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H. Percy Wilkins (right), late outstanding British selenologist, and Patrick Moore at Dr. Wilkins' home at 35 Fairlawn Avenue, Bexleyheath, Kent, England, in June, 1953. The telescope is the 15¼-inch reflector of his own construction used by Wilkins for numerous lunar observations in the 1950's. Photograph by Walter H. Haas.

THE STROLLING ASTRONOMER

Pan American College
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IN THIS ISSUE

ANNOUNCEMENTS

Editorial Policy. The opinions expressed in signed articles in this magazine are those of the authors thus identified and are not necessarily the opinions of the staff of *The Strolling Astronomer*. The Editor has attempted over the years to pursue a rather liberal policy of presenting articles with different points of view. A paper is worth publishing, he thinks, if it appears likely to stimulate creative and profitable new thought in a given direction or to offer a new and refreshing interpretation of observed phenomena. A paper should certainly not be excluded from these pages because its views are not in accord with those of the Editor or of any other particular member of the A.L.P.O. nor because they may conflict with opinions widely held among professional astronomers. When what we say bothers no one, we have ceased to have anything to say.

In Memoriam. Miss Charlie M. Noble died at Fort Worth, Texas, on November 30, 1959, at the age of 82. She was one of the chief leaders of junior astronomy in the United States since World War II, and her efforts had been recognized with the Astronomical League Award in 1956. The planetarium at the Fort Worth Children's Museum is named in her honor. Her juniors made outstanding and well-remembered contributions to the programs of several astronomical conventions which they attended, including the National Convention of the Astronomical League at Dallas in 1952. Her work demonstrated that astronomy never needs to be made trivial to appeal to teen-agers; and under her inspired direction, the Fort Worth juniors measured up to challenges of building models, carrying out Moonwatch operations, studying, and delivering clear and effective public speeches in a manner which most of their seniors could profitably seek to imitate.

Those of us who knew Miss Noble even slightly will miss her keenly. She had been a member of the A.L.P.O. most of the time since its beginning.

Mr. Robert G. Brookes died in Kennedy Veterans Hospital in Memphis, Tennessee on November 22, 1959, at the age of 36. He had been in poor health ever since he was discharged from the armed forces during World War II. Yet in his illness he read and studied extensively and had accumulated a great knowledge of astronomy, which he was always eager to share with others. Bob, as he was affectionately known to his many friends in the A.L.P.O., had been among our members for many years and had served as Jupiter Recorder from 1953 to 1956. Health did not even then allow him the pleasure of observing. That he was a most excellent Recorder and a very regular correspondent is sufficiently shown by the fact that when the Jupiter Recordership has subsequently been vacant, several colleagues have written to inquire whether Bob Brookes might again take over the post. He was an ardent flower gardener and was a member of Hazel Edwards Memorial Methodist Church in Newark, Arkansas. The uncomplaining cheerfulness with which he bore his physical trials can well be an example to those of us who have good health.

We extend our deep sympathy to Mr. Brookes' mother and immediate family in their loss.

The 1960 Conventions of the A.L.P.O. The Sixth Convention of the Association of Lunar and Planetary Observers is scheduled to be held at San Jose, California, on Wednesday, August 24, 1960, just before the annual meeting of the Western Amateur Astronomers on August 25-27. The San Jose Amateur Astronomers and other groups from the Bay Area will be the host societies. It is probable that the Editor will be unable to attend this meeting personally, to his considerable regret. However, Mr. David P. Barcroft, our A.L.P.O. Secretary and long one of our active members, has kindly agreed to serve as A.L.P.O. Convention Chairman.

Mr. Barcroft will receive the G. Bruce Blair Award this year. An Exhibits Chairman is being selected.

The Seventh Convention of the A.L.P.O. will be held as part of the Astronomical League Convention at Haverford College, Pennsylvania, on September 3-5, 1960. The A.L.P.O. program is tentatively scheduled for the forenoon of Monday, September 5. Mr. David Meisel will be in charge of the A.L.P.O. Exhibit; he has already taken care of our Exhibits at Ithaca in 1958 and at Denver in 1959.

We shall need papers from our members for both of these meetings, and we urge you to start thinking now about such a contribution. The months will pass quickly enough! We shall also need drawings, photographs, and charts for the exhibits. It may not be possible to exhibit the same items at both San Jose and Haverford with only a week in between the meetings so that each contributor should decide to which place he wants to send material. It will add much to the stature of the A.L.P.O. to put on two completely different programs of papers at these two meetings and to have the authors of papers present. However, papers from foreign colleagues are earnestly requested regardless of their ability to attend.

LUNAR AND PLANETARY OBSERVATIONS.

PART 1: THE MAKING OF DRAWINGS

By: William K. Hartmann

Until astronomical photography was introduced, the recording of lunar and planetary surfaces was accomplished chiefly through the making of drawings at the telescope; and this method still remains probably the best for most amateurs. The A.L.P.O. has surely relied primarily on such visual work. However, the observers who make and keep such records find it saddening to note how many amateurs, well equipped to do serious productive work, fail to use their instruments for anything more concrete than just looking. It is the hope of the author and the purpose of this paper to encourage those who may have been reluctant to start making such observations and to offer some instruction to those uncertain as to how to begin. I will attempt to describe the procedures accepted by most authorities and to make a few more specific comments of my own.

Let me state at the beginning some matters of policy. The purpose of making drawings is to provide scientific data by recording as accurately as possible what the observer sees in his instrument, and certainly not just to make nice looking pictures. I think it follows that the making of drawings should be considered an acquired skill, not an art, since we want to reproduce an image, not produce a composition. We are trying to copy a two dimensional view in the eyepiece (eyepieces are supposed to have flat fields!). Thus there are certain procedures which can be followed; and while individual styles may vary, it should be possible for almost any amateur to complete the process and in this way to produce a valuable record.

While I have said that we are not to consider ourselves artists in doing this job, we will nevertheless want to make use of the artist's techniques as will be seen shortly.

The materials needed are the telescope (listed for the sake of completeness), paper and a clipboard or pad to draw on, a fairly soft-leaded pencil with an eraser, and a flashlight with perhaps the customary red mask. For those who haven't come across a suitable piece of red cellophane, I suggest that red fingernail polish makes a fine translucent red coating for the flashlight glass or the bulb itself. Might as well put the stuff to practical use! A further note on flashlights--the pencil-light size is convenient to work with and doesn't provide too much light as a larger size is apt to do. It is also well to note Dr. Wilkins' comment that a good idea is to attach the pencil to the drawing board in order to prevent a time-consuming search in the dark.[1] This advice applies perhaps more strongly to the flashlight. Maps, photographs, and other drawings are not normally included among the materials at the telescope so that the observer will be prevented from trying to make his drawing match their appearances. It is worth an effort to remain unbiased while observational work is being done. On the other hand, maps and other aids are essential to the later analysis and interpretation of drawings; and if one plans to do serious lunar and planetary work, he should be well equipped with reference material about whatever object he is studying.

As a final word on materials I would like to mention the drawing paper. It is profitable to give some thought ahead of time to the manner in which the drawing is recorded on paper. As an example, I have been using a standard form printed on an $8\frac{1}{2}$ x 11 ins. sheet. At the top is space for the vital accompanying information. The space in the middle is large enough for the drawing itself and for noting of additional data such as conspicuousness and intensity estimates. At the bottom is space for remarks. The margin at the left is convenient for making cental meridian or colongitude calculations. Such a standard form is a safeguard against forgetting some of the vital data and makes for a more neat and efficient observing notebook. [Some A.L.P.O. Sections are beginning to use standard observing-forms.--Editor.]

The general stages of making a drawing are fairly well known. We sketch in major details with a low power, proceed to higher powers (as seeing conditions permit) and include the finer details, finish and check the drawing, add some estimates of intensities and other data if they are desired, and write up our notes.

I will go on to add some more specific comments on these stages, but first it should be noted that some differences in procedure between lunar and planetary drawings appear at once. For one thing, having the moon in view is not enough. We must pick out the particular formation to be drawn. Note here that the oft-repeated statement about the best views being near the terminator may be somewhat misleading, for study of the lunar terrain (lunain?) under high lighting can also be very profitable. Remember, too, that to be complete, the study of one formation must include its appearance under high lighting. This sort of observing may assume new importance if a lunar research program such as that suggested recently by Mr. Westfall[2] is to be carried out. Also, we must choose a scale for our lunar drawings. Planetary drawings are often made on two-inch disks, for the sake of uniformity of observations among the many observers. (One might suggest that latitudinal strip sketches such as are employed to show Jovian belts or zones don't use two-inch disks, but these can be made from disk drawings and transit observations.) However, how much lunar area, that is how many lunar details, should we attempt to put on our paper during one observation? With planetary drawings this problem is settled. We have only a certain size apparent disk; we will draw all that we can see, and put it on a two-inch diameter drawing. With the moon we have a more complicated situation. To answer the first question, we don't want to take in an area so big that it takes a long time, say much more than 45 mins. to an hour, to draw. Too much can happen in such a long period of time. The lighting conditions, and hence the appearance of our formation, will change; and there is further too much likelihood of seeing and transparency changes. Starting out ambitiously to draw a large area, we may find that by the time only the major details are sketched in, clouds are covering the moon; and we have a nearly worthless drawing, while we might have gotten a good, detailed drawing of some smaller part of the area in the same period of time. A general characteristic of scientific observation is that uncontrolled variable conditions should be kept to a minimum during the work, and this control is partially guaranteed when the observing time is kept short. So we will plan to draw areas containing about as much major detail as we can draw in around twenty minutes (the total period of observation will run longer as we will spend much time in study of the area, looking for the finer details). It can be seen that telescope apertures are now involved. If we think of "fine details" as being the smallest objects one can see with a given telescope, then it can be said that an observer with a large telescope (around 10-12 inches) can see as much "detail" in a small area as an observer with a small telescope (around 3 inches) can see in a larger area. If they are to draw the same amount of "detail", the large 'scope observer will draw a small area; the small 'scope observer will draw a bigger area. The second question, about how big the drawing itself should be, is the same as asking what scale should we use in lunar observing. Patrick Moore has suggested twenty,[3] later ten[4] miles to the inch. But I think this problem, too, can be answered in terms of telescope aperture. If an observer attempts to stick to a certain scale, he may experience difficulty when using different sized telescopes. When using a small telescope, the observer must use an unnecessarily large amount of paper to draw the suggested large area, and will find himself drawing large expanses of featureless grey surface across the page since the small objective fails to resolve detail here. At the other extreme, with large telescopes, the effect is more serious than the wasting of paper; the accuracy of the drawing is impaired. The observer finds that he sees more detail than his previously selected scale allows him to portray. He must now cram in the fine details and take an abnormally long time to get them all in. An illustration of this trouble is seen in comparing two drawings of Theophilus, shown in Figures 1 and 2. Figure 1, with a 2.4-inch refractor, is about the right scale, being originally a four-inch square. In Figure 2, with a 13-inch refractor, I used too small a scale; I took a long time, and had to crowd in details even though slightly less lunar area was drawn in the same sized square. While I agree that ten to twenty miles per inch is usually a good scale for lunar drawings, I think that it shouldn't be rigidly adhered to if the accuracy of the observation is endangered. The proposed system whereby small aperture observers draw more area and on a smaller scale than large aperture observers has the following application to observing programs: it lets small aperture observers study the larger, gross characteristics of the moon, doing such work as charting ray systems over wide areas, positional mapping of regions near the limb, observing some shadow lengths, etc., while the large aperture observers concentrate on recording the fine topographic detail which smaller telescopes won't show anyway. And now a last note on lunar drawings. It seems to be fairly commonly suggested that observers copy the rough outlines of lunar formations from photos ahead of time so as to save that much of the work at the telescope. I don't advise this for the simple reason that it never works for me. Invariably the libration changes the aspect of the object and new lighting changes any outlines I may have put in so that I usually end up erasing what I have copied and starting over again. Maybe I don't have the right photographs. (Ernst Both has pointed out to me that the method is useful in merely mapping the fine detail. That is, rather than attempting to reproduce the appearance of a formation, the observer only records the physical topography on his prepared outline sketch, irrespective of lighting conditions, etc. I agree that it is well to have a photographically accurate outline sketch to start with in such a program.)

