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## The Strolling Astronomer

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The three partially destroyed lunar rings Parry (lower right, 45 kms . in diameter), Bonpland (bottom, 57 kms .), and Fra Mauro (center, 92 kms .) are in the foreground of this wide-angle oblique view from the Apollo-16 metric camera, which extends north to Copernicus, on the horizon 600 kms . distant. The low solar elevation, colongitude $=21^{\circ}$, brings out the rugged small-scale relief of this area. Photograph AS16-1420, available for loan in the ALPO Lunar Photograph Library. See also text on pages 35-39.

##  <br> THE STROLLING ASTRONOMER Box 3AZ

University Park, New Mexico 88003


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By: Winifred Sawtell Cameron
A.L.P.O. Lunar Recorder
and
National Space Science Data Center
The formal program for observations of Lunar Transient Phenomena (LTP) for the Association of Lunar and Planetary Observers (ALPO) was first announced in Vol. 23, Nos. 9-10 of The Strolling Astronomer. In this issue the suggested methods of observation were given, and the call for observers was made. The gratifying response elicited 32 observers ( $1 / 6$ of whom are women) showing interest in observing for program (alphabetically listed in Table 1). The response in observations, however, is somewhat disappointing since only some six observers have reported with any regularity in the 15 months the program has been operating. Three others (all from countries other than the U.S.) have sent in a few reports, usually of features other than those assigned to them. Each observer was assigned four LTP sites, one non-LTP comparison site, and one of Latham's Seismic Zones.

The main objectives for the program are: (1) to monitor LTP sites and non-LTP comparison sites for normal as well as abnormal aspects in a random night observing format; (2) to establish quantitative albedo scales for each feature for each sunlit day (to decrease or eliminate the waxing phase bias of historic observations) ; (3) to establish a quantitative seeing scale based on the behavior of a star's diffraction disk. The first step for the observer was to set up his own albedo scale by observing at Full Moon and to produce a gray scale based on Elger's gray scale, with either pencil shadings or exposed film or paper.

The goal of randomness required that sites be observed at all ages of the Moon (scattered in time) both while the observed feature was sunlit and if possible while it was in darkness too. Each feature was to be observed at least twice, with observations at least 10 minutes apart. In order to produce albedo tables, every time a feature was observed, each point was to be monitored and its albedo estimated by using the established gray scale. Several points in the crater were to be chosen with one on the nearby north or south plain as a comparison point. North or south was desirable in order to maintain the same relationship to the terminator as for the feature. Ideally, several sets of albedo estimates for each sunlit day of a lunation would be obtained over a long period. Eventually, albedo charts even for each few degrees of colongitude might be produced. Bartlett for Aristarchus (1967) and Proclus (private communication) and Vaucher (1973) for Alphonsus have reported albedos in such a manner. To date, only one feature (viz, Dawes) approaches the ideal of measures for each day of the Moon's age; therefore, it will be the one that I will most fully analyze here.

Procedures to produce a seeing scale were described in Vol. 23, Nos. 9-10 of The Strolling Astronomer (W. Cameron, 1972). It should be emphasized here, though, that in order to produce a standard quantification of seeing conditions the observer always should rack the eyepiece the same amount; e.g., one complete turn, and in the same direction, e.g., clockwise; and estimate the amounts of the two motions of that diffraction disk: (a) amount of expansion, and (b) amount of excursion of the image, in terms of fractions of the field of view (FOV) of his telescope. A more accurate method of determining the size of the expanded (and smallest) disk would be to time first the interval between successive drifting disappearances of the east and west edges of the disk (set at the edge of the FOV), and then to deterinine the interval of time it takes the image to drift across the whole field of view. The intervals of time between successive blow-ups to the largest disk should also be timed. The amount of expansion gives an estimate of the amplitude of the wave that causes blurring (Baker, 1950), and the interval between expansions gives an estimate of the wavelength. The excursion motions, in turn, give estimates of the other type of "seeing" aberration -- scintillation. One type originates from turbulence a few feet above the ground and the other type from turbulence at a higher altitude.

In the period from June, 1972 through August, 1973 a total of 117 observing nights were reported. A few more were reported prior to June, 1972. Among these 117 nights ( 75 with albedo measures) were 13 lunar transient phenomena (Table 2). Five of the 13 were reported on nights when other negative observations were reported, and eight were of phenomena only. With relatively few observers reporting, there were no coincidences of dates, times, and features in the observations. The nearest coincidence in time was 14 hours, but observations were of different features.

Of the thirteen nights of positive reports, five were of non-LTP sites. Three sites had two reports each: Aristarchus, Lyell (or near it), and Calippus (or near it).

| Observer | Location | Telescope(s) | No. of Nights Obs. | No. of Features Obs. |
| :---: | :---: | :---: | :---: | :---: |
| S. An thony | Warren, PA |  |  |  |
| J. Bartlett* | Baltimore, MD | 3R, 4L, 5L | 10 | 10 |
| I. Beck | Wadsworth, OH | 6 L . |  |  |
| J. Benton | Savannah, GA |  |  |  |
| R. Borek | Lancaster, CA | 6L |  |  |
| G. Chevalier | Quebec, Canada |  |  |  |
| F. Dachille* | Univ. Park, PA | 10.5L |  |  |
| L. da Silva | Curitiba, Brazil | 13R | 2 | 7 |
| E. Davis | Youngsville, PA | 2R |  |  |
| K. Delano** | Taunton, MA | 12L | (3) | (43) |
| R. Dezmelyk | Newton Square, PA |  | (1) | (1) |
| R. Engstrom | Warren, PA | 4 L |  |  |
| J. Fontana | Peekskill, NY |  |  |  |
| M. Fornarucci | Garfield, NJ | 6L | (4) | (4) |
| B. Frank | Hopkins, MN | 6L | 23 | 75 |
| J. Galgocy | Philade1phia, PA | 2 R | 7 | 28 |
| D. Gens | Youngsville, PA | 2R |  |  |
| D. Harrold* | Cleveland, OH |  |  |  |
| R. Hill | Greensboro, NC | 6L, 2R, 10L | 10 | 23 |
| M. Huddleston | Mesquite, TX |  |  |  |
| $P$. Jean | Montreal, Canada | 4R | 3 | 15 |
| Z. Kleinman | Harrisburg, PA |  |  |  |
| T. Lynch | Pittsburgh, PA | 6 L | 6 | 29 |
| L. Maleske | Las Cruces, NM |  | 1 | 1 |
| B. McClellan | Canoga Park, CA |  |  |  |
| G. Persson | Hvidovre, Denmark |  | 4 | 16 |
| R. Peterson | W. Palm Beach, FL | 6L |  |  |
| A. Porter | Narragansett, RI | 6L | 40 | 119 |
| H. Stelzer | River Forest, IL |  |  |  |
| T. Traub | Warren, PA | 8L | 3 | 11 |
| M. Valentine | Clarendon, PA |  |  |  |
| G. Vargo (\& Assoc.) | Pittsburgh, PA | 5R, 6L, 13R |  |  |
| J. West | Bryan, TX | 8L |  |  |
|  |  | TOTAL | 117 | 382 |

