? Mr. Cornell voted for the following as his "don't believes:"

The expanding universe
The density of white dwarfs
The meteoric origin of lunar craters
Super-novae in distant galaxies
The low density of some stars
The curvature of space

If Milwaukee members seem to have suspiciously puffed out chests, here is the reason: After years of construction inactivity, the Milwaukee society now has its own observatory, located at the Phillips farm. A steel dome houses the 13-inch. And there are two sixes, two fours, two tens and an eight. The labor was willingly donated—virtually thousands of dollars worth—plus much of the material. Now, with considerable excitement and much stirring around, the observing program has gone into effect under C. M. Prinslow, chairman of the observatory committee.

Every Monday night will be an open house night and on succeeding nights various members will be engaged in detailed, careful observing work. Each observer will have his own personal work report to turn in with illness the only excuse acceptable. An automobile pickup system has been started for those who lack transportation to the "ob."

Milwaukee, Wis.
817 N. 28th Street,

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DEVOTED TO
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VOL. 4 NO. 6

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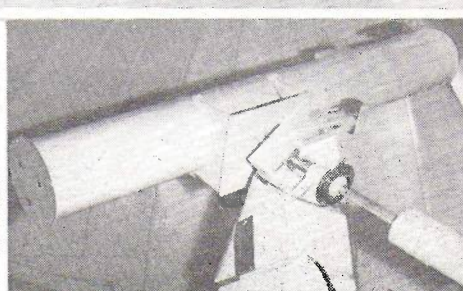
The Milwaukee Atoronomical Society Observatory



The upper photograph, taken last winter, shows a general view of the observatory which houses a 13-inch reflector. The shelter at left houses Mr. A. C. Tabbot's 8-inch reflector.

The lower left-hand view shows the 8-inch 'scope in use and the shelter rolled toward the north.

The 13-inch telescope is shown on its mounting inside the dome in the lower right-hand picture.

The Milwaukee Astronomical Society Observatory

EDWARD A. HALBACH, President

Little did the founder members of the Milwaukee Astronomical Society realize the importance of their plans for a "castle in the air" when in 1933 they decided it was time to build an observatory and began searching for a suitable location. Without funds to purchase property, the society was surprised by the grant of an acre of land from one of its members, Mr. M. J. W. Phillips, with the stipulation that construction begin within five years. Since this site was in a favorable location, far enough from the city lights (15 miles southwest of Milwaukee), and on high land, it was immediately accepted.

So enthusiastic did the observatory committee become that the property was immediately surveyed in spite of near zero weather. Frank Dieter, now of Annapolis, Md., prepared a plan for a proposed observatory according to the suggestions of the committee, but as no immediate funds were available, the project was shelved.

For several years observational work was carried on in the back yard of the home of our secretary, Luverne Armfield, in West Allis. Mr. Armfield had to move in the fall of 1936 and the observing members were left without a suitable place to congregate and observe.

At a meeting held in June, 1937, it was decided that the construction of an observatory should be started according to the original plans. Before the meeting ended, $40.00 in cash was placed on the table by those present and promises were made for more money to meet the first construction expenses. Mr. Phillips further offered to provide all materials and tools for building the pier.

Construction was begun early in July with the digging of a hole six feet deep to receive the form for the pier. The portion under ground was made three feet square and extended 12 feet above ground, tapering to a cross section of 12 by 18 inches at the top. The great height was needed to place the telescope in the second story of the observatory to conform to the original plan. All the building labor was furnished by the senior and junior members of the society.

Imagine the task of hoisting half the concrete for the 8-ton pier to the top of the form, 12 feet above the ground, with a small bucket! In delivering the 10 cubic yards of crushed stone and sand for the concrete, the Kohler Gravel Co. donated half in exchange for a glimpse of the heavens when the telescope was mounted.

Plans called for a frame building 16 feet square and 13 feet high, supporting a 14½-foot dome. Twelve small concrete piers were laid to support the building and dome. The frame and sheathing of used lumber were covered with new siding. The top of the side walls, three feet above the observing floor, supported by circular laminated ring, 14 feet inside diameter, constructed of a double layer of 2-inch planks. Eight 5-inch inverted truck casters were bolted to the ring to support the dome.

The skeleton of the dome was constructed of structural steel and covered with 24-gage black sheet iron. A base ring of 4-inch channel iron, rolled with the flanges outward, provided both a smooth track and a rigid base to which the vertical ribs were welded. The ring was rolled in two sections, put in place and welded together. The dome was completely fabricated in its final position. To keep the dome centered, a bracket with a 2-inch rolled mounted on top was fastened adjacent to each large caster. Since the upper end of this bracket with roller extends into the open channel, the dome is prevented from being lifted by high velocity winds. The 25 vertical ribs of 1¼-inch angles were welded to the base ring and to the 2-inch angles forming the slit which is three feet wide. The one piece shutter slides off to one side on angle iron rails. The arc welding was done by the Nordberg Mfg. Co. and the portable arc welder was furnished through the courtesy of the Harnischfeger Corp. Although the dome is to be motor-driven through a rubber-tire drive wheel, at present it is being turned by hand. All the metal work was painted with two coats of red-lead paint and the exterior was finished in aluminum. A lightning arrester with elaborate grounding system was attached to the dome for protection.

The observing floor is reached by a stairway along the north wall. A trap door covers the stair opening for safety while observing. The lower part of the interior, at present unfinished, is used mostly for storage of smaller telescopes and other equipment.

Early in May, exactly 10 months after construction started, Mr. Armfield's 13-inch reflector was mounted on the pier, the mirror for which was loaned to Mr. Armfield by the AAVSO. During the past winter, when work outdoors was not possible, the tube and the mounting for this telescope were completely rebuilt. The first step was the construction of a new mirror cell to replace an improvised holder of wood. The new cell is made of a heavy rolled ring to which three mounting ears are attached. Six support pads are placed in pairs to support the mirror.