Now, at last, we can go on to the general stages involved in both lunar and planetary drawing.

1. The major details

To begin either a lunar or planetary observation, mark down the beginning time, that time when we first seriously begin studying the object. Then examine the object for a few moments before starting to draw; get a feel for the overall appearance of the object. Remember the purpose of the drawing activity: we want to record as accurately as possible what we see in the telescope. Remember, too, that care is therefore necessary in all stages of making the observation.

FIGURE 1. Drawing of lunar crater Theophilus by William K. Hartmann. April 28, 1955. 1^h 54^m, U.T. 2.4-inch refractor at 100X. Colongitude = 340°3. Seeing 6. Transparency 4. Original square around drawing 4 inches on a side. Scale well chosen for aperture.

FIGURE 2. Drawing of lunar crater Theophilus by William K. Hartmann. July 3, 1957. 0^h 46^m - 1^h 44^m, U.T. 13-inch refractor (Allegheny Observatory) at 245X. Colongitude = 337°7. Seeing 6. Transparency 5. Original square around drawing 4 inches on a side. Scale too small for aperture. See also text of Mr. Hartmann's article in this issue.

The first strokes of the pencil should depict the most prominent, coarse features: crater shape, shadow outlines, phase, polar caps, shapes and positions of the dusky markings, postions of bands, etc. on the various celestial objects. (The two inch blank circles for planetary drawings are normally put in ahead of time. A hint for getting the oblate shape of Jupiter and Saturn: after putting in a circle lightly with a compass, draw it in heavily with the pencil, going just outside the line at the sides to get the equatorial bulge, and just inside the line at the sides to get the equatorial bulge, and just inside at the top and bottom to get the polar flattening.*) The goal here is to lay down the main pattern of markings on the object, so that we have a "coordinate system" on which to "plot" the minor details. It is this phase of the drawing, therefore, which will determine our positional accuracy.

In drawing the major details the artist's technique of smudging will be found very useful. Using our soft-lead pencil, we lightly shade in the disk or surface we use in our planetary or lunar drawing. Now this shading can be smudged by rubbing with the fingertip so that we have a uniform greyish surface to start with. Bright areas can now be easily reproduced with the eraser, and shadings by the further use of the pencil. In this way our drawing really shows the Martian polar caps, for example, to be brighter than the desert regions, as is the case on that planet. (Often, however, I further define bright areas by dotted lines to prevent their outlines from being blurred out later by further smudging.) This smudging technique is also a great aid in producing the slight variations in tone so often observed, and in making uniform shadow areas, etc. Furthermore, stray marks which might later be mistaken for real features will tend to be blurred out.

When the major details have been recorded to our satisfaction, we record the time again. It is this time which should be used for the later calculation of central meridian or colongitude, and so on, because it was at this time that the disk or lunar formation presented the general appearance we have drawn. Later, lighting changes on the moon and, often more noticeably, planetary rotation will have changed the appearance. We will, however, use the major details which we have sketched as a frame of reference so that the finished drawing will show the lunar formation or planet as it appeared at this second time. Even with this precaution, however, fast planetary rotation may confuse a drawing if it takes too long, and Prof. Haas has suggested[5] a time limit of 15 minutes for Mars drawings. I would say that such time limits apply primarily to this major details phase of the drawing, while the period of searching for finer detail may extend a little beyond the limit.

During the first part of an observation, a rather low magnification is often prescribed. We need only a low power to draw the major details, and contrasts are often enhanced at low powers. Further, with telescopes not equipped with a driving mechanism, a lower magnification allows the object to stay in the field of view longer. I would say that a magnification of around 20 or 25 times the aperture in inches might be reasonable to use at this stage. Nasmyth and Carpenter have described[6] a lower limit for the magnification to be used on any telescope. They point out that with very low power, and consequent bright images, the pupil of the eye can contract enough to become smaller than the pencil of light rays (exit pupil) from the telescope, and we thus cease to benefit fully from the light grasping power of our telescope. They suggest that the power used should not be lower than that where the pupil's diameter is equal to that of the exit pupil of the telescope.

2. The finer details

With a sketch of the overall appearance of the planet or lunar formation before us, we may now continue to finer and finer details of the object, proceeding in the usual fashion from the more prominent to the less prominent features.

* It is also possible to prepare beforehand form outlines with the geometrically correct amount of oblateness.--Editor.

Here we spend most of the time in studying the object and occasionally stop to record what moments of better seeing have revealed. Users of smaller telescopes will find that these moments of better seeing don't seem to play a very important part, but this is a result of the fact that smaller telescopes are not as critically affected by seeing conditions as are larger instruments. With telescopes of around six to eight inches aperture and larger, these moments of good seeing become all important; and it is at these times that the most delicate shadings and finest details suddenly appear with great clarity and very soon fade out again, leaving the observer to record what he has fleetingly seen.

During this stage the power is raised to the point where seeing effects call a halt. It may well be found that contrast is lessened when the power gets too high. It is often repeated that a common mistake is to use too high a power, and I have seen times when switching to a lower power brought out detail better.

Should we record those features which are once or twice momentarily suspected but are not seen with certainty? It has been said that one should draw only what he is absolutely <u>sure</u> he can see. I am not convinced of this. It seems to me that much of a drawing's value is its use in comparison to, and in conjunction with the drawings of others. If this weren't so, why should we have an A.L.P.O.? Now if two people independently suspect that a faint detail is present, it probably is; but this result will be uncovered only if both observers made some record of it in their observations. I admit, as an example, that I have (thus far, at least) never seen for certain any markings on Venus. However, I have strongly suspected markings; and the great majority of my drawings record markings described in my notes with words such as "possible", "suspected", and other assorted non-committal terms. (I might say that this state of affairs applies only to Venus and Mercury. I haven't tried Leonard Abbey's Realm yet!) I have observed in such fashion in hopes that some confirmation may be obtained with others' drawings, and presently some friends and I are attempting to study such possible confirmation with simultaneous independent drawings. On these grounds, then, I would suggest that a better rule might be: We may record on the drawing some of the strongly suspected but questionable features, if, and only if, we <u>always</u> record in our notes that these were only suspected and were not seen with certainty; still more questionable features may be described in the remarks and not put in the drawing. Please do not misunderstand; this rule is not an invitation to produce speculative drawings. Scientific accuracy and discovery are our goals.

We continue this studying of the object and adding of details to the drawing until we are satisfied that all that we see is recorded or, if we have been slow drawers, until the time limit makes it improper to continue drawing. In such rare cases where the recording of all the detail will take longer than the time limits would allow, I think that the complete recording of detail should have priority over finishing in a given time. If the drawing doesn't show all the visible detail, we <u>know</u> it is lacking; if we go on drawing, we can at least try to make it as accurate as possible. Presumably we have drawn quickly, however; and except with very large telescopes showing a great deal of fine detail, the drawing should be finished within a reasonable period of time.

3. Obtaining additional detail

At this moment, having finished drawing, we are not yet done. I am becoming more and more convinced that the mere making of drawings as such does not constitute the most satisfactory use of observing time. As one example, intensity estimates are another important and useful sort of data. These are numerical estimates of the brightness of spots or areas on the surface of the object. A scale of 0 (shadow black) to 10 (brightest marks) is used. These are not only valuable data, but can provide an activity for rainy evenings. Their purpose is to get information on how, for instance, a certain lunar formation, say some crater's

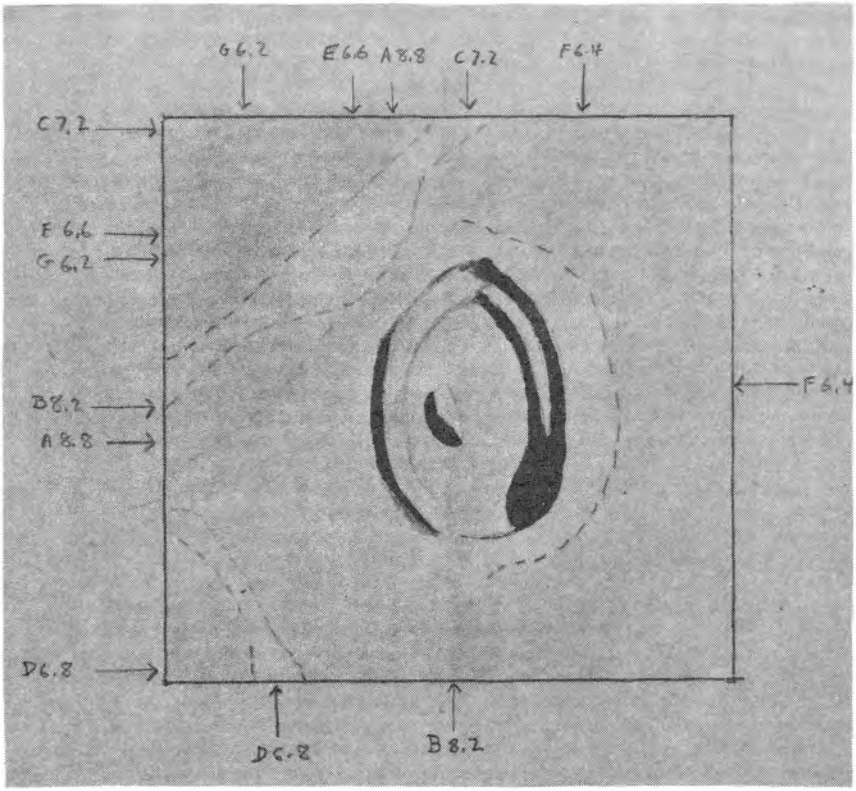

FIGURE 3. Drawing of lunar crater Schiaparelli by William K. Hartmann.
September 8, 1958. $9^h\ 52^m$- $9^h\ 56^m$- $10^h\ 3^m$, U.T.
(began at $9^h\ 52^m$, appearance for $9^h\ 56^m$, ended at $10^h\ 3^m$).
8-inch reflector at B 250X (250X with use of Barlow Lens).
Colongitude = 210°0
Seeing 9. Transparency 5.
See also text of Mr. Hartmann's article in this issue.

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central peak, varies in brightness over a period of one lunar day, or to show changes in intensity of planetary markings during an apparition. The intensities can be plotted vs. time to make a graph showing these fluctuations. Elmer J. Reese's article "Aristarchus from Sunrise to Sunset"[7] gives a good example of this type of work. It will probably be found that the observer's first attempts at intensity estimates turn out to be not very consistent, but with practice it should be possible to develop some accuracy in estimation of brightnesses. Rather than put the numbers on the drawing itself, as some observers do, I prefer to mark mine around the edges of the drawing. A horizontal arrow at the side and a vertical arrow at the top or bottom serve to fix a spot. If the two arrows for a spot are labeled identically, such as A 9.0, with a letter, A, designating the particular spot, and 9.0 being the intensity, then the brightnesses of certain spots are indicated without cluttering up the drawing with numbers. This system is illustrated in Figure 3. For the sake of working in orderly fashion, I usually try to start with A for the brightest area and work toward fainter ones. Another idea is Phillip Budine's system[8] of using an extra outline sketch

on which the intensities may be entered in the proper places. While I think this method is a more cumbersome system during the actual observation at the telescope, I also think it is better suited for studying drawings, being more clear in conveying the situation, and thus would prefer it for submitting drawings.

Another type of extra data has recently been described[9] by Mr. Budine in connection with our Jupiter Section's program, although it seems to be well applicable to our other studies. These are conspicuousness estimates. Here the observer starts with the image considerably out of focus. As he slowly approaches focus, he notes in what order the various features become visible. This method should produce an accurate record of which regions are most prominent and of how this conspicuousness changes over a period of time. Conspicuousnesses and intensities of several features don't necessarily occur in the same order, for a fainter large area can be more conspicuous than a dark small one.