*Part time observer.
**Observer on another program reports phenomena and sometimes normal aspects to me.
( ) Prior to June, 1972.
$\mathrm{R}=$ Refractor
L. $=$ Reflector

I consider eight of the thirteen positive reports as probably true phenomena (one of which was given as a non-LTP, but I rated it similar to other LTP reports and listed it as one). There are other cases (e.g., Dawes) where LTP were not reported, or rather, were reported as nomal, but in which the albedos indicate anomalies. In most cases, however, there are still not enough observations for the same lunar age to establish the normal albedo for that age. In one LTP report, the observer noted a brightening of three of his points (but two remained steady). In this case (Dawes), however, other nights of reported albedos at the same age suggest that this observer witnessed the ending of a dimming phenomenon and the subsequent return to normal. Such changes can be confirmed when we have the average of several albedo measures for a given age (or small range of colongitudes) for each feature. The outlook appears promising, and the efforts of these observers will establish for the first time a quantitative basis for comparison and detection of real lunar anomalies.

The estimates for "seeing" conditions are establishing a quantitative base for this usually arbitrary and subjective estimate. Some of the results have been surprising.


Judging from the reported star disk motions, I would have expected the estimates of very good seeing to accompany small expansion disks and long time intervals between expansions and excursions. Instead, observers have reported seeing conditions as excellent when the disk behavior suggested turbulence!. (See Table 3.) Again, it is too early to establish a table of disk motions with a related letter or numerical scale such as the Antoniadi scale of seeing. The time intervals between successive similar motions are very important, especially for comparis on with variations of lunar phenomena. If the variations are synchronous with the star disk motions, it is probable that those variations are due to terrestrial atmospheric phenomena. On the other hand, if they differ in timing, the phenomena are likely to be truly lunar rather than terrestrial. The observers who have been reporting have shown that the objectives of the program can be attained. It is urged that others who have expressed a desire to participate will indeed do so whenever possible.

For some of the analyses to follow, I will use the feature which has the most complete record, viz, the crater Dawes. The observer of Dawes has been rewarded with catching a

Table 3. Total Observations of Dawes $\left(26^{\circ} \mathrm{E}, 17^{\circ} \mathrm{N}\right)$ Sunrise at $334^{\circ}$ Colong., Sunset at $154^{\circ}$ Colong.