Since the original mounting had no drive, much work was necessary to adapt materials at hand. The drive consists of a Bodine 1/15 hp., 1800 rpm synchronous motor, with the following gear train: 1:50 (worm), 1:1 (differential), 12:66 (spur), 1:50 (worm), and 1:188 (worm). The 188-tooth worm gear drives the polar axis through a friction plate between the upper bearing and the tube saddle. Slow motion in right ascension for guiding purposes is obtained by a small reversible motor which turns the differential housing through a 1:98 worm reduction. A second small motor gives slow motion in declination through proper gear reductions. The latter drive is engaged or disengaged by a solenoid operated brake.

Since the 13-inch telescope is to be used primarily for variable star work in which rapid location of stars is important, a R.A. circle was added in addition to the conventional hour circle. A small synchronous clock motor was mounted on an 8-inch graduated disk for this bakelite R.A. circle which is free to turn on the polar axis. The 1-rpm shaft of the clock motor drives against the polar axis through the following gear reductions: 10:40 (spur), 15:15 (bevel), 1: 359 (worm to spur). A 32-tooth idler is necessary between the worm and the 359-tooth gear for the latter is an internal gear constructed of 48 pitch brass rack mounted in the inner circumference of an 8-inch wheel. The circle index is fixed and adjustment is provided by rotating the large gear and circle assembly on the polar axis. The circle is set for the evening from the known R.A. of a bright star near the equator. The telescope can be correspondingly set to any desired R.A. without further computations or without a sidereal clock.

A 12-gage sheet iron cover encloses the entire mechanism. The slow motion drives in R.A. and Decl. are operated from the observer's position through a push button control box actuating 6-volt A.C. relays. The control box also has a pair of push buttons for operating the proposed drive on the dome. An illuminated chart holder is located near the eyepiece for the variable star charts and two finders of 6-inch focal length are mounted on the telescope, one near each end of the tube.

Since the telescope and accessories could not be operated conveniently without electricity, a 1,500-foot power line was constructed from the Phillips farm buildings to the observatory. The only accident of any consequence occurred during the construction of this line. One of the poles placed in the ground proved unsound and broke off at the ground line causing our secretary, Mr. Armfield, to be precipitated at our feet. In coming down with the pole, he spiked his left leg with his climbing irons and is now moving about on crutches. We wish him a speedy recovery.

The observatory, as it stands today, is the first unit of a proposed larger and more complete building. A second unit of about the same size, to be constructed when funds permit, will be about 50 feet directly west of the present building, the two units to be connected by a one-story office, or meeting place, which can be heated. Directly north of the center point between the first two domes, there is to be a larger unit to house possibly a 20 or 30-inch reflector. Only the future will tell whether or not the entire plan will materialize.

In addition to the present observatory and telescope, there is an 8-inch F:15 reflector housed nearby in a rollaway shelter. This telescope, without a drive, belongs to Mr. A. C. Tabbatt and is intended primarily for planetary observations. A second, but smaller pier, is ready for the mounting of a 10 or 12-inch reflector.

The observatory program was begun with the prime purpose of utilizing the equipment to the best advantage for observational work. Hence, the 13-inch telescope is to be used only on variable stars fainter than 12^m. Smaller telescopes will be available to observe brighter variables. Those participating in the observing program have been assigned certain nights of the week on which they are responsible for the equipment.

Since meteor observation is to be part of our observing program, we shall concentrate our efforts on duplicate height work. A new 250-watt phone radio transmitter is ready to be installed at the observatory for coordinating duplicate meteor height observations. The antenna, 240 feet long, is to be supported by two 80-foot poles. A smaller portable transmitter has been in use in the past and will be available again if needed.

Without mentioning the winter evenings of 1937-8 when the intricate mounting of the 13-inch was reconstructed in the basement of the home of one of the members, the actual construction of the observatory itself took place during the summer of 1937, and the spring of 1938. On an average of eight society members motored the 15 miles from Milwaukee each week-end, and oftener, during these two seasons, rain or shine, and put into the building their time, technical training, plans, foresight and the sweat of their brow to make it a means of fur-

(continued on page 76)

Ionization of the Earth's Atmosphere

MAUDE S. WIEGEL, Solar Director

Taken from an article by I. V. Berkner, Dept. of Terrestrial Magnetism, Carnegie Institute of Washington (ontinued from the April 1938 issue)

During the eclipse of Aug. 1932 it was noted by astronomers that a sudden change took place in ionization in the lower region of the earth's atmosphere, while only a slight decrease occurred in the upper or F2 region. This held true during the eclipse of June, 1936, in Russia, yet during the eclipse of Feb. 1935 observers noted a decided change of ionization in the upper layer. Why do we have such conflicting data? Methods of observation being accurate, the answer will in all probability be found when more eclipse data may be had from all parts of the world lying in the path of the solar eclipse.

Upon investigating the dates on which these observations were made it was found that the F_2 region exhibited an eclipse-effect only when it was merged with the lower or F_1 region, no effect being observed to any extent when these regions were widely separated. It would seem then that the force which is ionizing the upper region does not undergo any change at the time of solar eclipse.

It must be remembered, however, that this line of reasoning is based upon only a few eclipse observations in one hemisphere and that any conclusions must be open to question until checked by further eclipse observations. If an ionizing agent from the sun is not eclipsed at the time of a solar eclipse, it can not be traveling with the velocity of light. This suggests that the ionization of this upper region may be due to particles which are shot off from the sun and which upon colliding with the molecules of the earth's outer atmosphere, knock off electrons, thus creating the ionization which is observed. It would seem then that there is a bombardment of the outer atmosphere of the earth by particles from the sun. Before accepting such hypothesis as a fact, much data must be had. The new automatic equipment will facilitate a continuity of data on the subject.

There are three main regions of ionization at heights of about 65, 130 and 180 miles respectively. Of these, two exist above any location and at any time, as far as we know. The third and upper region appears separately only when the sun is directly overhead, merging into the next lower region when the altitude of the sun is low.

When these two regions merge, the lower or F_1 seems to take on the characteristics of the outer F_2 region, becoming more highly ionized. The major source of ionization in the two lower regions during daylight is the uptraviolet light of the sun. Apparently the ionization of the upper region is caused by a bombardment of the outer atmosphere by particles emanating from the sun.