Of course it is customary to record some remarks or notes on the drawing, describing what was seen, general impressions on any possible changes since previous views, observing conditions, confirmation or otherwise of features by other observers who may have been present and/or other such topics. This is another important form of additional data which shouldn't be overlooked, although I tend to write these remarks at the very end of the observing period. I might say that I find that the recording of intensity and conspicuousness estimates greatly reduces the amount of writing of notes that needs to be done.

Colors can also be noted, with short descriptions of the colors of various features. It is usually pointed out that refractors are less reliable for this work than reflectors, which inherently have no chromatic aberration.

The recording of transit times when various features cross the central meridian of a planet is also a very important type of research, which can be conducted concurrently with the drawing.[10]

Of course, there are other types of data gathering which amateur astronomers can be equipped to do, but I have mentioned only those most easily worked in with making drawings. Discussion of yet other data would take us away from this paper's topic.

Now finally when the drawing and additional records have been made, we should record the final stopping time of the observation. We now have three times for our observation. A "middle time" is used in calculations of central meridian, colongitude, or other physical data. Beginning and ending times tell us how long we were observing the object. This interval is very important; in case another observer reports something unusual during the same evening, we must know during what period we were observing in order to know whether we have overlapping observations confirming or refuting his report. This incident actually happened to me once. Dr. Bartlett observed the elusive central bright spot in Herodotus on an evening when I also observed the crater. I didn't see the spot; however, I am sorry to say that until then I had been recording only a "middle time" so that we were unable to determine whether our observing periods overlapped. As another example, suppose that we had been observing Alphonsus on the fateful evening of November 3, 1958. Certainly it would be good just to have a drawing showing nothing unusual and marked only 3:35 U.T. At this time Dr. Kozyrev was taking his third spectrogram, which showed the normal appearance of the crater. Fine. Our observation agrees with his--nothing unusual at 3:35. But we can say nothing about the period from 3:00 to 3:30, U.T., when the gaseous emission was observed. What a different story it would be if we had recorded the time as 3:15 - 3:35 - 3:50, which means: started at 3:15 - finished main details at 3:35 - finished observation at 3:50. Now we could say that emission was over by 3:15, an important piece of information gained only by the recording of starting and ending times.

Each drawing must be accompanied by the following data, usually added at the end of the observation:

1. The date. It is usually stated that the Universal Time date is what is wanted, and it is true that U.T. dates are used in analysis of observations. However, when making observations, I prefer to record a double date, such as Jan. 1-2, 1959, for nighttime observations. This system fixes the night of the observation with certainty and prevents that terrible suspicion later on that by the time we recorded the date we were too sleepy to remember to take Universal Time into account. It's worth writing an extra number to prevent a mistake of 24 hours! [This precaution is commendable. However, one should never report a double date in Universal Time; such a statement is ambiguous and confusing.--Editor]

2. The time. Universal Time, that in Greenwich, England, is used commonly in astronomical work.

To convert to UT from	EST,	add	5 hours
" " " " "	CST,	add	6 hours
" " " " "	MST,	add	7 hours
" " " " "	PST,	add	8 hours

It is this adding of several hours that often changes the date of an observation to the morning of the following day, as referred to above. For example, June 1 at 9:00 P. M. EST is June 2 at 2^h 00^m U.T. Universal Time is in a 24-hour system beginning with 0^h at midnight.

3. The telescope. Aperture and type are listed.

4. The magnifications used. I denote the use of a Barlow Lens by the letter B preceding the magnification, such as B 250X. Also, under this entry I usually describe any filters used.

5. Seeing and transparency conditions. Seeing is recorded by most observers on a scale of 0 (worst quality image) to 10 (perfect steadiness). The fact that such estimation of seeing clearly is subjective has bothered many persons, and attempts have been made to work up a more objective system. Probably the best scheme, and one which promises to be adopted by many observers, is the Tombaugh-Smith scale[11, 12] which is characterized by describing in absolute terms what the particular telescope is seeing at the time of observation. Transparency is recorded on a 0 to 5 scale, with 5 best. Transparency refers not to the amount of sky free from clouds but rather to how clear the air is between the observer and the object. Thus on days when a deep blue sky is studded with puffy white cumulus clouds, the transparency between clouds can be very good, while a uniform layer of haze can cut transparency down when the sky is clear of clouds.

6. Name of observer.

7. Place of observation.

Now we have completed our work at the telescope. Checking over our results, we have before us a drawing showing the aspect of some lunar or planetary object, and records concerning its details' intensities, colors, conspicuousnesses, transit times, etc.--comprehensive records which our Recorders can use to produce valuable studies in planetary science.

Sometime, probably later on, an ephemeris, such as The American Ephemeris and Nautical Almanac, can be used to obtain the central meridian or colongitude and other pertinent information.

All completed observations should be carefully preserved in an observing notebook (not copied into it to get a "neater record". Much less chance for error is present if the original is preserved. Another characteristic of scientific work is that little is ever copied.) If the pencil drawings tend to get smeared as they are kept and used, it may mean that too soft a pencil has been employed, but one of the protective sprays sold in hardware stores will be found useful to provide a smear-resistant coating. When the observation has been filed in an observing book, the making of the observation is completed.

I still claim that the making of lunar and planetary drawings is a process which most observers should be able to learn to carry out, and is not an artistic effort. The slogan of the reluctant, "I'm no artist," doesn't hold up. We aren't trying to create; we are trying to copy. It may be beneficial, especially for the beginner, to try some practice in the form of copying photographs, preferably at some yards distance. This acquaints one with reproducing lunar crater forms, for example; and closer checking against the photo may indicate some trouble to which the observer is prone. Good practice for making planetary drawings is trying to draw the moon with the naked eye, as it thus appears similar in size to telescopic planet images. If it seems difficult at first to record much, we can be encouraged by the words of almost all leading observers, words which I heartily endorse, that the more you look the more you see, and that the ability to see fine detail becomes more and more highly developed with experience.

Let me now say that filing the drawings away in an observing notebook should not be the last activity of the A.L.P.O. observer with his drawings and data. In a later article I will discuss the submitting of lunar and planetary observations to the various Recorders of the A.L.P.O.

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9. Budine, Phillip W., "Some Suggestions for Observing Jupiter", The Strolling Astronomer, Jan.-Apr., 1959, p. 2.

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11. Tombaugh, Clyde W., and Smith, Bradford A., "A Seeing Scale for Visual Observers", Sky and Telescope, July, 1958, p. 449.

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NEW COMET BURNHAM

By: David D. Meisel

No designation has yet been given but is assumed to be either 1959k or 1960a. This object was discovered on the night of December 30, 1959, by R. Burnham, Jr., at Flagstaff, Arizona. The object was assigned a (visual ?) magnitude of 11. On January 2, 1960, H. L. Giclas reported a (photographic ?) magnitude of 14. Dr. Elizabeth Roemer reported a magnitude of 16 for the object, which was described as diffuse with central condensation or nucleus and with a tail less than one degree long. The magnitudes quoted are very misleading. For this reason the I.A.U. has adopted the procedure of reporting two magnitudes, one which is based on the photographic magnitude as represented for short exposures and another which is based on the visual magnitude. The visual magnitude is brighter than the photographic equivalent. Thus the magnitudes quoted below give the probable magnitude limits for all observers, whether observing photographically or visually. B. G. Marsden, Yale Observatory, computed the following parabolic preliminary elements:

T = March 21.6825, 1960 E.T.*
ω = $305^\circ.4083$, 1950.0 Equinox
Ω = 252 .0688, " " "
i = 159 .8347, " " "
q = 0 .524390 Astronomical Units

Date (1960 E.T.)		Right Ascension		Declination		Magnitude
Feb.	6.0	0 hrs.	15.6 mins.	- 6°	39'	
	16.0	0	02.1	- 8	14	8 ,16
	26.0	23	48.8	- 9	42	
Mar.	7.0	23	33.8	-11	08	5 ,16
	17.0	23	15.8	-12	17	
	27.0	22	56.2	-12	20	3 ,14

The extension of the ephemeris beyond the end of March is not made because the close approach of the comet to the earth in the middle of April may cause considerable deviation of the elements calculated above. Indications are at this time (Jan. 11, 1960) that the object will pass within 0.2 astronomical units of the earth and may then be quite a striking object because of its proximity. Perturbations of the orbit could swing the comet either closer to or farther from the earth's orbit. It is hoped that all observers will make a definite effort to obtain observations of this object. The Comets Section is planning to distribute observational report forms and ephemerides to interested observers. A.L.P.O. members or others desiring to receive this material should write to the Comets Recorder enclosing a three cent stamp. Be sure to state particulars about instruments and observational program (whether general, photometric, descriptive, photographic, etc.). Requests do not have to be made by Comets Section members. However, requests made by others not registered with the Section should be received before March 15, 1960. Reports to the Section should be sent at the termination of the series of observations except in the case of unusual appearances, which should always be sent without delay.

The methods of observing comets visually are described in the writer's article "Visual Obssrvations of Comet Arend-Roland 1956 h and Others," *The Strolling Astronomer*, Vol. 10, pp. 116-122, 1956. It is suggested that the following be used as a model observational report form:

*E.T. means Ephemeris Time. This system will be used instead of Universal Time as in the N.A.. For an explanation of Ephemeris Time see *Sky and Telescope*, Jan., 1960.

Observation of Comet ______________________.
Date (Universal Time) ______________________.
Time (Universal Time) ______________________.
Approximate Right Ascension ______________________.
Approximate Declination ______________________.
Seeing (scale of 0 to 10, with 10 best) ______________.
Transparency (scale of 0 to 5, with 5 best) ____________.

Other remarks on conditions of observation, such as moonlight, twilight, etc.

Magnitude Estimates and Comparison Stars

Description (coma diameter, degree of condensation, nucleus, lengths and position-angles of tails, etc.)

Telescope (kind and aperture) ______________________.
Magnification ______________________.

Name and address of observer

Place of observation

Make a field sketch of comet. Show scale and field orientation.

All observations of comets should be mailed to the writer at 800 Eighth Street, Fairmont, West Virginia, U.S.A.

VALUABLE AMATEUR STUDIES OF JUPITER

By: Phillip W. Budine, Jupiter Recorder, A.L.P.O.

(Paper read at the Fifth A.L.P.O. Convention at Denver, Colorado, August 28-31, 1959.)

There are two fields of Jupiter research that have been neglected to a considerable extent in the last few years. Both of these fields should be tackled by the enthusiastic Jovian observer. These fields are the recording of transits on Jupiter and the detailed study of very active Disturbances on the planet. The Recorder sincerely hopes that this paper will encourage more work in these valuable fields of Jovian research.

One of these important fields of Jovian research is the recording of transit observations. I have stressed before in various papers the importance of transit observations in understanding more about the various currents in Jupiter's atmosphere and their effects. When re-

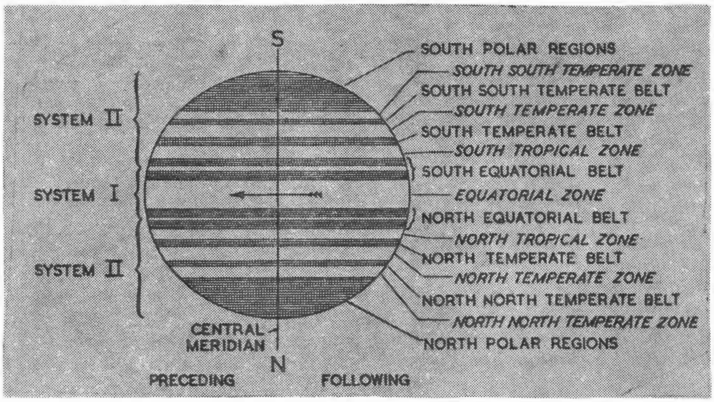
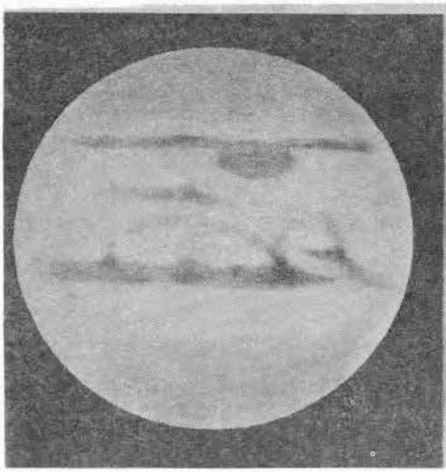


FIGURE 4. Standard nomenclature of the planet Jupiter.