|  |  |  |  | Points |  |  |  |  |  |  |  |  |  | $\begin{gathered} \mathrm{Col} \\ (\mathrm{deg}) \end{gathered}$ |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| No | $\phi_{\text {d }}$ | Date | Time (UT) | A | Avg | B | Avg | C | Avg | 0 | Arg | $E($ nrby plain) | Avg |  |
| 1 | 0.915 | 10/21/72 | 0150-0300 |  |  |  |  |  |  |  |  |  |  | 74 |
| 2 | 0.000 | 11/22/72 | 0035-0230 | 8,8,8,8,8 | 8.0 | 3,4,4,4,4.5 | 3.9 | 3,3,3,3,3 | 3.0 | 4,4,4,4.5,4.5 | 4.2 | 3,3,4,2.5,3 | 3.1 | 103 |
| 3 | 0.761 | 01/9-10/73 | 2245,0015 | 5,4.5 | 4.8 | 6.5,6 | 6.25 | 3.4,4 | 3.7 | 4.5,4.5 | 4.5 | 2.5,2.5 | 2.5 | 337 |
| 4 | 0.796 | 01/10/73 | 2250,2320 | 2.5,2 | 2.25 | 4.5,5 | 4.75 | 5,4,5 | 4.75 | 2.5.3 | 2.75 | 2.5,2.5 | 2.5 | 350 |
| 5 | 0.832 | 01/11-12/73 | 2320-0030 | 4,3,3.5 | 3.5 | 6,5.5,5.5 | 5.7 | 6,5,6 | 5.7 | 3.5,3,3.5 | 3.3 | 2,2.5,2.5 | 2.3 | 3 |
| 6 | 0.973 | 01/15-16/73 | 2330,0015 | 5.5,6.5 | 6.0 | 5,5.5 | 5.25 | 5.5,6 | 5.75 | 4.5,5.5 | 5.0 | 2,2 | 2.0 | 51 |
| 7 | 0.009 | 01/16-17/73 | 2325,0100 | 5.5.5 | 5.25 | 5,5.5 | 5.25 | 6,6 | 6.0 | 6,6 | 6.0 | 3,3 | 3.0 | 63 |
| 8 | 0.045 | 01/18/73 | 0010,0200 | 5.5,5.5 | 5.5 | 6,6 | 6.0 | 6,6 | 6.0 | 7,7 | 7.0 | 2.5,2.5 | 2.5 | 76 |
| 9 | 0.196 | 01/22/73 | 0325,0350 | 3.5,3.5 | 3.5 | 4.4.5 | 4.25 | 4,4 | 4.0 | 8,8.5 | 8.25 | 3,3 | 3.0 | 126 |
| 10 | 0.874 | 02/10/73 | 0000-0215 | 5,4,4 | 4.3 | 5.5,6,5.5 | 5.7 | 6,5,5 | 5.3 | 4.5,4.5,4 | 4.3 | 3,3,5,3,5 | 3.3 | 355 |
| 11 | 0.982 | 02/12-13/73 | * 0030-2355* | 4,6,6,6,5,5 | 5.5 | 6.5,6.5,6.5,6 | 5,6.5 |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  | 6.5 | 4,6.5,6.5,5,6 | 5.6 | 4,6,5,5,6,6 | 5.5 | 3,3.5,3.5,3,3 | 3.2 | 32 |
| 12 | 0.185 | 02/18/73 | 0130-0215 | 6,5.5 | 5.75 | 5.5,5.5 | 5.5 | 6,6 | 6.0 | 7.7 | 7.0 | 2.5,2.5 | 2.5 | 93 |
| 13 | 0.226 | 02/19/73 | 0115,0150 | 6,5,5 | 5.75 | 5.5,5.5 | 5.5 | 6,6 | 6.0 | 7.5.7.5 | 7.5 | 2.5,2 | 2.25 | 105 |
| 14 | 0.266 | 02/20/83 | 0255,0340 | 6,5 | 5.5 | 4:,5.5 | 4.75: | 3.5: 5.5 | 4.5:8 | 5,8.5 | 8.5 | 2.5,2.5 | 2.5 | 118 |
| 15 | 0.988 | 03/9-10/73 | 2350,0035 | 5.5,5.5 | 5.5 | 5,5 | 5.0 | 7,7 | 7.0 | 5.5,5.5 | 5.5 | 3.5,3.5 | 3.5 | 336 |
| 16 | 0.138 | 03/13-14/73 | 2345,0150 | 6,6 | 6.0 | 6.5,6.5 | 6.5 | 6,6 | 6.0 | 4.5,4.5 | 4.5 | 3,3 | 3.0 | 25 |
| 17 | 0.135 | 04/9-10/73 | 2350-0125 | 3.5,3,3 | 3.4 | 6,6,6 | 6.0 | 4,3,3.5 | 3.5 | 5,4,4 | 4.3 | 3,2.5,2.5 | 2.7 | 354 |
| 18 | 0.313 | 04/14-15/73 | 2330,0005 | 7.5.7.5 | 7.5 | 8.8 | 8.0 | 7.5,7.5 | 7.5 | 8,8 | 8.0 | 2.5,2.5 | 2.5 | 55 |
| 19 | 0.261 | 06/09/73 | 0030,0100 | 4,5 | 4.5 | 6,6.5 | 6.25 | 5,5.5 | 5.25 | 4.5,4 | 4.25 | 3.5,3.5 | 3.5 | 6.5 |
| 20 | 0.444 | 06/14/73 | 0335,0400 | 6,6 | 6.0 | 6,6 | 6.0 | 6,6 | 6.0 | 6.5,6.5 | 6.5 | 3,3 | 3.0 | 69 |
| 21 | 0.212 | 07/06/73 | 0100-0200 | 2,2,2 | 2.0 | 6.5,6.5,6.5 | 6.5 | 2.5,2.5,2.5 | 2.5 | 5.5,5.5,5.5 | 5.5 | 2.5,2.5,2.5 | 2.5 | 337 |
| 22 | 0.251 | 07/07/73 | 0110,0230 | 4,4 | 4.0 | 6,6 | 6.0 | 4,4 | 4.0 | 4.5,4.5 | 4.5 | 4.5,4.5 | 4.5 | 350 |
| 23 | 0.283 | 07/08/73 | 0030-0100 | 4.5,4 | 4.25 | 5.5:,6.5 | 6.0 : | 4,4 | 4.0 | 4.5,4 | 4.25 | 3,3.5 | 3.25 | 1 |
| 24 | 0.322 | 07/09/73 | 0100-0220 | 4,4,4 | 4.0 | 5.5,6,6 | 5.8 | 4,4,4 | 4.0 | $3.5,3.5,3.5$ | 3.5 | 3,3,3 | 3.0 | 14 |
| 25 | 0.459 | 07/13/73† | 0040,0110 | 6.5,6.5 | 6.5 | 6,6 | 6.0 | 6.5,6.5 | 6.5 | 6.5,6.5 | 6.5 | 3,3 | 3.0 | 62 |
| 26 | 0.498 | 07/14/73 | 0215,0250 | 6.5.6.5 | 6.5 | 6,6 | 6.0 | 6.5,6.5 | 6.5 | 7.7 | 7.0 | 2.5,2.5 | 2.5 | 75 |
| 27 | 0.534 | 07/15/73 | 0120,0150 | 6,6 | 6.0 | 5.5,5.5 | 5.5 | 6,6 | 6.0 | 6.5.6.5 | 6.5 | 2.5,2.5 | 2.5 | 86 |
| 28 | 0.608 | 07/17/73 | 0420-0515 | 5.5,5,6 | 5.5 | 4,5,5 | 4.7 | 5,5.5,5.5 | 5.3 | 7,7,7 | 7.0 | 3,3,3 | 3.0 | 113 |
| 29 | 0.675 | 07/19/73 | 0245,0315 | 6,6 | 6.0 | 5,5 | 5.0 | 5.5,5.5 | 5.5 | 8,8 | 8.0 | 2.5,2.5 | 2.5 | 136 |
| 30 | 0.275 | 08/05/73 | 0000-0030 | 3,3,3 | 3.0 | 6.5,6.5,6.5 | 6.5 | 3,3,3 | 3.0 | 3.5,3.5,3.5 | 3.5 | 2.5,2.5,2.5 | 2.5 | 343 |
| 31 | 0.311 | 08/06/73 | 0030-0725 | 4,4,4 | 4.0 | 6,6,6 | 6.0 | 5,5,5 | 5.0 | 4.5,4.5,4.5 | 4.5 | 3,3,3 | 3.0 | 355 |
| 32 | 0.346 | 08/07/73 | 0020-0115 | 4.5,4,5,4.5 | 4.5 | 6.5,6.5,6.5 | 6.5 | 4.5,4.5,4.5 | 4.5 | 5,5,5 | 5.0 | 2.5,2.5,2.5 | 2.5 | 8 |
| 33 | 0.386 | 08/08/73 | 0145,0240 | 5,5 | 5.0 | 6,6 | 6.0 | 5,5 | 5.0 | 5,5 | 5.0 | 4,4 | 4.0 | 21 |
| 34 | 0.636 | 08/15/73 | 0200,0370 | 6,6 | 6.0 | 5.5,5.5 | 5.5 | 6,6 | 6.0 | 7,7 | 7.0 | 2,2 | 2.0 | 106 |
| 35 | 0.707 | 08/17/73 | 0130-0230 | 6,6,6 | 6.0 | 5,5,5 | 5.0 | 4. 5,4.5,4.5 | 4.5 | 7,7.7 | 7.0 | 3.5,3.5,3.5 | 3.5 | 130 |
| 36 | 0.743 | 08/18/73 | 0230-0330 | 6.5 | 6.5 | 6 | 6.0 | 6.5 | 6.5 | 8.5 | 8.5 | 2.5 | 2.5 | 143 |

[^0]phenomenon in this feature, and, in fact, in another of his features (Godin). Thus he has seen two phenomena (possibly more) in 40 nights of observing, which represent 86 separate times and 430 point observations (of which 35 were involved in the phenomena)! I conclude that, based on his experience, one can expect to see a recognizable phenomenon with a frequency of less than once in 10 times of observing.