That two regions exist which both owe their ionization to the same source (ultra-violet light) presents another problem. A possible solution to this may be the composition of the atmosphere itself at these great heights. Physicists have shown that if we conceive the outer atmosphere to be undisturbed, the lighter gases will rise to higher levels than the heavier gases. Winds keep the gases mixed close to the earth so that the proportion of oxygen and nitrogen is always the same. At greater heights, however, the lighter nitrogen should float to higher levels than the heavier oxygen. A ray of light entering the outer atmosphere will have passed a certain number of nitrogen atoms, after penetrating through a certain amount of atmosphere. The same ray must penetrate much more deeply into the atmosphere to pass the same number of oxygen atoms. Oxygen is most affective in absorbing certain light-frequencies while nitrogen is most active in absorbing others. The light which ionizes the nitrogen will be absorbed at a higher level than the light which ionizes the oxygen.

There would be two distinct levels of ionization, because of the absorption of a different band of light by a different gas. The difficulty with such an explanation is that as yet we can not be sure whether such a partial separation of gases by diffusion actually occurs in the upper atmosphere and whether the atomic states which have been assumed in this example are actually correct.

It is impossible to observe the high-frequency radiation from the sun because of its obsorption in the upper atmosphere. Some of the characteristics of this radiation can be determined, however, from its reaction on the outer atmosphere. The mean value of ionization is changing from year to year in an orderly manner, and seems to move with the sunspot activity. Since the change in visible radiation from the sun appears negligible as activity increases, it would appear that there is much more activity in the ultra-violet radiation, which causes this ionization in the atmosphere, a conclusion which has important consequences in the study of the sun.

Since the last sunspot minimum the

percentage of ionization in the outermost region of the ionosphere has increased more than 250 per cent, while a change of 45 per cent was present in the lower regions of the atmosphere for the same period of time. This not only emphasizes a difference in character of the ionizing forces as already suggested, but implies, on the basis of our hypothesis of particle-bombardment, an enormous change in the number or velocity of particles emitted from the sun as solar activity varies. So while data are lacking, definite conclusion must await operation over a longer period of time.

Deductions from the shorter period are not entirely speculative when we remember the close relationship between sunspot activity and terrestrial magnetism and, in turn, the dependence of the earth's magnetic phenomena upon the ionosphere.

Changes taking place in these regions must have immediate effects in radio transmission and in the earth's magnetic field, which depends upon them.

A few years ago certain police radio stations were assigned to a frequency of about 43 megacycles per second because this frequency was high enough to penetrate the ionosphere. Therefore the range of these stations was limited to their immediate vicinity. Today, as the result of the enormous increase of ion-density in the F_2 region, these stations are frequently heard in Europe. To provide a minimum of interference to service, a knowledge of the fluctuations of the ionization in the upper atmosphere is essential. The best frequency for transmission across the Atlantic this year may not be the best next year.

In the case of a bright solar eruption coinciding with certain geophysical effects, what really does happen? At the beginning of the eruption all refractions faded out suddenly, staying out for its duration. When communication was again restored, the upper regions were essentually the same as before the eruption. This shows that the two upper regions were not affected, but the regions below 100 kilometers was so strongly ionized that it completely absorbed the radio waves without reflecting them.

Mr. Berkner, in closing his article, speaks of many observed effects which have not been mentioned, but which contribute definite facts to aid in the construction of the theory. There are, for instance, the sudden sporadic ionizations of very great intensity at the 100 kilometer level. These can occur any time of day or night, more frequent in summer in any location, frequenting the polar region, practically never found at the magnetic equator. During such times the upper regions may be entirely invisible to the exploring radio wave because of the great intensity of this ionization, and phenomenal radio transmission on ultra high frequencies occur. It has been also necessary to leave night effects entirely unmentioned.

It may be seen then that this outer atmosphere of the earth, once so isolated and inaccessible, is yielding to the exploration of scientists now better equipped with more modern instruments for experimental work. Highly important effects which might have been passed over unnoticed have been discovered through observations at widely separated stations.

Despite the relative vacuum in the outer reaches of the atmosphere, the events which occur there actually do play an important part in the scheme of things.

SOLAR ACTIVITY

Folks are complaining about the static on their radios these days. A neighbor with a set that has been giving good service for quite a few years began working on it but to no avail. Disturbances are more noticeable on highly sensitive sets it seems, for the reception is as quiet as ever on small sets with, say, five tubes. The sun resembles the family cat with the canary feather clinging to his whiskers; it has a guilty look, as large spot after spot glide across its shining face. April showed a very active condition with large spots and spot groups that tempt the astronomer-photographer.

Appendix to the Trig Micrometer

D. F. BROCCHI

In "The Trig Micrometer" appearing in *Amateur Astronomy* for May, 1938, it was suggested that with an altazimuth telescope a new setting be made on AB from time to time to reduce the error due to the turning of the image.

It has been found that under certain conditions the rotation is quite appreciable even during the three settings made for one star in spite of fast work.

To test for rate of rotation, a second setting is made on AB with working edge facing the interior, after the setting of the third side. If there is a noticeable difference between the two directions of AB, a setting on this side must be made for each star, which will serve as the first AB setting for that star and the second AB setting for the preceding one, with one additional AB setting at the end of the performance.

The third angle is found by adding 180° to or subtracting 180° from the second direction of AB, and subtracting from the result the direction of the third

(continued on page 76)

Irregular Variables for Observation

ARTHUR L. PECK

We notice as we read the heading on a number of the AAVSO variable star charts that the stars rated as irregular variables or at least that their periods are questionable. Upon investigation we find that many of the red stars vary within narrow limits, barely more than half a magnitude, and are not readily predicable. Alpha Herculis is an example, vary from 3.1 to 3.9 magnitude. The spectrum of this star, from Adams and Joy, is M5 with the calcium lines H and K brightest.

Betelgeuse, the brightest of all the irregular variables, at times comes nearly to the splendor of Rigel. At other times it is hardly more than one third as bright.