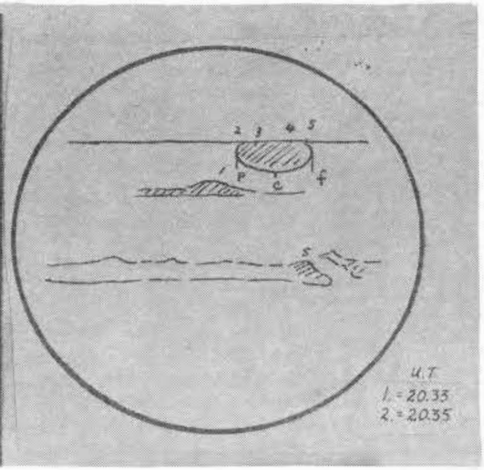


FIGURE 5. Drawing of Jupiter with a 6-inch reflector. January 23, 1958, at 20^h 35^m, U.T. See also text of article by Mr. Budine in this issue.

FIGURE 6. Example of how features on Jupiter may be sketched and numbered. Same observation as Figure 5.

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cording transits on Jupiter, it is necessary to know the location of various markings on the disc. Figure 4 illustrates the standard nomenclature used on Jupiter. As seen through a simply inverting telescope in the northern hemisphere, one will note that south is at the top, north at the bottom, east would be on the right and west on the left side of the disc. The arrow indicates the direction of rotation from right to left or east to west and therefore any marking on the planet will have a preceding end and a following end. The line running north to south illustrates the position of the central meridian. Also illustrated are the two Systems of Jovian longitudes. System I rotates in 9^h 50^m $30^s.003$ and System II rotates in 9^h 55^m $40^s.632$. The diagram shows the latitudinal positions of these two Systems. System I is used for all markings situated on or between the north component

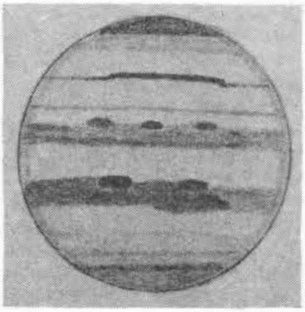

FIGURE 7. Drawing of Jupiter on May 18, 1955, at $1^h\ 30^m$, U.T.

FIGURE 8. Sample table of central meridian transits of surface markings on Jupiter. May 18, 1955. $1^h\ 29^m$ - $1^h\ 53^m$, U.T. The markings observed are those drawn in Figure 7.

No.	U.T.	Feature	Longitude I	C.M. II
		S.E.B.$_s$		
1	$1^h\ 30^m$	C. of darkest spot on C.M. (drawing)	-	244°9
2	1 32	F. end of darkest spot (drawing)	-	246.1
3	1 42	P. end of dark spot (drawing)	-	252.1
4	1 46	F. end of dark spot (drawing)	-	254.5
5	1 52	C. of dark spot	-	258.1
		N.E.B.$_s$		
6	1 29	F. end of dark spot (drawing)	103°1	-
7	1 33	P. end of other dark spot (drawing)	105.5	-
8	1 36	C. of dark spot (drawing)	107.3	-
9	1 41	F. end of dark spot (drawing)	110.3	-
10	1 51	P. end of dark hump disturbance	116.4	-
11	1 53	F. end dark hump disturbance	117.6	-

of the South Equatorial Belt and the south component of the North Equatorial Belt. System II is used for almost all markings situated north of the south component of the North Equatorial Belt or south of the north component of the South Equatorial Belt.

Now let's make an actual observation of the Giant Planet with a 6-inch reflector; the date is January 23, 1958, at $20^h\ 35^m$ U.T., Figure 5. By using our nomenclature diagram, we can see that we are observing the South Polar Region, South Temperate Zone, South Temperate Belt, Red Spot, South Tropical Zone, South Equatorial Belt, Equatorial Zone, North Equatorial Belt, North Tropical Zone and North Polar Region. One will also note in the drawing the polar flattening and the fact that the Red Spot has its preceding end on the central meridian.

When recording transit observations, some observers use a separate sketch of Jupiter showing the location, size and type of object observed, see Figure 6. This sketch was made at the same time and date as the drawing in Figure 5. On the sketch itself the areas observed in the drawing are outlined and numbers are given for the various transit markings. These numbers are then listed in a column along the side of the sketch and after each number is the time of transit. Also illustrated in Figure 6 are the preceding end, center and following end of the Red Spot.

Most Jovian observers in the A.L.P.O. use a chart system of recording transit observations. This system is shown by the drawing and chart in Figure 7 and Figure 8. In Figure 7 is a drawing of Jupiter

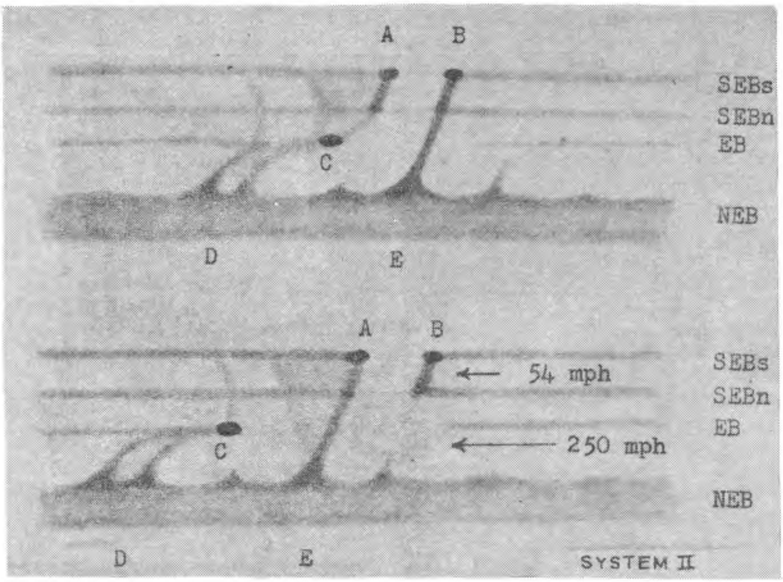

FIGURE 9. Sample sectional drawings of Jupiter, illustrating the early development of the 1949 South Equatorial Belt Disturbance. See also text of Mr. Budine's article in this issue.

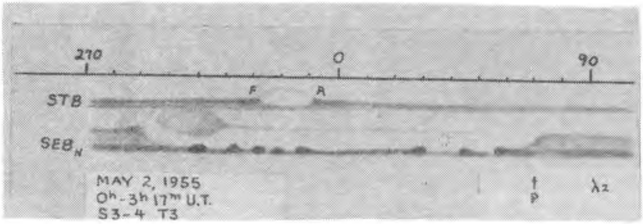

FIGURE 10. Drawing of the South Equatorial Belt Disturbance of 1955. See also text.

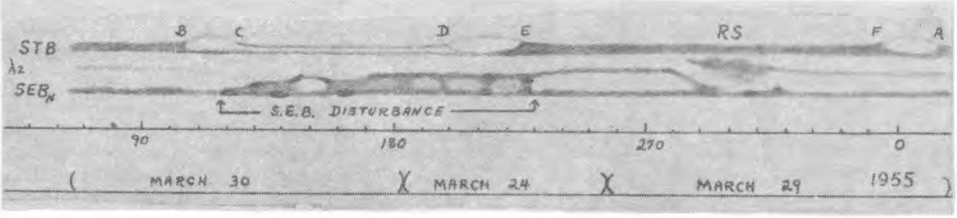

FIGURE 11. Drawing of the South Equatorial Belt Disturbance of 1955. See also text. Note combination of observations on three different dates.

made on May 18, 1955, at $1^h\ 30^m$ U.T. Transit features are in the form of dark spots located on the $S.E.B._s$ and $N.E.B._s$. All these objects were timed as they crossed the central meridian. Their times, descriptions and longitudes are shown in the chart in Figure 8. The times are in Universal Time, which is desired when recording the transits; but one's local standard time may be used if specified. The description of each marking and the part of the marking in transit are given in the column marked "Feature." Some observers use a separate column for the location of the marking. The last two columns are the longitudes of the transits for System I or System II. For an observer to calculate the longitude of a feature, he will need a copy of the American Ephemeris and Nautical Almanac for the proper year. The procedure used in calculating the central meridian or longitude of a feature in transit has been dealt with in The Strolling Astronomer. Transit observations as described above are very valuable to the A.L.P.O. and each observer of Jupiter is urged to contribute as many as possible along with his drawings. If even a few observers could contribute several hundred transits each, this would give us a substantial number of transits. The last few apparitions have been very disappointingly low in the number of transit observations. We should strive for at least 2,000 transits per year in order to obtain a good picture of the planet's activity.

The second field of Jupiter research is very valuable and is a type of observation which is practically untouched. This field is the detailed study of very active Disturbances on the planet on closely adjacent dates. This program of observation calls for very carefully executed sectional drawings of active regions supplemented with the time of transit of each major object depicted. Observers possessing telescopes of 8 inches aperture or larger and living in arid or semi-arid climates have the greatest chance of success in this program.

The sketches in Figure 9 are based on actual observations made during the early stages of the great South Equatorial Belt Disturbance of 1949. These sketches illustrate a puzzle which has long perplexed Jovian observers, namely, that dark streaks or festoons moving in one Jovian current seem to have a strong tendency to align themselves with festoons moving in another current. In the upper sketch, an equatorial festoon from the projection at E is perfectly aligned with a festoon in the South Equatorial Belt at B. In the lower sketch, just four days later, the same equatorial festoon is aligned with another festoon in the South Equatorial Belt at A. Identifications of these features were confirmed by transits made both during and following these observations. The puzzle is that we never seem to catch an equatorial festoon in the process of switching from one terminal to another. What meager evidence we have seems to indicate that the festoon diffuses when the transition begins and fans out to include both terminals. That portion of the fan which leads to the old terminal fades away, while that portion leading to the new terminal darkens and becomes better defined. The transition may be quite rapid, perhaps in less than a day. As one can see, this type of activity requires detailed and regular observing by the Jovian observer in order to solve this puzzle.

Also, included in this field of research and following about the same pattern is the development of major Disturbances in the S.E.B. or South Equatorial Belt on Jupiter. When recording the development of a Disturbance and its effect on a region, the best way to illustrate this activity is probably by the use of sectional drawings since they may cover an area much extended in longitude and also may span several days of observation. In this paper we will illustrate the activity and development of a major S.E.B. Disturbance on Jupiter.

First, we can give some general aspects of development and effects of almost all South Equatorial Belt Disturbances of major proportions. The Jovian observer should always pay close attention and undertake a thorough examination of the Giant Planet for any of these aspects: the Jovian observer will first note one or two very dark spots in the S.E.B., the activity increases and advances in the direction of decreasing longitude (toward the west or preceding end of the planet) at the rate of several degrees a day. The space between the S.E.B. components darkens behind this advancing front, and new spots and streaks continue to appear at or near the longitude of the initial outburst, see Figure 10. Note in this sectional drawing the Red Spot, preceding end of the S.E.B. Disturbance at 70° (II), and dark spots along the $S.E.B._n$ near the spot of the original outbreak. Also, note the darkened South Equatorial Belt now apparent.