Table 3 lists all the observations for Dawes reported through August 31, 1973, with auxiliary data from which analyses were made. Table 4 is the albedo chart for this feature. One can see from Table 4 that only 2 days are lacking measures for the whole lunar age cycle when the feature is sunlit. The sunrise and sunset lines are averages for these ages since they can shift by $11 / 2$ days either way, depending on the shape of the lumar orbit which changes its ellipticity in a 14 -month cycle. (See Figure 1.) Note the LTP observations compared with estimates for other dates at age 9 days in Table 4. (There are three nights of observations for this age.) For the LTP estimates (five for each point) the first estimate was four (for point A), the next a few minutes later was six, and following estimates remained higher. Similarly for points $C$ and $D$ the first estimate was low, and the later ones were higher. Note also that point $B$ and point $E$ (the nearby plain comparison point) did not change. Note also that the measures for other dates are the higher ones, except for point $D$. This relation is the basis for my suspicion that the observer actually saw the end of a dimming phenomenon and the return to normal.


I have analyzed the observations for several hypotheses similar to my previous analyses in several papers (W. Cameron and Gilheany, 1967; W. Cameron, 1967; W. Cameron, 1971; and W. Cameron, 1972). Figure 2 shows two panels, the panel on the right giving the anomalistic phase histograms (tidal effect hypothesis) for Dawes (Porter's observations) for all observations (mostly normal) received through August, 1973 which contained albedo measures ( 75 nights), and for the LTP phenomena. The other panel on the left shows histograms of the same observations with respect to the Moon's age.

The first explanation to be discussed is the tidal hypothesis. For the tidal hypothesis (anomalistic phase $\left.\emptyset_{d}\right) \theta_{d}=P_{2}-P_{1}$ ( $P_{2}=$ following perigee date, $P_{1}=$ preceding perigee date, thus surrounding the date of observation, and $P=P_{2}-P_{1}$ in days). Perigee and apogee are indicated by vertical lines labeled $P$ and $A$. Examining the anomalistic phase histograms, one notes that there are two peaks for the normal aspects reports and for Dawes -- the higher one at $\theta_{d}=0.3$ and the other at $\theta_{d}=0.0(1.0)$, i.e., perigee. The first three points are repeated at the right edge, labeled REPEAT. If observations were at random, the bars would all be equal in height (indicated by the horizontal line labeled RANDOM); therefore, the observations were not random with respect to the anomalistic period. The positive (LTP) reports histogram has three peaks and therefore has no correlation with the tidal hypothesis. Little reliance can be placed on these results since in all cases we are dealing with small samples, especially for the positive LTP reports. The number of nights of observation are 75 for the negative, 36 for Dawes (Table 3), and 13 for LTP (Table 2). In Table 2 the columns are mostly self-explanatory (see footnotes). Column 9 is "days from Full Moon," minus indicating before, and plus after, Full Moon. Column 13 contains solar data giving maximum $K_{p}$ index ( $K_{p m a x}$ ) for that day, the sum of $K_{p}$
for that day ( $\left(\Sigma K_{p}\right)$, and indication of a magnetic storm where S.C. $=$ sudden commencement and M.S. $=$ magnetic storm. The last column (Seeing) gives smallest diffraction disk diameter (Sm) in terms of fractions of field of view, largest disk diameter (Lg) and interval in seconds for expansion, amount of excursion (Fr) of image in fractions of FOV, and interval between excursions in seconds. It also rates the seeing ( $S$ ) on a numerical scale and transparency ( T ) in limiting stellar magnitudes visible. In Figure 1 the relationship of the observations with the shape variations of the orbit is shown where, in Green's hypothesis (1965), maximum degassing (LTP) would occur at eccentric apogees (Apr. to June and Oct. to Dec., 1972, and May to July, 1973) and minimum degassing (few or no LTP) at minimally eccentric perigees (Aug. to Sept., 1973). We get one observation at the right apogee time but also one at the wrong perigee time, and all the rest fall at the in-between times with no tidal correlation.

The age panel (Figure 2) has vertical lines indicating the approximate ages at which the Moon enters and exits the bow-shock front (BSF) and magnetopause (MP) of the Earth's magnetic tail and the approximate sunrise and sunset ages for Dawes. Two variations of the second hypothesis (Speiser, 1965, 1967; A. Cameron, 1964) suggest energetic effects of the magnetic tail on solar particles which are focused on the Moon and excite surface materials or escaped gases. Low-angle illumination effects would be expected near sunrise and sunset. The one LTP in Dawes has no sunrise or magnetic tail correlation. It does have perigee and solar particles correlations. There are several peaks for the LTP group, one of which occurs within the magnetopause, indicating a possible correlation with magnetic tail effects. The fourth hypothesis considered is the direct influence of solar particles (Kopal, 1966) as correlated with simultaneous (or nearly simultaneous) terrestrial magnetic storms (when energetic solar particles are bombarding both the Earth and Moon nearly simultaneously). In this respect, the Dawes LTP occurred not only at perigee, but also when energetic solar flare particles were striking the Moon and Earth, since a magnetic storm was in progress on the Earth. Since only Dawes and Calippus, 22 hours later, were reported as anomalies (although the whole Moon was not being monitored), surface characteristics at these places must be studied to determine, if there truly is a solar particles effect, why some places respond to particles and other do not. There are, however, correlations of LTP in general (W. Cameron, 1972) with the Earth's magnetic tail, and for historic Proclus data with direct solar particles, which are still maintained in the recent data (see Table 5).