Gamma Cassiopeiae also comes under this heading. This star varies from 1.6 to 2.3 magnitude. During the last half of the year 1936 it brightened considerably. The standard magnitude of it had been 2.25 on the Harvard Revised Photometric scale, which is only slightly fainter than Polaris. The star was found to be of magnitude 1.6 on Oct. 5, 1936 at Perkins Observatory, so members of the AAVSO immediately undertook observations visually, and estimates of brightness varying between 1.6 and 2.2 were being reported from different stations within short periods of time. From *L'Astronomie*, P. Blaize reports an increase of light for the star, as of July 25, 1936, magnitude 1.85 based on observations with several comparison stars. No appreciable change from this value was noted by him over an interval of 11 days.

W. H. Smyth, in his 1844 edition of the "Cycle of Celestial Objects," called attention to the suspected variation of Gamma Cassiopeiae by Sir John Herschel as far back as 1838. Smyth states that he regrets that more attention had not been paid to this star, as a possible variable, rather than to Alpha Cassiopeiae. Alpha Cassiopeiae has been suspected of variation for a long time and is listed in the largest catalogues with a range of half a magnitude (2.1 to 2.6); spectral class, G8.

In the following table listed with several of the brightest irregular variables are the irregular variables from the AAVSO observing list. Column 1, the designation; column 2, the star; column 3, the range in magnitude; column 4, the spectrum from Schneller, 1938; column 5, the color; column 6, remarks.

IRREGULAR VARIABLES

Designation	Star	Range	Spectrum	Color	Remarks
Gamma	Cass	2.1— 2.6	G8	5.8	Irregular
Alpha	Ori	0.6— 1.1	M2	7.3	2070d (?) Per. (P)
Alpha	Her	3.1— 3.9	M5	6.0	Irregular
....	R Lyr	4.2— 4.8	M5	4.1	Irregular
?	Cep	4.0— 4.8	M2	7.0	Irregular
020356	UV Per	12.4—(16.0	....	....	U Gem Type
021258	T Per	8.0— 9.0	K5	....	Irregular
021558	S Per	8.5— 11.0	M5	5.0	Irregular
051316	XX Tau	6.0—(16.0	Pec	....	Nova (1927)
053005a	T Ori	9.7— 12.8	....	....	R CrB Type
053005t	An Ori	11.3— 12.0	....	....	Irregular
053326	RR Tau	11.0— 13.6	....	....	RW Aur Type
054319	SU Tau	9.5—(14.0	Goe	0.0	R CrB Type
060547	SS Aur	10.5— 15.0	Pec	0.0	U Gem Type
063308	R Mon	10.0— 12.6	——	1.0	R CrB Type
073520	Y Gem	8.5— 10.0	M6e	....	Irregular
074922	U Gem	8.9— 14.0	Pec	....	Irregular
081473	Z Cam	9.6— 13.0	G (?)	....	Irregular
094836	U LMi	9.8— 13.0	....	....	Irr. 280d Per (?)
154428	R CrB	5.9— 15.0	cGoep	0.5	Irregular
174406	RS Oph	4+— 11+	Ocp	4.5	Nova N.3 (1933)
184205	R Sct	4.5— 9.0	K5ev	3.0	Irregular 146d Per (?)
191033	RY Sag	6.0— 14.0	Goep	....	R CrB Type
201520	V Sge	9.5—(13.0	Ob	....	Irr. 309. 0d Per. (?)
213843	SS Cyg	8.1— 12.0	Pec	0.0	U Gem Type
215717	U Aqr	10.0—(13.0	....	0.0	Irregular
232848	Z And	8.5— 11.0	Ocp	2.0	Nova (?) (1901)

Irregular variables should be observed more frequently than the stars of known period. In fact they should be observed at least once each night. Sometimes it has been found of value to observe a star such as SS Cygni each Julian Day period when it is rising rapidly and also when it is fading.

Pickering separated a few stars which are of a pecular character of variation into two subdivisions. These he called IIb and IIc, the first of which includes U Gem, SS Cyg, and SS Aur. Stars of class IIb are characterized by a very rapid rise from a constant minimum to a maximum which does not last for any regular interval of time, being sometimes long and sometimes short, and in turn is followed by a slow decline to the minimum. This change does not occur with any regularity, but is always unexpected.

U Geminorum remains at the minimum for a large part of the period, then without warning suddenly rises to its maximum brightness where it remains for a time and then gradually fades away to the minimum . This star has been an object of much interest ever since its discovery in 1855 by Hind, an English observer, for the suddenness with which it rises from the minimum. Because of this characistic it should be watched constantly. This star is so faint, even at time of maximum, that the spectrum has been only imperfectly observed. It is usually described as hazy and at times it resembles Class F.

SS Cygni is a little brighter and has a shorter period than U Geminorum. It is almost more favorably placed for observation and therefore has been studied more extensively. A verv complete discussion of this star by Leon Campbell may be found in *Annals, Harvard College Observatory* 56,210. The spectrum of this star is peculiar and is stated at times to resemble Class F.

However, little of the spectral characteristics can be described in the limited space that we have, considering their many peculiarities as noted by different observers.

SS Aurigae, the third star of this group, is quite faint and has not been under observation long enough for the collection of much data concerning it. However, data are piling up regarding this star, and with the continued observation of the AAVSO members we will soon have a good history of it.

The third division of the long period variables which we know as IIc from Pickering was announced in *Harvard College Observatory Circular*, 166, 1911. This subdivision contains stars which are ordinarily bright, but sometimes for a year or more become faint without warning, and vary irregularly until they again attain their normal brightness. Three stars are in this class: R Coronae Borealis, RY Sagittarii, and SU Tauri. Their spectra also are peculiar and subject to changes.

R Coronae Borealis was discovered to be variable by an English observer, Pigott, 1768-1807. It is typical of the three stars in its group. We, who have followed it through several years of observation, know that a drop to or near minimum occurs at unpredictable intervals and comes when least expected. These three stars together with the three in the preceding group merit the careful attention of all variable star observers.