Finally to obtain a better picture of S.E.B. Disturbances and their activity, we shall observe the major S.E.B. Disturbance of 1955, see Figure 11. This sectional drawing covers the longitudes observed over a period of three different dates: March 24, 29, and 30, 1955. Interesting features of this drawing are: the dark spots near and on the preceding end of the Disturbance at 120° (II), the white spots in the interior of the Disturbance, and the darkening of the S.E.B. up to the following end of the S.E.B. Disturbance at 240° (II). Also of much interest is the obvious change of the Red Spot to the "Hollow", taking place as the S.E.B. continues to darken along its length.

In conclusion we urge Jovian observers with larger apertures to observe Jupiter frequently and carefully for the early stage development of any S.E.B. Disturbances; also very important are the observations of the last stages of a dying Disturbance. Again transit observations are important in calculating the location and drift of these Disturbances. A systematic program of observing transits and developing Disturbances might best be carried out on a round-the-clock and round-the-world basis, an idea which was formerly forwarded by our Director and is being developed by the Jupiter Section. This program is similar to the Lunar Missile Survey and is designated as the Jupiter Visual Patrol. Ideas and comments from A.L.P.O. members on the operation of the patrol are most welcome. The effectiveness of such a patrol over a period of time is no doubt rewarding in producing a vast number of transit observations and more knowledge of the Giant of the Giant Planets, Jupiter.

JOVIAN NOMENCLATURE AND TRANSIT OBSERVATIONS

By: Phillip W. Budine and Elmer J. Reese

There is perhaps a need to standardize our nomenclature of Jovian surface detail if for no other reason than to expedite and clarify the recording of central meridian transit observations. Anyone who has compiled several hundred transit observations during an apparition will appreciate the task of copying a long list of transits containing very lengthy descriptions. He will also appreciate the desirability of abbreviating these descriptions as much as possible without sacrificing necessary information. It is also desirable that the Recorder will be able to determine at a glance whether the object observed was a bright marking (W) or a dark marking (D), and whether the preceding end (p), center (c), or following end (f) was on the central meridian.

Thus, if the observer will begin each description of a transit with the capital letter (W) or (D) with the proper subscript (p, c, or f), the all-important part of the description will have been recorded! If these letters are followed by an abbreviation indicating the type of marking observed, the Recorder is frequently aided considerably in identifying and following the marking from day to day. A suggested nomenclature with abbreviations follows:

Dark Markings (D)

Darker section of a belt (sect.)......The temperate belts frequently display darker sections having well-defined preceding and following ends.

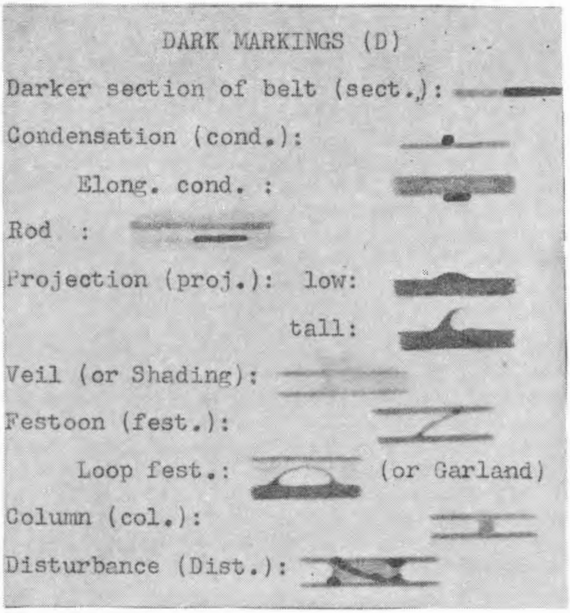

FIGURE 12. Sample typical dark markings on Jupiter, illustrating nomenclature proposed by Phillip W. Budine and Elmer J. Reese in article in this issue.

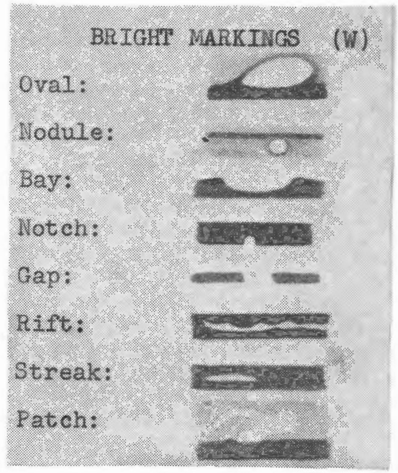

FIGURE 13. Sample typical bright markings on Jupiter, illustrating nomenclature proposed by Phillip W. Budine and Elmer J. Reese.

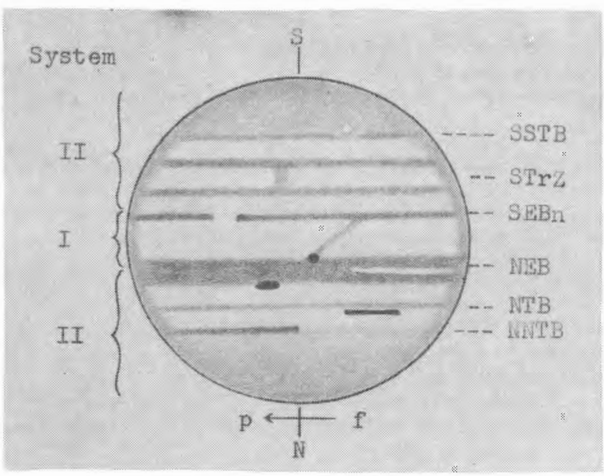

FIGURE 14. Fictitious view of Jupiter illustrating the sample list of central meridian transits in article by Messrs. Budine and Reese.

Condensation (cond.)......A small round or somewhat elongated spot which is intensely dark. Condensations range in size from tiny specks to spots comparable to the shadow of Satellite III. If elongated, the long axis is usually parallel to the equator.

Rod......A very elongated condensation with its major axis usually parallel to the equator. In some instances, a rod may be an isolated short section of an otherwise invisible belt. Rods are quite common along the north edge of the NEB and in north temperate latitudes. Intensely dark rods are frequently seen imbedded in the NEB.

Projection (proj.)......A protuberance on the edge of a belt. The protuberance may or may not be darker than the main body of the belt. Projections vary in form from low rounded humps to tall spike-like objects.

Veil or Shading ......A uniform dusky area of large size sometimes found in the polar regions and in the zones.

Festoon (fest.) ......A dusky filament crossing a zone or looping out into a zone. One or both ends of a festoon may terminate at a dark condensation or projection on the edge of a belt. (Photographic and visual observations with very large telescopes indicate that at least some festoons are merely the background duskiness in a zone seen around the edges of numerous, closely packed, bright oval areas.) The base (or bases) of a festoon should be selected when timing its transit across the central meridian.

Column (col.)......A columnlike dusky area in a zone. A column may be either vertical or somewhat inclined. Columns appear most often in the STrZ and the SEBZ. Thinner columns are sometimes classified as festoons.

Disturbance (Dist. or D.)......A dark or dusky area of large size, more or less sharply defined, and usually mottled with smaller detail which may assume unusual shapes. True disturbances seem to be limited to the STrZ and the SEBZ.

The dark markings described above are illustrated in Figure 12.

Bright Markings (W)

Oval........Medium to large, round- or oval-shaped area that is fairly bright and well-defined. Very common in the EZ.

Nodule......Small, very bright spot, usually round and not much larger than the disc of Satellite III--frequently much smaller.

Bay.........A large, usually semi-oval indentation in the edge of a belt. Frequently seen along the south edges of the NEB and STB. The outstanding example is the famous Red Spot bay in the southern part of the SEB.

Notch (or Nick)........Small, semi-circular indentation in the edge of a belt. Usually somewhat brighter than the adjacent zone. Some notches are produced by nodules situated along the edge of a belt. Notches are found most frequently along the north and south edges of the NEB.

Gap.........A rather wide break in a belt. A very faint or missing section of a belt.

Rift........A long, usually thin, bright streak extending more or less horizontally along the interior of a belt.

Streak......A very elongated white spot. When situated within a belt, a streak may be a fragment of a rift.

Patch.......Irregular whitish area of large size and indefinite outline. Sometimes found in the polar regions and the EZ.

The bright markings described above are illustrated in Figure 13.

An imaginary example of the use of this nomenclature in recording transits may be of some help to the beginner. All the markings recorded in the list of transits below are depicted in Figure 14 which illustrates the appearance of Jupiter at 4:00 U.T.

No.	U.T.	Object	Location	CM I	CM II
1	3:19	Wc (gap)	SEB_n	175°	
2	3:41	Dc (elong. cond.)	N. edge NEB		89°
3	3:51	Dc (dusky col.)	StrZ		95
4	4:00	Df (sect.)	NNTB		100
5	4:08	Dc (cond. & base fest.)	S. edge NEB	205	
6	4:28	Dp (rod)	N. edge NTB		117
7	4:32	Wp (rift)	middle NEB		119
8	4:33	Dc (sf. base fest.)	SEB_n	220	
9	4:37	Wc (v. sm. nodule)	S. edge SSTB		122
10	5:06	Df (rod)	N. edge NTB		140

This article is not intended to present a comprehensive classification of Jovian surface detail. It is felt, however, that the nomenclature included will be adequate for recording most transit observations. Maedlow's nomenclature (Str. A., Vol. 13, pp. 99-100) was adhered to rather closely. It will be noticed, however, that the name "gap" is herein substituted for "rift", while the latter is applied to an entirely different type of marking.

In closing, the writers would like to quote an excerpt from a letter recently received from the Editor: "In practice we know that the markings are not of all possible sizes, shapes, intensity, and colors. The usefulness of a set of names may thus be in part a question of how well this set conforms to physical patterns on Jupiter. In other words, do all, or nearly all, surface markings fit handily into this proposed scheme? This determination must evidently be empirical. If the 'fit' is close, a more general system may be mathematically amusing but of no real practical value."

PROGRESS REPORT OF THE A.L.P.O.
LUNAR METEOR SEARCH PROJECT IN 1958-59

By: Robert M. Adams

These are the results of the 4th year of observation, covering the period from August, 1958, through September, 1959. Most of the individual observers turned in very interesting reports but when they made positive discoveries, these were not corroborated by overlapping observations; nevertheless, many of their discoveries are very interesting, and they are to be highly congratulated for their observations. As in the past, most of the overlapping resulted from the concerted efforts of teams whose participating stations were 0.5 miles to 7 miles apart from one another.

The following people were engaged in the lunar meteor search observations, submitting one or more reports each:

Curtis Anderson, Mineapolis, Minn., 6" reflector
Ronald Bales, Salem, Oregon, 10" reflector
Jim Bukowski and Jim Colburn, Oxnard, Calif., 4" reflector
Kenneth Delano, Taunton, Mass., 8" reflector
W. F. Duncan, Galveston, Texas, 6" reflector
John R. Gilmour, Terre Haute, Ind., 3"? refractor
Walter Haas, Las Cruces, New Mex., 12.5" reflector
Craig Johnson, Boulder, Colorado, 4" reflector
Mike Kelly, Neosho, Mo., 3" and 10" reflectors

Observers from Manchester, Connecticut, were divided into two stations: Eugene Spiess with a 5" refractor and Daniel and Doris Fraher with a 3" reflector.

Observers in Montreal, Canada, using instruments varying in aperture from 3 inches through 12 inches, observed from a total of 16 stations located more than 0.5 miles and up to 10 miles apart. An inventory includes 11 active stations, and there were almost always at least two stations observing at the same time. The observers were: I. K. Williamson (80 mm. refractor, station 1), D. Yane and D. Zorgo (5" reflector, station 2), K. Zorgo and D. Yane (5" reflector, station 3), S. Downing and George Wedge (12" reflector, station 4), G. Gaherty and D. Sands (8" reflector, station 5), W. A. Warren (6" reflector, station 8), D. Sands, B. Rawlings, and E. Fraser (4" reflector, station 11), S. M. and R. G. Sundell (6" reflector, station 13), Vic Williams (6" reflector, station 14), D. Zorgo (5" reflector, station 15), and Vic Williams (6" reflector, station 16). There is a map giving the location of all the stations.