If LTP actually occurred randomly, one could estimate what percentage of observations would be expected to occur within arbitrarily prescribed limits for each of the competing hypotheses. Under the tidal hypothesis, for example, if the observations were considered in increments of one-tenth of an anomalistic period (perigee to perigee), then observations falling within one-tenth of a period of perigee would constitute a correlation. on this basis, plus or minus one-tenth of a period equals 20 percent. One would expect then, if they occurred at random, that 20 percent of the observations would occur $\leq \pm 0.1 \mathrm{P}$, with the same proportion for apogee. Thus 40 percent of observations should fall $\leq 0.1 \mathrm{P}$ and A . Similarly, sunrise and sunset correlations may be considered to be observations occurring with in 1 day ( $12^{\circ}$ ) of sunrise and sunset. This is equivalent to 1 day in 25.5 days (considered to be a lunation period since the Moon is seldom observed at ages $\leq 2^{d}$ or $\geq 27 \mathrm{~d} .5$ ) for sunrise or $\sim$ four percent of the time (and another four percent for sünset); ōr if 2 days are considered the limit, then eight percent for sunrise and eight percent for sunset. For magnetic tail effects it might be $\leq \pm 1 \mathrm{~d}$ of BSF entrance $=\frac{2}{25 \cdot 5}=\simeq$ eight
percent. In Table 5 all percents are to the nearest whole percent, and all numbers for Number Expected (No. Exp.) are given to the nearest whole number. On these bases Table 5 gives the observed and expected percents for the various hypotheses so that all hypotheses can be compared together. Since the columns for All Negative and for Dawes are for normal aspects of features (with one exception for Dawes), the figures for observed versus those for expected will indicate just how near to random the observations were (summarized in the column $\frac{0}{E}$ which is the ratio of the observed to the expected in percent). Thus the majority of negative observations were almost at random with respect to the tidal hypothesis(anomalistic period) -- slightly deficient near apogee. The observations of Dawes, however, were almost twice as frequent (over randomness) for times very near perigee, and half as frequent (as they would be if random) during the anomalistic period between 0.4 and 0.6 (near apogee). The one Dawes LTP came very near perigee ( $\varphi_{d}=0.98$ ). The LTP column is the column of greatest interest although the sample number (13) is too small to give significant results. One and one-half times as many were observed as would be expected if they occurred randomly for phases very close to perigee and apogee ( $\leq \pm 0.05 \mathrm{P}$ or A ), but the LTP's fell to randomness when the limits were expanded ( $\leq \pm 0.1 \overline{\mathrm{~F}}$ or A ). (See column $\frac{0}{E}$, i.e., if phenomena occurred near perigee or apogee, they occurred very near one or the E other.)

Table 4. Dawes Albedo Chart

| A. Porter <br> Narragansett, R. I. <br> 6L, $\left\{\begin{array}{l}100 \mathrm{X} \\ 193 \mathrm{X}\end{array}\right.$ |  |  | $\underset{\mathrm{E}}{\mathrm{X}} \underset{\mathrm{D}}{\mathrm{D}} \stackrel{\mathrm{O}}{\mathrm{C}} \mathrm{~B}_{\mathrm{A}}^{\mathrm{S}}$ |  | $\begin{aligned} \text { Sunrise Colong, } & =334^{\circ} \cong 5^{\mathrm{d}} \\ \text { Sunset Colong. } & =154^{\circ} \cong 21^{\mathrm{d}} \end{aligned}$ |
| :---: | :---: | :---: | :---: | :---: | :---: |
| AGE | POINT A | POINT B | POINT C | POINT D | (NEARBY <br> POINT E PLAIN |
| ${ }^{\text {d }}$-0.9 $9^{\text {d }}$ |  |  |  |  |  |
| 1.0-1.9 |  |  | DARKSIDE |  |  |
| 2.0-2.9 DARKSIDE |  |  |  |  |  |
| $3.0-3.9$ |  |  |  |  |  |
| 4.0-4.9 |  |  | SUNRISE |  |  |
| 5.0-5.9$6.0-6.9$ | 5,4,5; 2,2,2; 5.5,5.5 | 6.5,6; 6.5,6.5,6.5; 5,5 | 3.4,4; 2.5,2.5,2.5; 7,7; | 4.5,4.5; 5.5,5.5,5.5,5.5,5.5; | 2.5,2.5; 2.5,2.5,2.5; 3.5,3.5; |
|  | 2.5,2; 3.5,3,3; 3,3,3; | 4.5,5; 6,6,6; 5.5,6,5.5; | 5,4.5; 4,3,3.5; 6,5,5; | 2.5,3; 5,4,4; 4.5, | 2.5, 2. 5; 3,2.5,2.5; 3, 3.5,3.5; |
|  | 5,4,4; 4,4; | 6,6; 6.5,6.5,6.5; | 4,4; 3,3,3; | $4.5,4 ; 4.5,4.5 ; 3.5$ | 2.5,2.5,2.5; 4.5,4.5; |
| 7.0-7.9 | $\begin{aligned} & 4,3,3.5 ; 4,4,4 ; 4,5 ; \\ & 4.5,4 ; 6,6,6 ; \end{aligned}$ | $\begin{aligned} & 6,5.5,5.5 ; 5,5,5 ; 6,6.5 \text {; } \\ & 5.5: 6.5 ; \end{aligned}$ | $\begin{aligned} & 6,5,6 ; 4.5,4.5,4.5 ; 5,5.5 ; \\ & 4,4 ; 3,3,3 ; \end{aligned}$ | 3.5,3,3.5; 4.5,4; 4.5,4; | 2,2.5,2.5; 3.5,3.5; 3,3.5; |
| 8.0-8.9 | 4,4,4; 4.5,4.5,4.5; | 5.5,6,6; 6.5,6.5,6.5; | 4,4,4; 4.5,4.5,4.5; | 3.5,3.5,3.5; 5,5,5; | 3,3,3; 2.5,2.5,2.5; |
| 9.0-9.9 | 4,6,6,6,5.5*; 6,6; 5,5; | $\begin{aligned} & 6.5,6.5,6.5,6.5,6.5^{*} \\ & 6.5,6.5 ; 6,6 \end{aligned}$ | 4,6.5,6.5,5,6*; 6,6; 5,5; | $\begin{aligned} & 4,6,5.5,6,6^{*} ; 4.5,4.5 \\ & 5,5 ; \end{aligned}$ | 3,3.5,3.5,3,3*; 3, 3; 4.4; |
| 10.0-10.9 |  |  |  |  |  |
| 11.0-11.9 | 5.5,6.5; 7.5,7.5; | 5,5.5; 8,8; | 5.5,6; 7.5,7.5; | 4.5,5.5; 8.8; | 2,2;2.5,2.5; |
| 12.0-12.9 | 5.5,5; 6.5,6.5; | 5,5.5; 6,6; | 6,6; 6.5,6.5; | 6,6; 6.5,6.5; | 3,3; 3, ${ }^{\text {; }}$ |
| 13.0-13.9 | 5.5,5.5; 6,6; 6.5,6.5; | 6,6; 6,6; 6,6; | 6,6; 6,6; 6.5,6.5; | 7,7; 6.5,6.5; 7,7; | 2.5,2.5; 3,3; 2.5,2.5; |
| 14.0-14.9 | 6,5.5; 6.5,6.5,6.5; 6,6; | 5.5,5.5; 6,6,6; 5.5,5.5; | 6.6; 6.5,6.5,6.5; 6,6; | $\begin{aligned} & 7,7 ; 7.5,7.5,7.5 ; 6.5, \\ & 6.5 ; \end{aligned}$ | 2.5,2.5; 3,3,3; 2.5,2.5; |
| 15.0-15.9 | 8,8,8,8,8; 6,5.5; | 3,4,4,4,4.5; 5.5,5.5; | 3,3,3,3,3; 6,6; | 4,4,4,4.5,4.5; 7.5,7.5; | 3,3,4,2.5,3,2.5,2; |
| 16.0-16.9 | 6,5; 6,6; 5.5,5,6; | 4:,5.5; 4,5,5; 5.5,5.5; | 3.5:, 5.5; 5,5.5,5.5; 6,6; | 8.5,8.5; 7,7,7; 7,7; | 2.5,2.5; 3, 3, 3; 2, 2; |
| 17.0-17.9 | 3.5,3.5; | 4,4.5; | 4,4; | 8,8.5; | 3,3; |
| 18.0-18.9 | 6,6; 6,6,6; | 5,5; 5,5,5; | 5.5,5.5; 4.5,4.5,4.5; | 8,8; 7,7,7; | 2.5,2.5; 3.5,3.5,3.5; |
|  |  |  |  |  |  |
|  |  |  |  |  |  |
| 21.0-21.9 SUNSET |  |  |  |  |  |
| 22.0-22.9 |  |  |  |  |  |
| 23.0-23.9 |  |  |  |  |  |
| 24.0-24.9 |  |  |  |  |  |
|  |  |  |  |  |  |
| 26.0-26.9 DARKSIDE |  |  |  |  |  |
| 27.0-27.9 |  |  |  |  |  |
| 28.0-28.9 |  |  |  |  |  |
| 29.0-29.5 |  |  |  |  |  |
| :uncertain measures ;Separation of measures of different night |  |  |  |  |  |
| *LTP Repor | ed (for points A, C, D) | ,Separation of i | ndividual measures in one ni | ght |  |