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Planetary Report No. 29

By E. P. MARTZ, Jr., Director Planetary Section

SUMMARY OF 1937 WORK OF THE PLANETARY SECTION

The following report cannot pretend to be more than a brief statistical survey of observations and reports turned in to the section director covering the work of 1937. The vast amount of data presented makes immediate and adequate analysis obviously impossible. However, it is hoped that by the end of 1938 we may be able to present in published form a "Planetary Section Memoir No. 1," covering the work of the section members during the four years from 1935-1938. Any further planetary and lunar observations made during this period which have not yet been communicated to us will be gratefully received. It is extremely gratifying to contemplate the great amount of conscientious and valuable work produced in this period by the relatively small number of communicating observers, and the results point toward a fertile future for the Planetary and Lunar Sections.

I.—Contributing Observers and Correspondents:

1. Walter H. Haas—10-inch refractor at Mount Union College Observatory, Alliance, Ohio, and 6-inch reflector at New Waterford, Ohio.
2. Latimer J. Wilson—12-inch, 8-inch, and 4-inch reflectors from Nashville, Tenn., and 21-inch Cassegrainian reflector of the Jones Municipal Observatory at Chattanooga, Tenn., of which Mr. Wilson was acting director.

3. Hugh M. Johnson—7-inch reflector and 8-inch refractor from Des Moines, Iowa.
4. W. W. Spangenberg — 2.5 inch, 4-inch, and 5-inch refractors, and 4-inch reflector from Schwerin, i. M., Germany. Also 13-inch horizontal telescope, and 24-inch reflector from the Hamburg Observatory in Bergedorf, Germany.
5. E. P. Martz, Jr.—60-inch reflector and 6-inch refractor of Mount Wilson Observatory, and 12-inch Zeiss apochromatic refractor of the Griffith Observatory, in southern California. A few desultory observations were also made with the 24-inch refractor, and Mr. Clyde Tombaugh's 12.5-inch, F:13, reflector at the Lowell Observatory, Flagstaff, Ariz.; with the 40-inch refractor and the 6-inch comet-seeker of the Yerkes Observatory, Williams Bay, Wis., and with the 6-inch refractor at the Students' Observatory of the University of Chicago, the last during the fall and winter of 1937.
6. Lawrence Aller—Now a graduate student at the Harvard College Observatory; used the 12-inch refractor of the Lick Observatory, Mount Hamilton, Cal., on Mars during 1937.
7. Dana K. Bailey—Rhodes scholar in astronomy at Oxford, England; verbally communicated observations of Mars in 1937, made with the 36-inch reflector at Steward Observatory of the University of Arizona, Tucson.
8. J. Russell Smith—8-inch reflector and 2.5-inch refractor, from the observatory of Smyer High School, Smyer, Tex., of which he is the director and principal.
9. A number of communications of interest were received from the Rev. Mr. T. E. R. Phillips, B. M. Peek, and Henry McEwen, of the British Astronomical Association and directors respectively of the Saturn, Jupiter, and Mercury-Venus sections of the B. A. A. The late Walter Goodacre, Director of the B. A. A. Lunar Section, also sent some B. A. A. Lunar Section memoirs. Dr. Peter M. Millman, of the David Dunlap Observatory, Toronto, Can., wrote of spectra of Mars that he had taken with the 84-inch reflector in 1937.
10. Letters indicating interest in beginning planetary observations were received from James L. Russell of Cleveland, Ohio, Phillip Fish of Superior, Wis., and Rosario Casamento of New York City.
11. The Director is greatly indebted to the following for aid and advice in undertaking his own planetary photographic program during 1937: Dr. Dinsmore Alter, Director, Griffith Observatory; Dr. Walter S. Adams, Director, Mount Wilson Observatory; Dr. E. C. Slipher, Dr. C. O. Lampland, James Brown Edson, and Clyde Tombaugh of the Lowell Observatory; and the late Professor William H. Pickering of Jamaica, B. W. I. Further, the Planetary Section Director is indebted to the following for aid and discussion in undertaking the present analyses of the Mars and Jupiter 1937 photographs and other work: Dr. George S. Monk, Ryerson Physical Laboratory of the University of Chicago; Professor W. H. Wright, Director, and Mr. J. F. Chappell, photographer, of the Lick Observatory; Dr. Arthur Adel and others at the Lowell Observatory; Dr. Rupert Wildt, of Princeton University Observatory; Dr. Otto Struve, Director, Professor Frank E. Ross, Dr. Jesse Greenstein, and Professor Bengt Stroemgren, of the Yerkes Observatory; Dr. Donald Menzel of Harvard Observatory; Dr. Phillip C. Keenan of the Astronomy Department, and Dr. Hans G. Beutler of the Physics Department, of the University of Chicago.

II.—General Discussion of Observations:

A total of 3202 planetary and lunar observations were received or reported for 1937 from the nine co-operating observers though the vast majority of the data was from the first observers listed, whose names are wellknown to the readers of the planetary reports. These observations comprised the following: 654 drawings, mostly by Wilson, Haas, and Johnson. 238 photographic negative films and plates by Wilson and the writer. Wilson took about 30 instantaneous exposures of Mars on each of 31-roll film negatives, about 930 images, and at least two lunar photos. The writer took about 6 time exposures on highly enlarged scale of the planets on each of 205 cut film and plate negatives, about 1230 images, and 32 lunar plates; 591 miscellaneous observations of specific planetary and lunar phenomena, for which no drawing or photos were obtained. These comprise transit observations, word descriptions, etc., each observers's results usually being in series and co-related. Finally, 1719 estimates of relative intensities and colors of lunar and planetary markings were reported by Haas and the students working under him at Mount Union Observatory. These were all made in the pursuance of specific observational programs on a limited number of subjects. It is worth while to call attention here to the splendid energy and ambition shown by Mr. Haas, who reported 2263 observations in 1937, 836 of which were planetary. The other contributing observers of the Section added 939 planetary observations.