Observers from the Pittsburgh, Pennsylvania, area include Thomas Sadd and Leonard Moore, 4" reflector, Dr. D. Orringer, 6" reflector, Jim Mullaney, 6" reflector and 2.4" refractor, Virginia Lyle, using a 4" reflector and John Hreha, using a 2.4" refractor.

Curtis Anderson searched for lunar meteors on July 12, 1959, from 03:02 to 03:30 U.T. under intermittent haze with negative results. He also observed from 02:30 to 03:30 U.T. on June 13 and 14 under varying conditions of seeing but with negative results. The observing on the 14th was under excellent seeing conditions.

Ron Bales observed with his 10" 'scope on April 12, 1959, from 04:05 to 04:24 U.T. under rather poor seeing conditions. Results were negative. He observed again from 04:00 to 05:00 U.T. on May 12 and from 04:05 to 05:00 on May 13 (with time away from 'scope from 04:30 to 04:35). The results were again negative. The sky was bright on June 13 when he observed with negative results from 04:05 to 04:52 U.T. Mr. Bales was again at his 10" reflector on August 9 and September 9 when he observed in Universal Time from 03:00 to 04:00 and from 05:05 to 05:30 respectively. The transparency was good for the first night and good for the beginning of the second night but was very poor toward the end of the observing on September 9. The results were entirely negative on both nights.

Jim Bukowski and Jim Colburn observed with their 4" 'scope for lunar meteors on several occasions in 1958 and 1959. Mr. Bukowski watched on August 9, 1958, from 11:30 to 11:48 U.T. with negative results. Two days later the results were again negative: 11:30 to 12:00 U.T. On September 5 and 6, 1958, there were negative results during the period of time from 12:00 to 12:30 U.T. for each night. A very faint flash was seen on September 11 at 12:55 U.T. while observing between 12:35 and 13:05 U.T. This flash was reported to have been close to the center of the moon and was 0.5 seconds in duration. Mr. Bukowski was observing, and Mr. Colburn was not observing at this time. On September 17 and December 18, 1958, Mr. Bukowski had negative results while he observed from 02:40 to 03:10 and from 04:30 to 05:00 U. T. respectively. Mr. Colburn then observed on February 16 and March 11, 1959, with negative results. His times of observations were from 02:07 to 02:25 U.T. and from 03:35 to 03:41 U.T. respectively. In a report submitted on July 21, 1959, Mr. Bukowski writes that he searched on July 12 and 13 for lunar meteors with completely negative results. His observation times were from 05:35 to 06:05 U.T. on the first night and from 05:25 to 05:55 U.T. on the second night. He observed from 03:25 to 04:00 U.T. on September 7, 1959, with negative results.

Mr. Kenneth Delano wrote on August 28, 1958, that while trying to identify lunar features on that date, using his 8" telescope, he saw a bright flash at 01:29 U.T., lasting a "small fraction of a second" at colongitude 71°. It came so fast that Mr. Delano was not able to pinpoint its location exactly, but it was between Tycho and Schickard and was clearly visible against the brightly illuminated surface. Mr. Delano also observed from 00:00 to 00:30 and from 00:35 to 00:50 U.T. on September 9, 1959. The results were negative.

Mr. Duncan observed from 09:30 to 10:30 U.T. on June 2, 1959, under poor seeing conditions. The results were negative. He reports negative results on August 1 when he observed from 09:56 to 10:56 U.T. The seeing conditions were fair to good. He observed on August 29, 09:28 to 10:28 U.T., under conditions which Mr. Duncan describes as "moon too bright and high in the sky." The results were negative as they were on the next night when he states it "sure was a good night for flares," although presumably the moon was brighter than on the previous night. His observations on the 30th were from 09:28 to 10:20 U.T. Incidentally Mr. Duncan has been one of our most assiduous observers in the past and often saw flashes or trails of light, but he has been seriously ill and is just now back in the harness once more.

John Gilmour was looking at the moon with his 'scope on August 19, 1958, about 00:45 to 01:00 U.T. when he saw a flickering light in the earthshine close to the terminator. He adds that it reappeared again a few minutes later. It was most unexpected so that he did not record the exact time. He continued to observe on subsequent nights but saw nothing further.

Walter Haas has taken time out from his multifarious activities to send in several reports. His reports cover these observational periods: November 7, 1958, 10:50 to 12:15 U.T.; December 7, 11:58 to 12:46 U.T.; January 13, 1959, 00:57 to 01:54 U.T. and from 01:40 to 02:07 and 02:10 to 02:40 U.T. on February 12. The seeing was poor to fair, and the results were negative on the November date. The seeing was rather poor on the December date; and he <u>suspected</u> several swiftly moving specks of light, but he believes that their velocities would preclude their being close to the lunar surface. Seeing again was poor to fair on January 13, and again Mr. Haas writes of half-suspected swiftly moving specks of light both on and off the lunar surface but "rather patently illusions." Again the seeing was poor to fair on the February 12 date. Here, however, Mr. Haas <u>strongly suspected</u> a very swiftly moving speck of light but "surely too rapid to be a lunar meteor." It was about 11th magnitude, 35° S. latitude, 30° W. longitude, NW to SE, 2-3 minutes of arc long in its path, and with a duration of approximately 0.5 secs. The time was 02:13 U.T. The limiting magnitude was 10 to 12 so that the observations were well worth doing in spite of the poor seeing. This certainly indicates the advantage of a larger 'scope in this work, although a smaller 'scope can yield profitable results especially on nights of good seeing and also for a small percentage of observers who seem to have extraordinarily good vision.

Mr. Craig Johnson, using only a 4" reflector, has reported seeing many flashes, frequently under conditions of rather poor seeing. As a matter of fact, he indicates so many positive discoveries that for the sake of this report I am merely summarizing the number he has seen during each observation period unless there is substantiation from other observers. On December 14 with fair seeing he reports one trail and 15 flares or flashes while observing from 00:25 to 02:06 U.T. On December 15 with poor seeing, Mr. Johnson reported seeing three flashes between 00:40 and 00:43 after which the wind developed into a gale, and presumably this fact spoiled his seeing anything else that night. On January 12 Mr. Johnson started looking at 00:43 U.T. and observed until 02:05, during which time he states he saw no less than 15 flashes varying in magnitude from 8 to 9--none appeared to be brighter. As he says the "rate of seeing objects is unbelievable." Now then on the 13th he saw under extremely good seeing conditions at least three flares. Curiously these were all flares and presumably had some duration but showed no direction. These were seen from 00:53 to 02:01 U.T. It will be noted above that Mr. Haas also observed, using his 12.5" reflector, during almost the same total time period; and he spoke of seeing swiftly moving specks of light both on and off the moon which to him were rather patently illusions. Mr. Johnson watched for a short time on March 13 from 01:45 to ? with negative results, but the wind was very high so he stopped. Negative results were reported on May 11 between 02:45 and 02:53 U.T., and only one faint flash was seen from 04:00 to 04:35 U.T. on May 12, 1959. This flash was seen at 04:05. Mr. Bales observed from 04:00 to 05:00 U.T. on this date with his

10" reflector, but he did not record any positive results. Negative results were obtained on June 11 while Mr. Johnson watched from 03:50 to ?. On the 12th he saw five flashes and flares while he watched from 03:24 to 04:32 U.T. On the 13th he reports one flash from 03:16 to 03:26 and resumed at 03:28 for "several hours," although there were intermittent clouds and it is not certain how much he observed during this long interval.

Mike Kelly observed on December 15, 1958, from 02:15 to 02:45 (with his 3"), on the 16th from 00:00 to 00:30 (3"), on the 17th from 01:55 to 02:30 (3"), on January 13, 1959, from 00:05 to 00:37 U.T. (using the writer's 10" reflector), on February 12 from 01:15 to 01:45 U.T. (3"), on March 12 from 01:15 to 01:45 (3"), and on March 16 from 02:15 to 02:45 U.T. (10"). Although the seeing was fair to good he reported entirely negative results.

There was very little overlapping of observations between the members of the two Manchester teams. Mr. Spiess observed from 01:08 to 01:28 U.T. on August 19, 1958, with negative results. The Frahers observed on October 16 from 22:40 to 24:00 with negative results. Spiess saw nothing while observing on the 19th and the 20th of October from 00:30 to 01:40 on the first night and from 00:00 to 01:55 U.T. on the second night. On January 4/5, 1959, Mr. Spiess reported negative results while observing from 23:00 to 00:43. The seeing was reported as good. The results were negative with Spiess after observing for an hour on February 11/12 from 23:05 to 00:03 U.T. Negative results were obtained on March 15 as a result of observing from 01:42 to 03:10 U.T. with time out for rest from 02:20 to 02:33. On April 14 and 15 Mr. Spiess again reported completely negative results in observing from 00:58 to 03:02 on the first night and from 01:25 to 02:16 on the second. Mr. Spiess saw no flashes or flares on May 14 from 00:20 to 03:18 with time off from 02:10 to 02:23. The Frahers looked from 02:00 to 03:00 on June 12; and Spiess watched from 02:28 till 02:59, both observers with negative results. The atmosphere was hazy that night. Spiess searched on four nights in August, 1959, in connection with the Lunar Missile Survey and saw nothing, although the seeing was good. These nights were August 10, 11, 13, and 14. On the 10th he looked from 00:56 to 01:33, on the 11th from 01:10 to 01:58, on the 13th from 01:40 to 02:33 U.T., and on the 14th from 02:20 to 03:35 U.T.

The Montreal team members under the very capable leadership of Geoffrey Gaherty achieved by far the greatest amount of overlapping as between teams and some overlapping with other observers mentioned above. They have consistently adhered to the very highest observational standards, and they have continued their work in the face of a paucity of positive results. Stations 1, 2, 10, 11 and 13 observed on August 20, 1958, from 00:15 to 01:15 with at least two of the stations being manned at all times. The results were completely negative. The seeing conditions varied from good to poor. On September 19/20 only one station observed with negative results, the other stations being clouded out. Seeing conditions were hazy. Station 3 observed from 23:45 to 00:30. Stations 1, 10, and 11 searched on the night of October 15 from 23:00 to 23:45 with poor to good seeing although observing ceased because of clouds. There was some very good overlapping on the night of November 13 when stations 1, 5, 8, 10 and 11 searched for lunar meteors beginning at 21:30 and terminating at 22:30 with complete overlapping except for the first and last five minutes of the period. December 13 was a good observing night save for the last five minutes or so when trees obscured the moon. Stations 1, 2, and 5 reported negative results. Stations 2 and 5 observed from 22:00 to 23:00 U.T., and station 1 observed from 22:15 to 22:40 U.T. On the 14th stations 1, 2, 15, and 8 searched with negative results. At least two of these stations were looking all of the time between 22:00 and 23:00 U.T. Stations 2, 5, and 8 searched on December 15 from 22:00 to 22:54 with at least two stations always looking. On the night of February 11, 1959, stations 1, 5, and 14 searched for lunar meteors from 23:00 to 24:00 U.T., with almost complete overlapping save for the first 15 minutes. It will be recalled that Mr. Spiess of the Manchester teams also observed at the same time with negative results. In March two stations observed from 23:30 on March 14 to 00:30 on March 15. The seeing was good, and members of both stations each took the same time out for a rest period (23:55 to 00:05). April was a banner month for observing. Only one station reported for the 12th when Station 5 observed from 00:04 to 01:00 under excellent seeing conditions but with negative results. Stations 1, 2, 5, and 10 looked from 00:00 to 01:00 U.T. on the 13th, and all of them observed most of the time under excellent observing conditions. Again the results were negative. Stations 1, 2, 5, 8, and 14 observed for one solid hour on the 14th (and all at the same time) under excellent seeing conditions. Here again nothing was seen. The time of observation was from 00:00 to 01:00 U.T. Three stations, nos. 5, 14, and 15, searched on May 12 from 01:30 to 02:12 U.T. with incomplete overlapping, but most of the time period was covered by at least two of the stations. David Sands observing from station 5 reported a point flash at 01:57 U.T. It was described as being as bright as the lunar crescent (located near Aristarchus) and of two seconds duration. Mrs. D. Zorgo observing from station 15 at the same time did not see the flash so that it may have been an earthly meteor. Seeing conditions were poor for the 30 odd minutes of observing accomplished by teams 5 and 15 on May 13 when they overlapped for most of the period between 01:56 and 02:27 U.T. Stations 1, 4, 5, 11, and 15 observed on June 12, 02:00 to 02:34 U.T., overlapping taking place most of the time by at least two stations. Results were negative. It will be noted that Mr. Spiess observed during this period with negative results. Observations ceased because of clouds. Stations 1, 5, and 16 searched on July 13 from 22:00 to 23:00 U.T.* with incomplete overlapping coverage. The same statement applies to the night of July 14, 02:00 to 03:00 U.T., when stations 1, 4, 5, 15, and 16 observed; and the results were negative for both nights. Station 8 looked from 02:10 to 02:30 U.T. on August 11 with negative results. On the 12th six stations investigated from 01:30 to 02:30 U.T., most of them working for most of this time period. Results were negative. Five stations, 4, 5, 10, 14, and 15, watched on September 9 from 00:30 to 01:30 with irregular overlapping but with always at least two stations watching at the same time. Stations 4, 5, and 14 searched from 00:30 to 01:30 U.T. on September 10 with negative results. This very remarkable series of overlapping observations certainly serves to indicate that lunar meteors are not easily seen by 'scopes up to 12" in diameter.