For low-angle illumination (or sunrise) effects the observed quantities cannot
easily be determined since these represent nights when several features were observed.
Each feature's results were not assessed for this table. (The number of observations would be about 200 instead of 75 .) Therefore, the observed columns have been designated as not applicable (N/A). For Dawes we can see that the bias toward waxing phases is still present -- where 3.5 times as many observations were made near sunrise on Dawes as wouns nd five times as many were observed near sunrise as at sunset. One of the objectives of re some professional observations of glows occurring near sunset (Anon., 1973). In my analyses of $>800$ reports (W. Cameron, 1972), the histograms showed a slight peak near
sunset, but the number of observations was only about $10!$ I would like to see if there




Figure 1. Reported LTP observations plotted on the anomalistic orbit of the Moon to show tidal relationship with respect to Green's hypothesis (1965). See
early morning observations -- a difficult time for people who have other vocations - a practically universal condition. Nevertheless, I make the plea that all observers make an effort to get observations for ages later than 22 days occasionally. Observers sometimes may be compensated by observing phenomena at those times.

For the magnetic tail hypotheses we see that for All Negative the number observed were at random since the $\frac{0}{E}$ ratio is near unity, with a similar result for solar flare effect. In the case of Dawes, there was a definite positive bias in the observations for near Full Moon (MP) and a negative bias for near the bow-shock front (BSF). The number of on magnetic storms arefects is smaller because there was not the auxiliary information tics have even less meaning. They indica and August, 1973 observations. Thus the statisexpected on a random basis.

If we look at the small sample of LTP observations, we find that almost six times as many phenomena were seen near sunrise as would be expected $\left(\frac{0}{E}=5.75\right)$ and twice as


Figure 2. Histograms of the Normal Aspects, Dawes, and LTP Observations with respect to the Moon's Age (left panel) and the phase of the anomalistic period (right panel). Vertical lines indicate approximate locations of the boundaries of the bow shock front (BSF), magnetopause (MP) of the Earth's magnetic tail, perigee ( $P$ ), and apogee ( $A$ ). Phases are indicated symbolically at the bottom. The horizontal lines marked RANDOM indicate the number of observations per unit if the observations were distributed at random. See also text.
many near sunset. A slight excess was observed when the Moon was within the magnetopause (MP) of the Earth's magnetic tail, but there was a deficiency with respect to the BSF. The surprising statistic is the number of lunar events which occurred on the same day that a terrestrial magnetic storm occurred (signaling the arrival of energetic particles bombarding the surfaces of both planets). Almost seven times as many events were observed as would be expected on a random basis. This is the largest ratio; hence it was circled as showing the greatest effect among the hypotheses. When percentage of observations is considered, we find that 46 percent of all LTP occurred near sunrise or sunset, and 45 percent occurred when a lunar event occurred within 1 day of a terrestrial magnetic storm (arrival of particles in the Earth-Moon system). This limit of 1 day means that the arrival of particles at the Moon was up to 1 day sooner or one day later than at the Earth. This limit is probably too generous since the arrival times ought to be nearly simultaneous, or at most, separated by a few hours. Note, however, that only 15 percent (about 1/7) occurred near either perigee or apogee -- which is far from the majority of cases, or even all of them, occurring at those times which are frequently quoted in the literature and usually without actual statistics. In contrast to the 15 percent near perigee or apogee ( 31 percent for both tidal effects), 23 percent (about $1 / 4$ ) occurred within 1 day of sunrise, 31 percent within 1 day of sunrise or sunset combined (same percentages as the tidal effects), and 23 percent ( $1 / 4$ ) occurred while the Moon was in the magnetopause. The largest individual percentage ( 27 percent or $>1 / 4$ ) occurred on the same day that a magnetic

Table 5. Comparisons of Observations with Hypotheses

ALL NEGATIVE DAWES LTP

$\star 1$ of the 6 was a LTP, thus $\frac{1}{36}=3 \%$
$.05 P=1.4$ days

$$
\begin{aligned}
1 \mathrm{AP} & =2.8 \text { days } \\
P & =77.0 \text { den }
\end{aligned}
$$

storm occurred on Earth. These statistics imply stronger cases for the other hypotheses than for the tidal one. Note also that the LTP tidal histogram is really random, showing no correlations since it has three peaks, one of which extends over 0.3 of a period.