A survey of the above figures indicates that nearly half of all the reported and communicated work was done on the moon. Over half of the remainder (i.e.: strictly planetary observations) was composed of observations of Mars in 1937, about one-third of observations of Jupiter, and the remaining one-sixth fairly evenly distributed among the other planets and studies of planetary observing technique and seeing. If, as seems justifiable in view of the large number of lunar intensity and color estimates by Haas, the planetary photographic negatives are considered as contributing an observation for each image recorded (930 images by Wilson, 1,230 images by Martz) then we have a total of about 5100 individual and usable planetary and lunar observations contributed by the Section members during 1937. Of these, about one-third were lunar observations, and the remaining two-thirds planetary. Even so, it is still apparent that we are justified in having an independent Lunar Observation Section, of which Mr. Haas is the Director.

III.—Publications by Section Members during 1937:

A total of 41 papers concerning the work of the AAAA Planetary and Lunar Sections were published either by members or others during 1937. Twenty-three other papers, as yet unpublished, have been received by the Director, making a total of 64 papers. It should be noted, however, that some of these papers and notes discussed 1936 planetary and lunar work, as well as that of 1937. The majority of the papers were published in the following journals: *Amateur Astronomy*, *Popular Astronomy*, *Astronomische Nachrichten*, *Das Weltall*, *Die Sterne*, *Die Himmelswelt* (German papers by Spangenberg), *The Journal of the Royal Astronomical Society of Canada*, *The Journal of the British Astronomical Association* (paper by McEwen concerning Mercury work of Haas, Martz and others), and the *Publications of the Astronomical Society of the Pacific*. The accompanying table indicates the percentage distribution with respect to subject matter of the papers among the planets and moon and observing technique and seeing researches. The table also indicates the percentage distribution of the 3202 observations and of the nine contributing observers among the subjects of research. The significance of this table is apparent and clearly indicate fertile fields for future observational and analytical work. It should be pointed out, however, that the figures given in this report represent only those observations which have either been communicated or reported to us by the observers concerning 1937 work, and that we are aware of a large number of as yet unreported observations for that period made by certain of the contributing observers. We cannot, of course, take account of them until they are communicated to us, and the writer hopes that none of the contributing observers will feel slighted if, in the report to follow, our record does not check with that of the observer himself. We are reporting only that work for which we have definite evidence.

IV.—Summary of 1937 Observational Work:

1. OBSERVING TECHNIQUE, SEEING, etc.: Though most of the observers made experiments with, and records of, these factors in the course of other work, the only specific data on hand are 92 observations by Martz, covering a program to determine relations between seeing, sky transparency (clearness), and the amount and height of fog layers below the Mount Wilson and Griffith observatories. Experiments in the adaptation of various color filters and the development of techniques for their use in photographic and visual planetary and lunar observation were also made. Notices of the work of Haas and Martz on color sensitivity of the eye and observations of Venus appeared in *The Week's Science* by Dr. E. E. Free for February 15 and March 22, 1937.
2. MERCURY: 44 drawings of the planet were received from Haas and Johnson with accompanying word descriptions of the observations and specific phenomena. A paper presenting the 1936 observations by Haas and Martz with those of the British observers was published by McEwen in *The Journal of the British Astronomical Association*, March, 1937.
3. VENUS: 95 drawings of the planet were received from Haas, Johnson, Wilson, Spangenberg, and Martz. Eleven photographic plates in red, yellow, green, and blue lights were made by Martz (66 images). 36 miscellaneous observations were received from Haas, Spangenberg, and Martz.
4. MOON: 105 drawings were reported by Haas and Martz (Haas, 103). Johnson also observed specific craters regularly. At least 34 photographs were made by Martz and Wilson. The lunar appulse of May 24-25, and the lunar eclipse of No-

vember 18, 1937, were photographed in red, yellow, green, and blue by Martz. 233 miscellaneous lunar observations were reporeed by Haas, Johnson, Spangenberg and Martz. Haas and his co-workers reported 1115 estimates of the colors and relative intensities of about 30 specific lunar features suspected of abnormal changes. The more detailed report of the Lunar Section for 1937 will be presented by the Director at a future time. We have on hand the Lunar Section Report for 1936, which will be published in the near future. Mr. Haas communicated it to us some time ago, but various delays have occurred in getting it published to date.

5. MARS: 385 drawings of the planet were communicated by Wilson (243), Haas, Johnson, Aller, Smith, and Martz. 116 photographic negatives and plates were made by Martz and Wilson, comprising about 1440 images. Wilson used Eastman panatomic film on a 12-inch reflector, obtaining the integrated color effect between 4000 A. U.-6500 A. U. Martz photographed the planet simultaneously in red, yellow, green, and blue, using four appropriate panchromatic and orthochromatic plates and filters, covering the entire range with some overlapping: 3700 A. U.-7000 A. U. with 60-inch reflector and 12-inch apochromatic refractor. 55 miscellaneous observations of Mars were received from Haas, Johnson, Wilson, Spangenberg, Bailey, Martz, and the Rev. Mr. Phillips of the B. A. A. Haas made 254 estimates of color and intensities on the planet. Preliminary considerations and tentative hypotheses have been published in Planetary Reports Nos. 22-27. Mr. Wilson's unusual observations and photographs of bright flashes in the southern polar cap on May 30, 1937, are worthy of especial note (*Amateus Astronomy*, October, 1937, and *Popular Astronomy*, October, 1937).

6. JUPITER: 14 drawings were made by Haas, Johnson and Martz, and probably a number by Wilson and others as yet uncommunicated. 70 photographic plates were obtained by Martz under identical condition as those of Mars above (about 420 images). 100 miscellaneous observations were contributed by Haas Johnson, and Martz, and in addition the Rev. Mr. Phillips communicated 55 observations of longitudes of prominent Jovian markings in 193 as determined from transit observations by the B. A. A. observers. Haas made 308 estimates of colors and intensities of selected Jovian regions.