The Pittsburgh group submitted a few reports. They watched on October 11, 1958, from 08:30 U.T. to daylight with negative results and on October 15/16 from 23:15 U.T. to moonset with negative results, by Mr. Garland. Dr. Orringer overlapped by observing from 23:15 to 23:30 U.T. on the same night. Results were negative. Virginia Lyle watched from 23:55 (Oct. 15) to 00:18 U.T. (Oct. 16) with negative results. On October 16/17, Dr. Orringer and Virginia Lyle observed, Dr. Orringer from 23:15 to 00:20 and Miss Lyle from 00:25 to 01:05 U.T. Both report negative results. As indicated above, the Frahers of the Manchester team observed from 22:40 to 24:00 U.T. on October 16, also with negative results. On December 12, 1958, Dr. Orringer, John Hreha, Thomas Sadd, and Fred Garland watched from 22:15 to 23:40 U.T. at varying times for each but with overlapping for the full period. Dr. Orringer observed from 23:10, Mr. Hreha from 22:30 to 23:30, Mr. Moore and Mr. Sadd from 22:15 to 23:30 and Mr. Garland from 22:15 to 23:40 U.T. The results were negative. Miss Lyle observed from 23:50 to 00:20 U.T. (December 13/14) with negative results. On February 12, searching was done from 00:13 to 00:55 U.T. by Miss Lyle, from 00:15 to 01:00, and by Garland from 00:00 to 00:45 U.T., all with negative results. While observing the moon on August 13 at 01:33 Miss Lyle reports that she saw what she thought might have been a lunar meteor near Fra Mauro. It was of about the first magnitude and occurred while she was not looking for lunar meteors. Mr. Mullaney observed by U.T. from 01:25 to 01:50 on August 13, 1959, with negative results. Dr. Orringer looked from 00:40 to 01:05 on September 5 and Miss Lyle looked from 00:13 to 00:33 on the 6th, also with negative results.

*These times are surely wrong.--Editor.

We come again to the necessity of reporting that there was not a single instance of verification. The reports of the Montreal team are of extremely great significance because of the large number of observations accomplished by at least two teams observing at the same time. One very puzzling feature is the findings of Haas and Johnson, who both seem to indicate a high degree of activity on the night of January 13, 1959; but Haas dismisses this awareness of flashes or streaks of light as "patent illusions." Now this may or may not be, but independently on the same night Johnson sees several "flares" and also on the night before (when Haas wasn't observing, alas). Johnson reported "the rate of seeing objects is unbelievable." Since Mr. Johnson uses a small 4" 'scope his eyesight must be extraordinary. Unfortunately our Montreal friends were clouded out or frozen in January. Now this writer wishes to recall being barely conscious of seeing many trails or streaks while observing variable stars for the AAVSO in January several years ago. The impression was just too vague to record them positively. He has also reported telescopic meteors for Olivier and the American Meteor Society for several years in connection with his work on the variables, using a 10" reflector. There are occasions of seeing very faint streaks, above the 14th magnitude, which he is aware of but which are not of sufficient brightness to be certain enough to record. H. H. Nininger in his Out of the Sky (p. 36) writes that: "Several astronomers have estimated that these [telescopic meteors] are from 40 to 1000 times as abundant as naked eye sizes." In line with this thinking, fainter telescopic meteors of dimmer than magnitude 12 are much more common than those from 6 to 12. Perhaps we can all try to observe on the nights of the 10th to the 16th of January, 1961, off the moon. Perhaps we have a possibility of a yearly display of telescopic meteors just before the middle of January. This tentative result may prove to be an extremely valuable byproduct of our research. In this connection the 'scopes of the Montreal team could be brought into service--each team selecting a different portion of the sky to cover the heavens with the intent of locating a radiant point if possible.

Below is a suggested schedule for 1960 to be followed by individual observers who are not members of teams. Those who are members of teams should make up their own schedules. Any observers who would be interested in forming teams and who have 'scopes at least 0.5 miles apart (and preferably at greater distances) should communicate with this writer.

The two nights before 1st quarter (your own standard time):

March, 7:00 to 8:00, P.M.	August, 8:00 to 9:00, P.M.
April, 7:30 to 8:30, P.M.	September, 7:30 to 8:30, P.M.
May, 8:00 to 9:00, P.M.	October, 7:00 to 8:00, P.M.
June, 8:30 to 9:30, P.M.	November, 6:30 to 7:30, P.M.
July, 8:30 to 9:30, P.M.	December, 6:00 to 7:00, P.M.

This Recorder wishes to thank all those who participated in this project. Although we have not been privileged to verify the existence of lunar meteors, we have at least been able to show during the past four years of observations that such phenomena are not so common as heretofore believed.

THE A.L.P.O. PHOTODUPLICATION SERVICE

By: William E. Shawcross

(Paper read at the Fifth A.L.P.O. Convention at Denver, Colorado, August 28-31, 1959.)

This service was instigated by the comments of a number of A.L.P.O. members who did not have access to back issues of The Strolling Astronomer, and who wanted the use of rare and out-of-print reference materials. There seemed to be a need for a means whereby such materials could be made available at a reasonable cost, and the Photoduplication Service is the result.

The Service provides black-on-white paper prints on 35-mm. strips from photocopies made using a 35-mm. camera fitted with a 100-foot film magazine. These contact prints may be used in a viewer, or examined with a magnifying glass; they have the advantage over film negatives of rendering pictures as positives, as well as making it feasible to produce copies at a cost of less than a cent a frame--far less than the commercial rate of four cents per frame.

The works to be made available immediately in this form are, so far, The Strolling Astronomer and The Selenographical Journal. Other works to be included will be determined by demand. These will be available to anyone essentially at cost. An extension of this service will be to reproduce rare materials for which there is little demand, on individual order, and for A.L.P.O. members only.

Inquiries should be directed to William E. Shawcross, A.L.P.O. Photoduplication Service, P. O. Box 18, Cambridge 38, Massachusetts.

AN APPRECIATION OF H. PERCY WILKINS

By: Walter H. Haas

On January 23, 1960, I received a telegram from Dr. James Gant, the President of the International Lunar Society, with the sad news of the passing of Dr. H. Percy Wilkins of Bexleyheath, Kent, England, one of the great lunar students and visual observers of our time. Dr. Wilkins had been a personal friend of mine since we first met in London in 1953, after having corresponded since 1946. He was a charter member of the A.L.P.O. and was a frequent contributor to The Strolling Astronomer. It was typical of the man that he permitted and encouraged the publication in this periodical of the Sections of the Second Edition (1946) of his great map of the moon when the sales of the original map were necessarily rather limited. He was certainly one of the outstanding visual lunar observers of all time. It is not likely that any of us will again know a man who dared to map the whole moon primarily on the basis of his personal observations. During the last 10 years of his life most of his observations were carried on with a 15¼-inch reflector of his own construction.

It is not the purpose of this note to give full biographical details. Dr. Wilkins was born in Wales 62 years ago. He was an amateur astronomer in the best sense of the word, being employed by the British Civil Service. He was Director of the Lunar Section of the British

FIGURE 15. Dr. H. Percy Wilkins and his family at their home at 35 Fairlawn Avenue, Bexleyheath, Kent, England in June, 1953. Left to right: Mrs. H. P. Wilkins, Miss Eileen Wilkins (daughter), and Dr. Wilkins. Photograph by Walter H. Haas.

Astronomical Association for a number of years. In 1956 he was the chief founder and first President of the International Lunar Society, the first truly international group devoted to lunar astronomy. His very extensive correspondence was literally global, and much of the effort of his last years was given to the I.L.S. He was the author of a number of books, the most important of them being surely The Moon on which he and Mr. Patrick Moore collaborated. This book is an excellent and detailed description of the lunar surface in the worthy tradition of Goodacre's Moon and other still earlier out-of-print classics.

In recent years it has been fashionable in some quarters to vie in criticizing the Wilkins map in superior-sounding phrases. Its failings must await the evaluation of history, like the work of the rest of us. Perhaps, however, we can realize that he who does anything will make some mistakes and that he who attempts much will make many mistakes. Perhaps also we may feel that it is better to attempt much than to sit and criticize.

Dr. Wilkins--his degree was an honorary one from the University of Barcelona in Spain--was a quiet, unassuming man, who would not attract attention in a crowd. He was the very soul of hospitality, as Dr. Gant and I, among other visitors to Bexleyheath, fondly recall; and he had a lively if subtle sense of humor. He made many American friends during his visit to this country in 1954.

On January 23 I sent the following telegram to Mrs. Wilkins:

"Deepest regrets and sympathy from me personally and the Association of Lunar and Planetary Observers. Your loss is our loss also."

It seems singularly fitting that one of Dr. Wilkins' last lunar observations may well have been that of the impact-flash of the Russian Lunik II carrier rocket on September 13, 1959, (see "Observations and Comments" in this issue). It would be a worthy climax to his life that he who had loved the lunar scene so keenly and for so long should witness the arrival of the first artificial vehicle on the lunar surface.

SOME SUGGESTED OBSERVATIONS OF THE TOTAL LUNAR ECLIPSE ON MARCH 13, 1960

By: Walter H. Haas

The circumstances of this eclipse are as follows:

Event	Ephemeris Time	Pacific Standard Time
Moon enters penumbra	March 13, $5^h34^m.3$	March 12, 9:33.7, P.M.
Moon enters umbra	6 38.4	10:37.8, P.M.
Total eclipse begins	7 41.0	11:40.4, P.M.
Middle of eclipse	8 28.3	March 13,12:27.7, A.M.
Total eclipse ends	9 15.7	1:15.1, A.M.
Moon leaves umbra	10 18.3	2:17.7, A.M.
Moon leaves penumbra	11 22.2	3:21.6, A.M.

Magnitude of eclipse = 1.520

Interested readers will find a discussion of Ephemeris Time by G. M. Clemence on pp. 148-149 of Sky and Telescope for January, 1960. The Pacific Standard Times above should be increased by one hour to give Mountain Standard Time, by two hours to have Central Standard Time, and by three hours to obtain Eastern Standard Time. It will be noted that the eclipse can be observed under favorable conditions over most of the United States, most favorable on the Pacific Coast.