Let us now examine the observations for albedo behavior. Mr. Vaucher (1973) reported on observations of Alphonsus and showed curves of albedos vs colongitude in $10^{\circ}$ increments for several points in Alphonsus. He noted that there were peaks for bright areas and valleys for dark areas in the albedo curves generally near certain colongitudes, viz, $60^{\circ}$, $100^{\circ}$, and $140^{\circ}$. In Figure 3 the albedo histograms are given for several points in three features: Dawes, Proclus, and Alphonsus. The Dawes observations are from the ALPO-LTP program from observer Alain Porter, Narragansett, Rhode Island, with a 6-inch reflector at about 100 magnification. The Proclus observations (covering about 20 years) are from a private communication from James Bartlett, Baltimore, Maryland, who used a 3 -inch refractor, a 4 -inch refractor, a 4 -inch reflector, and a 5 -inch reflector at various powers from 50 to 300X. The Alphonsus integrated light observations are taken from Vaucher (1973) and are represented as histograms instead of curves. Histograms are appropriate because the albedos have been averaged in increments of 10 degrees of colongitude. Besides the various individual points plotted, we can choose some points between each feature which


Figure 3. Albedo histograms of observations with respect to colongitude for specific points within Dawes, Proclus, and Alphonsus for comparison. Approximate locations of the bow shock front, magnetopause of the Earth's magnetic tail, sunrise and sunset for each feature and the phases of the Moon are indicated.
might be considered more comparable. For example, the floor of Proclus may be compared with the plain near Dawes and the dark spot on the floor of A1phonsus. To a first approximation, the three areas show similar behavior. The nearby plain at Dawes, however, behaves more similarly to the dark patch on the west central floor of Alphonsus than to the floor of Proclus. Comparisons can only be made over $130^{\circ}$ of colongitude (from $4^{\circ}$ to $134^{\circ}$ ). Sunrise and sunset for each feature, the phases, and the magnetic tail features (magnetopauses (MP) and bowshock front (BSF)) are indicated on Figure 3. At $60^{\circ}$ both Proclus and Alphonsus have drops in albedo, but Mare Tranquillitatis (just east (IAU) of Dawes) rises at $100^{\circ}$. Proclus and Alphonsus rise, but Mare Tranquillitatis is down. At $140^{\circ}$ both Alphonsus and Mare Tranquillitatis are down, but Alphonsus rises and stays elevated till sunset. The Alphonsus floor is brighter near Full Moon (in the magnetopause) while M. Tranquillitatis and the floor of Proclus are darker, though Proclus rises in albedo as the Moon is passing out of the magnetopause. The bow-shock front depresses the albedo. Averaging all the albedo measures for each feature (indicated by horizontal line marked AV), we obtain 2.8 for Mare Tranquillitatis, 2.5 for the Proclus floor, and 3.8 for the Alphonsus floor (dark patch). The apparent anomalous albedo behavior of Mare Tranquillitatis between $60^{\circ}$ and $70^{\circ}$ colongitude is real; for there are three nights with six individual measures in the average, and all were estimated at 3.0. It occurs at the time when the Moon enters the magnetopause of the Earth's magnetic tail. From the measures submitted I suspect a possible LTP (albedo anomaly) in Mare Tranquillitatis at $350^{\circ}$ colongitude. The observer did not report it as anomalous, even though on the previous night he estimated the area at 2.5 and on the night after at 3.0 and 3.5 for an average of 3.25; on this night (July 17, 1973) he twice estimated it at 4.5, which is the highest albedo recorded for it on all 36 nights. On one other night (August 7, 1973) it was estimated twice at 4.0 at colongitude $21^{\circ}$. The suspicion of a real brightening (almost two whole albedo steps) is fairly wellfounded since there are five nights of observations (with 13 individual measures) so that the average of 2.9 (without the anomalies) from four nights and 11 individual measures can be accepted with some confidence. This point is one of the darkest parts of the Moon, being in that dark border between Mare Tranquillitatis and Mare Serenitatis. Comparing the bright areas of the three features, viz, the west wall point (B) of Dawes, a bright peak near the west wall of Alphonsus, and the central peak of Proclus (Figure 3), again, to a first approximation, all three areas behave similarly. In general, their behavior is almost opposite to that of the dark areas. Note also the mirror behavior between points $A$ and $C$ in the Dawes histograms (see sketch on Table 4 for locations of points in Dawes). Until Full Moon the central peak of Proclus and the west wall peak in Alphonsus behave similarly, and in the phases after Full Moon the west wall of Dawes and the central peak of Proclus behave similarly. There is a smaller variation in the

Proclus central peak than in the other two features. Near colongitude $60^{\circ}$ Proclus and Alphonsus peaks are up, and the Dawes peak is down. At or near $100^{\circ}$ Alphonsus is up, but the other two are down, while at $140^{\circ}$ both Dawes and Alphonsus are up considerably. Kepler (Delano, 1972) also confirms this $140^{\circ}$ peak, somewhat less so for the peak at $60^{\circ}$; but it has a valley at $100^{\circ}$ (converting Delano's days to colongitude values). Thus the results for the other two comparable features supply both confirmation and contradiction for the results reported for Alphonsus. There are enough measures now that I can make similar analyses for a few other features. That will be done in a future report. The results indicate variations in behavior of the lunar surface in different regions of the Moon.