7. SATURN: Six drawings were communicated by Haas and Spangenberg. Seven photographic plates in red, yellow, and green were obtained by Martz (42 images). 17 miscellaneous observations were sent in by Haas and Martz, and observations were also made by Wilson and Johnson. Haas contributed 42 estimates of colors on Saturn. Of particular interest is the blue tint observed a number of times in the rings by Haas, Johnson, and Martz. Such a color is called for by Schoenberg's theoretical photometric analyses based upon particle size in the ring and angle of the incident light, and has been further indicated by R. W. Wood's photographs in 1915, those of Martz in 1937, and others.

8. URANUS: Five drawings and three miscellaneous observations of the planet were made by Haas. The color was distinctly greenish to him as it is to other observers due to the strong absorption in the red end of the spectrum of the planet. Haas recorded three faint belts on the disk of the planet.

* * *

In conclusion, the Planetary Section Director takes pleasure in expressing again his deep appreciation to all those who have helped make this and past Reports possible, and to record the sincere hope that the contributing observers will continue to communicate their work to us for a thorough analysis in the not too distant future.

Percentage Distribution with Respect to Subject of Publications, Observations and Observers, of AAAA Planetary Observation Section During 1937

Subject:	Papers	Observations	Observers
1. General papers and observing technique, seeing etc.	18.7%	2.9%	11.1% (1)
2. Mercury	9.4%	1.4%	22.2% (2)
3. Venus	18.7%	4.4%	55.5% (5)
4. Moon	18.7%	46.3%	55.5% (5)
5. Mars	20.3%	25.3%	100.0% (9)
6. Jupiter	9.4%	17.1%	44.4% (4)
7. Saturn	4.8%	2.3%	33.3% (3)
8. Uranus (notes, no specific papers)		0.3%	11.1% (1)

Total: 64 papers, 3202 observations, 9 contributing observers.

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Optical Division of AAAA

R. WALLACE, Correspondent

An interesting story appeared in a recent issue of *Scientific American* concerning the telescope and observatory of Mrs. Marion Grant Bowen, Carson City, Nev. The name of this observatory is the James A. Grant Observatory. The brother mentioned in the story is none other than Jim Grant, honorary member of our group. Jim is a textile machinery consultant and builder, and is well known "way down South", Yes, suh!

The ingenious machine mentioned last month for making our 21-inch mirror circular and beveling the edges, was designed by Lou Lojas of our group, and put together by Lou, Carl Grosswendt, Ed Hannah, and Bob Cox. It has done a job that would be a credit to a high-class professional shop.

Lou's inventive ability again came to light in smoothing the edges of the bubbles. He used a brass round-head screw fitted into a hand drill, and as he drilled he was assisted by Jim Grant who sprinkled water on the carbo. The disk face has but one "decent" bubble—about ¼-inch diameter—and a few insignificant ones, which will be considerably lessened, we hope, as work progresses with carbo, polishing, etc. There are a number of bubbles on the walls but Lou gave them his attention too, and the disk looks mighty clean. Incidentally, the five-inch hole has been drilled from the back of this disk to within ⅛-inch of the face. This work was done by Ed. Hannah and Jim Grant.

Carl Grosswendt has finished his primary and secondary for a 10-inch Cass. Any day now he will be testing the secondary, and we hope he has the good fortune of John Guasch Tous whose secondary was perfect at First testing.

Our group is now offering kits comprising 6-inch disk and tool, 12 grades of abrasives, pitch and rouge for the modest sum of $7.25 to all and sundry who wish to make mirrors at home. Bob Cox has been delegated to the job of seeing that tons of sawdust are placed around the building so the rush for this bargain will not result in emergency calls for ambulances to attend those who may happen to get mangled or maimed or scratched in the crowd!

Roy A. Seely made a RFT characterictic of the quality of work he turns out, and is busy making a fine equatorial mount fitted with setting circles, etc., for a gem of an 8-inch reflecting mirror. The tube is round and of bakelite—so you will understand that it will be a beautiful job when completed. Ed. Hannah had the honor of having his RFT used during the ecilpse expedition to Peru.

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We wish more of our members would do something constructive with their telescopes and go in for some specialized work such as Roy A. Seely is doing. His name you often see in the columns of this magazine in connection with AAVSO observation reports or articles. By "constructive" I mean entering such fields of service as the variable star, planetary, comet, etc. work and particularly making known the results of observations and study in the columns of *Amateur Astronomy*.

On April 20 Dr. Richard N. Sutton, Haverford College, Pa., delivered a lecture with demonstrations on "Spinning Bodies." On May 4, William H. Barton, executive curator of the Hayden Planetarium, where we have our headquarters and workshops, gave a lecture on "Epochs and Eras."

Mrs. Helen Spence Federer has just completed a 6-inch mirror for a Newtonian telescope, 43-inches focal length.

It hain't the 'eavy 'aulin' 'urts the 'orse's 'oofs, but the 'ammer, 'ammer, 'ammer on the 'ard 'ighway. So say our British cousins. But in our workshops —it hain't the rub, rub, rub that 'urts your 'ands and harms, but the 'eadaches that come from finding a big scratch after many 'our's polishing and 'ave to go back and grind, grind, grind. That was the recent event in the life of our 21-inch. Ed Hanna, who has slaved and slaved on the grinding and polishing, found, after bringing the mirror to a beautiful polish, that a grain or two of carbo had entered the trenches of his lap! Ed swears that Rufus is to blame. From this sad event comes a moral—don't do your polishing in a room where grinding is done. So, profiting from this experience, we have now enclosed the mirror in a separate room under lock and key and the polishing is going ahead with a merry swing. The inscription on the door reads:

"Abondon hope
All ye that here uninvited."
—Dante and Ed Hanna.

Our member Roy Seely has been attempting to make a telescope mirror by deposting copper and nickel on a finished mirror and coating the metal mirror with rhodium. This unorthodox method results in a fair enough mirror which might be improved by refining the process. Mass production of Schmidt camera mirrors without labor seems li' a dream. Let us hope the result will not be a nightmare. The first mirror made by him using this method was shown to the AAVSO at its spring meeting in Providence, R. I., and he described the process briefly.