A.L.P.O. members who are properly situated are invited to attempt one or more of the following programs of observation on this eclipse:

1. Estimates of the brightness of the eclipsed moon.

2. Timings of when selected points on the lunar surface enter and leave the umbra.

3. Searches for possible lunar surface changes caused by the eclipse.

4. Searches for possible lunar meteors and/or meteoritic impact-flares.

5. Photographic searches for possible small sub-satellites travelling in orbits around the moon.

Brightness of Eclipsed Moon. Impressions of the brightness and color of the eclipsed moon are interesting but are also extremely subjective. Of greater value are careful observations of the stellar magnitude of the eclipsed moon, perhaps repeated several times during the 95 minutes of totality. The eclipsed moon may be compared in brightness to stars or planets above the horizon at the time. The moon should be viewed through binoculars turned the wrong-end-foremost in order to appear starlike. (Very myopic observers may need no such help because stars show large discs to them when glasses are discarded.) The stellar magnitude of the moon is estimated by the familiar methods of variable star observation. Comparison "stars" bright enough for matching will be scarce, though; we may be limited to Jupiter (near stellar magnitude -2) and to Vega and Arcturus (near 0, with Arcturus preferable in that its color will more nearly match that of the moon).

Times When Craters Enter Into or Exit From Umbra. We can perhaps present this program in no better way than to quote part of a letter from Dr. Joseph Ashbrook on December 24, 1959: "Amateur times of this sort [immersion into umbra of selected lunar objects and later emersion from it], recorded to the nearest 0.1 minute, are very suitable material for deriving the value of the enlargement of the umbra. [The atmosphere of the earth enlarges the umbral shadow beyond the geometric size caused by the solid body of the earth.--Editor.] ...I have already computed the auxiliary tables needed for the reduction of crater times...

"If there are observations of this kind by A.L.P.O. members, either published in The Strolling Astronomer or made available to me in manuscript, I would be glad to reduce them also, and prepare a report for you.

"For the actual observations of crater times, small apertures and low powers are best, to sharpen the border of the umbra. Telescopes of 2 to 6 inches aperture, with powers of 30 X to 50 X, are very suitable. Observers should be advised to check carefully the identifications of the craters used. In the case of a small crater, such as Bessel, one simply notes when the middle of the crater is passed by the umbral edge. In the case of a large crater, such as Tycho, Plato, or Grimaldi, the observer times both the first contact of crater and umbra, and also the moment when the crater is just covered. (The mean gives the time for the midpoint.)"

We thank Dr. Ashbrook for his kind offer of assistance and ask our readers to show their appreciation by submitting a large number of reliable observations. Remember, however, the necessity of recording the time accurately to 0.1 minutes, or 6 seconds. This program is very well suited to the small 1.5- to 5-inch telescopes used by many of our younger and newer members.

Possible Eclipse-Caused Changes. Many lunar areas go through periodical changes of a rather curious sort each lunation; for example, dark areas on the floor of Eratosthenes darken as lunar noon approaches and fade out again under afternoon lighting, and the Linné white area diminishes in size toward its lunar noon and then enlarges again. W. H. Pickering, who pioneered the study of such variable areas, imputed them to such physical agencies as lunar vegetation, mists, and hoarfrost; but most astronomers would regard them as produced merely by the changing solar illumination. A lunar eclipse offers some possibility of deciding between the two points of view since the rapid and extreme fall of temperature in the earth's umbra might create in the variable areas aspects abnormal for the full moon when they are observed just after re-entry into sunlight _if_ physical agencies are involved. Past studies of eclipses have indicated that most of these variable lunar areas are not affected to an observable extent but that a few eclipse-caused changes do occur and that the same lunar area is differently affected at different eclipses. The following objects are suitable to study for eclipse-caused changes:

1. _Linné_. Watch carefully the size, brightness, and sharpness of the white area around this crater. Equipped observers should measure the diameter of this white area with a filar micrometer.

2. _Eratosthenes_. Estimate the intensities of the dark areas on the floor and walls, especially of those in the east half of the floor.

3. _Atlas_. Watch the intensity and appearance of the two main dark areas on the floor, the one near the south wall and the other northwest of the central mountains, and of the narrow dark band joining these two areas.

4. _Riccioli_. Watch closely the south tip of the conspicuous dark area in this crater, and note its darkness. Micrometrical measures of the north-south length of this dark area are desired; otherwise, the latitude of the south end relative to other lunar objects should be carefully estimated. Note whether the south end is pointed or rounded.

5. _Stoefler_. Examine carefully the dark areas on the floor, and compare the intensities of those in its east and west parts.

6. _Alphonsus_. Watch the intensities of the dark areas on the floor and the appearance of the now-famous central peak.

7. _Plato_. Watch the darkness of the floor and the appearance of the craterlets thereon, visible as white spots near full moon.

Although there are no objections to studying other apparently changing lunar areas, it is highly desirable to try to get results from a number of different observers upon each object watched. We hence request that each observer study _at least two of the seven areas listed above_. _No one should attempt to study more than four lunar areas altogether_; else he will have time for only superficial views. Most observers will do better to select only two or three objects. _The same telescope and the same eyepiece_ should be used for all observations in this program in order to remove one fruitful source of false variations in the appearance of lunar features. It is extremely important to know the usual full-moon appearance of the regions being watched for eclipse-caused changes. Photographs of _good_ quality can here be helpful, but in addition visual check observations can scarcely become too numerous. Each lunar area being studied should be carefully observed, if possible, before immersion in the umbra, on the night before the eclipse and also on the night after, and in at least one other lunation at about the same solar illumination as will prevail on the night of the eclipse. It is best to make many of the observations by comparisons to other lunar features not far away. For example, the size and brightness of Linné may be compared to the size and brightness of other similar white spots on the Mare Serenitatis. Each observer should select the comparison-areas he desires to use with much care, perhaps with some help from photographs.

On the night of the eclipse each object on the program should be examined carefully _soon after it leaves the umbral shadow._ If anything in the least abnormal is seen, this object should be reobserved at short intervals either until the normal appearance returns or else for as long as possible. One must be very careful here not to be deceived by penumbral illumination, from which cause it is probably impossible to detect eclipse-caused changes that do not endure for at least 15 minutes. Penumbral effects on a crater will be the same before immersion in the umbra and after emersion from it. Of course, the time of each observation and the other usual accompanying data (see, for example, Mr. William K. Hartmann's article in this issue) must be recorded if the whole program is to have value. Observers possessing telescopes above 10 inches in aperture and equipped for photography are encouraged to obtain a series of good photographs which can then be studied for possible eclipse-caused changes.

Searches for Possible Lunar Meteors and/or Meteoritic Impact-Flares. Current work on this program has been discussed by Mr. Robert M. Adams on pp. 21-26 of this issue. The great advantage of a total lunar eclipse here is that simultaneous searches are then possible over almost half of the whole earth. Searches during the March 13, 1960, eclipse should be limited to the 95 minutes of totality; and the whole moon should then be watched as carefully and as nearly continuously as possible. A low power should be used in order to show the entire moon. In reporting searches for possible lunar meteors or meteoritic impact-flares one should give the usual data about observer, station, telescope, magnification, seeing, and transparency. In addition, one should record the beginning and ending times for the search, the number of minutes spent in actual watching (for example, it may be necessary to take time out to move a telescope lacking a drive), the region observed if not the whole moon, and the results.

If any unusual bright spots are seen, the most important data to record are the exact time of appearance, if at all possible to the nearest second, and the precise location on the moon, perhaps marked on a chart relative to known lunar features. If two independent observers many miles apart independently and simultaneously record a bright object at the same place on the moon, that object was not in the earth's atmosphere and was hardly an illusion. Other desired data, less critical but still of interest, upon unusual bright objects found during these searches are: the apparent angular diameter, the stellar magnitude, the length of path, the lunar direction of motion or alternately a statement that the object was stationary on the lunar surface, the duration of visibility, the color, and any other noteworthy characteristics. Objects which are merely suspected should be reported as suspected, for another observer may have had a clearer view. Larger telescopes are advantageous in this program because they can show dimmer lunar meteors.

Searches for Possible Sub-Satellites of the Moon. By far the most exhaustive and conclusive search of this kind so far was the one undertaken by Mr. Clyde W. Tombaugh and his associates at the Lowell Observatory during the highly favorable "dark" eclipse on November 18, 1956 (The Strolling Astronomer for January-June, 1957, pp. 61-64). The general strategy here was to have the camera track the moon so that lunar satellites in almost all parts of their orbits would be revealed either as star-like points or else as trails shorter than those of stars. Mr. Tombaugh's search was effective from stellar magnitudes 13 to 17½ over practically all of the volume of space within which a lunar sub-satellite may exist, and his results were negative. Earlier, less complete searches were recalled by Mr. Richard M. Baum on pp. 7-11 of the January-February, 1956, issue of this periodical. At a given eclipse the photographic search, as Tombaugh has pointed out, cannot be complete in front of the moon or behind it; and hence further studies at several more lunar eclipses are desirable. The ideal instrument would be a large, fast focal-ratio Schmidt camera. Visual searches for lunar satellites at lunar eclipses can be effective only in very limited areas of the sky because of the necessity of detecting the orbital motion of one (or more) of a multitude of faint stellar images.

Request. We wish all our readers excellent skies on March 13, and we ask them to report their results to us at Pan American College, Edinburg, Texas, as soon as possible after the eclipse.

OBSERVATIONS AND COMMENTS

Disappearance of Comet 1959 f. Many of our members must have read about the curious disappearance from view of this comet as described on pp. 35-36 of Life magazine for January 25, 1960. Mr. Alan McClure's fine photograph on September 4, 1959, was carried on the front cover of our November-December, 1959, issue. Mr. David Meisel, our Comets Recorder, contributes the following note:

"Contrary to expectation, Comet Alcock 1959 f did not survive its perihelion passage in mid-September. Because of the orientation of its orbit it was observed for only a week. Two A.L.P.O. observers were able to get fairly reliable observations of this comet. Expected to become a fairly bright object after perihelion, Comet 1959 f was searched for by many A.L.P.O. members with negative results. Because of its low altitude in the western sky, several false alarms were reported but turned out to be faint stellar groups that were not resolved by the search instruments.

"During its brief period of visibility the object appeared to be a well developed comet. Any indication of subsequent disintegration was not apparent at the time. It will be extremely difficult, if not impossible, to reconstruct the events leading up to the final dispersion. However, the Recorder will make an attempt to obtain some definite conclusions concerning this remarkable event. Many theories have been advanced, but each one has a certain element of improbability. To say that the comet evaporated does not account for completely annihilating an object of this size with no trace of remains. Other explanations on the basis of a single mechanism have similar failings, as will be demonstrated at a later time.

"A more complete account of the observations of 1959 f along with a description of the disappearance of this object will appear in a later issue of The Strolling Astronomer. The Recorder requests all observers to submit for analysis just as soon as possible any observations not yet reported on this comet. Solar surface charts and phenomena accounts for the month of September, 1959, that might reveal special solar correlations are also needed. All contributors will receive due credit for their material. Speculations by experienced observers will also be welcomed."

Two Apparent Observations of the Impact of the Lunik II Carrier Rocket. Mr. Patrick Moore of East Grinstead, Sussex, England, has communicated the following report: "On September 13, 1959, observations were carried out in an effort to detect the impact of the Russian vehicle Lunik II on the lunar surface. The instrument used was my 12½-inch reflector with powers from 200X to 400X. Only a small part of the 'area of uncertainty' could be covered, and the region selected was that of the Mare Vaporum. At a time which subsequently proved to be that of actual impact a minute, short-lived flash was recorded very close to Schneckenberg. It has been suggested that this was due to the impact of the carrier rocket; an identical and quite independent observation was made by Wilkins with his 15¼-inch reflector at Bexleyheath, Kent, England. My own observation was so uncertain that I am not prepared to trust it; the flash was at the limit of visibility, and at the time I was by no means sure that it was due to anything more than eyestrain."

Reports on their observations by Wilkins and Moore appear in the British magazine Nature for August 15, 1959, Volume 184, page 502. The two observers agree in seeing the flash of light at $21^h\ 2^m\ 23^s$, Universal Time and further agree in placing it close to Schneckenberg, lunar coordinates about Xi = +0.085 and Eta = +0.195. It may be significant that Wilkins with the larger telescope was the more confident of seeing something and recorded a longer-lasting phenomenon.

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