In connection with his College Course at C. C. N. Y., Carl Grosswendt completed an aluminizing apparatus. and is coating mirrors. Mrs. Helen Lane is now figuring her 6-inch mirror. Mrs. Charles A. Federer has just completed a fine 6-inch mirror, but is afraid that hubby will grab it for a shaving mrirror! Dr. Edward G. Clifton works away silently at grinding a 6-inch Gordon Raisbeck is making a 6-inch. Max Mattes, after exasperating attempts to get rid of a hill in his 8-inch, finally took Lou Lojas' advice and made a new la- and BINGO! a beautiful mirror came back from Evaporated Films Company, Ithaca, N. Y. According to Bob Cox, Lou Lojas, Ed Hanna and Carl Grosswendt, the 10-inch Cassegrain just completed by John Guasch leaves nothing to be desired. They are raving about it. And William Burdian is finishing up a 4-inch R. F. T. for spotting Robert Nelson not only made a beautiful parabolized 8-inch mirror, but made a rugged mount of novel design with woodseat tube, and he is now installing a clock drive.

John Luce, Jr., is the essence of patience, but he is being rewarded with a fine 8-inch mirror, and his father for the fun of it made a honey of a mirror from a castor from the five and dime store. Is that the world's smallest telescope mirror? If it isn't, let us know. and he'll see what he can get from a piece of glass the size of a dime! Your 'umble correspondent has started work on the secondary for his 12½-inch perforated Cassegrain and is greatly appreciative of the help and advice given by Box Cox, Carl Grosswendt, Lou Lojas (I have forgiven him. Don't ask why!), Ed Hanna and William Mason. Selah!

Hayden Planetarium,
New York City.

Tri State News Notes

CHESTER B. ROE, Correspondent

Our speaker for the May meeting was Dr. Lee Devol, research associate of the glass research department of Mellon Institute. He lectured on "The Theory of Glass Polishing."

Just how much we amateurs owe to the untiring efforts of Albert G. Ingalls, Editor of *Scientific American's* amateur astronomy department, we will never know. Due to his alertness, the Pittsburgh group now has an instrument for locating strains in glass. This instrument was described in the April issue of *Scientific American,* and is the invention of Horace Dall of Luton, England. After reading the article, one of our members wrote to England for detailed instruction and we now have an instrument for detecting strains. We take this opportunity to thank Mr. Ingalls for his industry, and the space alloted to Mr. Dall's article. If you contemplate grinding a lens or mirror, you may save much future grief by having your glass blanks tested. Make your arrangements with Leo J. Scanlon.

The June meeting of the Pittsburgh group was of great interest. We look forward to an active summer. Visits to several observation stations are on schedule and a number of telescopes have just been completed that will help to make these visits more interesting.

In time for these fine summer evenings are: A 6-inch by Dr. J. L. Wagoner an 8-inch by W. R. Wickersahm, a 4-inch refractor by H. B. Boose. Dr. A. L. Runion, the oldest member of our group, has completed a fine 8-inch pyrex and is now working several 4-inch flats preparatory to making a 10-inch this coming winter. Dr. Runion is well past eighty. Our youngest member, William Devine, of fourteen years, is also hard at work, having just completed an excellent 6-inch Richfield. Another 6-inch Richfield, made by C. W. Kelly, goes into use shortly.

We were unfortunate in the loss of one of our most active members: The Reverend Father F. J. Sullivan has completed his studies at the University of Pittsburgh and is now permanently located at St. Bonaventure College, Allegany, N. Y.

One of the outstanding achievements of the Pittsburgh group was the recent completion of a 6-inch mirror. Now, a 6-inch mirror is nothing in itself, but to complete this one required reams and reams of paper, dozens of pencils, and many bottles of liniment for the treatment of writer's cramp. Albert Slacenski has finished this mirror, all instructions had to be written out for him, a tribute to the patience of those who helped this young man. Albert, you see, is a deaf-mute.

Valley View Observatory,
Pittsburgh, Pa.

MAS News Notes

M. N. FISHER, Correspondent

The June meeting comprised not only our annual picnic but also—and more important—the dedication of our newly completed observatory.

Invitations to this event were sent out to both professional and amateur friends all over the country, although well over 100 members and outsiders were able to be present. More than twenty drove up from Chicago, about ten from Madison, six from Waukesha, Wis., two from Iowa, to say nothing of those from other neighboring places.

The dedication was preceded by a picnic supper, which was planned and provided by Mrs. De La Ruelle, the wife of the late founder of our society, with the cooperation of her helpers and of the household of Prof. M. J. W. Phillips near whose farm our observatory is situated.

The meeting itself, held outdoors in front of the building, began when it was dark enough for slides to be seen. Our president, Edward Halbach, presided; Prof. Phillips made the dedicatory address, which included a brief history of the building of the observatory, illustrated by lantern slides of the various stages in its construction; Dr. S. A. Barrett, head of the Milwaukee Public Museum and a long-time friend of the Society, spoke, and a few other special friends from out of town gave brief congratulatory messages.

The main address was presented by Dr. Charles Hetzler of the Yerkes Observatory, who has done unusual work on red variables. He told us of his research, showing slides of it, and informed our group that if we would like to cooperate, there would be plenty of opportunity for us to work out an observing program with him which would be of real interest and value both to him and to us.

As the sky was clear, the rest of the evening was taken up observing with the 13-inch 'scope in the building and the many other instruments belonging to our members which were scattered about the grounds.

May we extend our invitation to all our friends and readers of *Amateur Astronomy* to visit us; you will be more than welcome at our observatory.

The Milwaukee Astronomical Society Observatory

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thering the interest of amateur astronomy.

The society wants to thank all of its members and friends who have given so wholeheartedly of their time, money and materials, and regret that it is not possible to list the individual contributions.

We are pleased and grateful to have the observatory and invite our friends and the public to observe with us.

2346 N. 47th Street,
Milwaukee, Wis.

Appendix to the Trig Micrometer

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side. The angles are then adjusted by subtracting from each ⅓ of the difference between their sum and 180° if the field is in the northern hemisphere, or by adding the like amount if it is in the southern. As a check, the sum of the adjusted angles should be 180°.