During the December 7-19, 1972, time period the last Apollo mission took place. I asked all observers to maintain a watch for a 2 -week period surrounding the time when the astronauts would be in the vicinity of the Moon. The period was to be December 7 through December 21, and the observers were to observe on every night that the weather would permit. Unfortunately, the weather was uncommonly poor throughout the country. The majority of people who sent in reports reported that they were clouded out for the mission. Of the 25 observers in the program at the time, only five were able to observe. Of these five, one, Mrs. Jean of Montreal, Canada, using a 4 -inch refractor at $250 x$, reported two anomalies. On December 11 she noted reddish color at Alfraganus (a non-LTP site) and on December 14 reddish and yellow colors at Proclus (see Table 3). These colors might have been caused by chromatic aberration, a defect of refractors which requires great care to eliminate as a cause of false colors on the Moon. I am uncertain whether Mrs. Jean exercised the necessary precautions. Her assigned features are North Mare Crisium, Maskelyne, Ptolemaeus, and Copernicus. The albedo measures I wanted my observers to make were not reported by her, and she observed many other features besides her assignments but did not make the albedo or seeing estimates. Similarly, I have received reports from other foreign observers about features other than those assigned to them, with no numerical albedo or seeing estimates. I present in Table 6 a sample monthly reporting form for non-LTP (normal aspect) reports. This form indicates the information I would like to receive monthly for the six assigned features (four LTP, one non-LTP comparison feature, and one seismic zone). I can supply these forms to observers upon request.

In summary, the LTP program has been operating for about 15 months at the time of this writing. Although more than 30 observers expressed interest in joining the program and were assigned features (thus all 100 or so LTP features have been assigned), only about a half dozen people have sent in observations more or less regularly. In some cases, those who did send in reports did so on features other than those assigned to them, or in addition to their assignments. Out of 117 nights of observations, there were 13 on which phenomena were reported. Eight of these nights were reports of LTP only, and five were coincident with nights when other features had normal aspects. None of the LTP dates and times overlap, although two occurred within 22 hours of each other. On another date, one LTP and a peculiar phenomenon (listed at the bottom of Table 3) occurred within a 14 -hour interval. In the albedo measures reported, there are several cases of suspected anomalies, judging from other albedos reported for the same lunar age or for ages within 1 day of the same age. It is too early yet to confirm these suspicions. It points up the need for several independent measures for each day of lunar age. It is doubtful whether there are any real correlations with any of the hypotheses, al though the number of observations of phenomena are too few for significant statistics or conclusions to be drawn. From the few observers who have more or less regularly sent in obervations, it has been demonstrated that a catalog or scale of albedos can be set up for each feature from which other observers can then observe the feature, estimate the albedo, and determine whether the feature is normal or unusual at that time. Eventually, perhaps, the visual estimates scale can be tied into some of the professional photometric scales or albedos, extending the latter. This would be a contribution to the astronomical profession.

Comparison of albedos of Dawes and Proclus from this program with those of Alphonsus from Vaucher's Selected Areas Program (SAP) program revealed confirmation of some intensity peaks found by Vaucher but not others. These results indicate that the different regions of the Moon respond to radiation with varied characteristics.

## Acknowledgements

I thank all the observers who have sent in observations, especially those who have reported the information sought in the program. I thank Mr. Bartiett for suppiying unpublished observations of Proclus from which albedo and LTP comparisons were made for this report.

Table 6. Sample Yonthly Reporting Form for Non-LTP Reports ,
Date:

| Observer: |
| :--- |
| Location: |
| Telescope |
| (kind, aperture, power): |
| Feature: |


| Point/Time | U.T | U.T. | U.T. |  |
| :---: | :---: | :---: | :---: | :---: |
| A |  |  |  |  |
| B |  |  |  |  |
| C |  |  |  |  |
| D |  |  |  |  |
| E |  |  |  |  |
| Nearby Plain |  |  |  |  |

Diffraction disk fraction (largest): Time interval between blow-ups:
Diffraction disk fraction (smallest: Tine interval between excursions:
Excursion fraction:
Terminator features:
Field of view (FOV) features:
Altitude of moon:

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## THE 1968-69 EASTERN (EVENING) APPARITION OF VENUS

By: Julius L. Benton, Jr., A.L.P.O. Venus Recorder

## Introduction

The 1968-69 evening apparition of the planet venus included the period from 1968, June 20 (superior conjunction) to 1969, April 8 (inferior conjunction). The planet reached the point of greatest eastern elongation ( $47^{\circ}$ ) on 1969 , January 26 , at which time Venus exhibited an apparent visual magnitude of -4.0. Greatest brilliancy was attained on 1969, March 3, the planet having a visual magnitude of -4.3 on that date and a disc that was nearly $30 \%$ illuminated.

The following fourteen individuals contributed observational reports to the Venus Section during the 1968-69 apparition:
Observer and Location Number of Observations Basic Instrumentation

1. Anderson, Carl A. Manchester, New Hampshire 5

5
2. Blandford, Michael Dayton, Ohio 4
3. Cross, Eugene W. Las Cruces, New Mexico19
4. Delano, Kenneth J. Taunton, Massachusetts 15
5. Gordon, Rodger W. Barrington, New Jersey 1
6. Heath, Alan $N$. Nottingham, England
7. Krisciunas, Kevin Naperville, Illinois
8. Lazor, Fred Victoria, Texas
9. McClowry, Richard Sarver, Pennsylvania
10. Mayer, Ernst

Barberton, Ohio
11. Senour, Martin Cleveland, Ohio
$10^{13}(25 \mathrm{~cm})$ reflector

6" ( 15 cm ) reflector
$6^{11}(15 \mathrm{~cm})$ refractor
$2.4^{\prime \prime}(6 \mathrm{~cm})$ refractor
12 " ( 30 cm ) reflector
$12.5^{\prime \prime}(31 \mathrm{~cm})$ reflector
$3.5^{\prime \prime}(9 \mathrm{~cm})$ reflector

12" ( 30 cm ) reflector
$6^{\prime \prime}(15 \mathrm{~cm})$ reflector

9" (23 cm) refractor
$6^{\prime \prime}(15 \mathrm{~cm})$ refractor
$6^{\prime \prime}(15 \mathrm{~cm})$ reflector
$6^{\prime \prime}(15 \mathrm{~cm})$ reflector
12. Simmons, Karl

Jacksonville, Florida 4
13. Stover, Gary

Charleston, West Virginia
14. Thiede, Eric

Madison, Wisconsin
A total of 119 observations were received from the persons 1 isted above, and some attention should be given to the following distribution of submitted reports by month:

| 1968 June | 0 | October | 0 | February | 33 |
| :---: | :---: | :--- | :---: | :--- | :--- |
| July | 0 | November | 1 | March | 38 |
| August | 3 |  | December | 0 | April |
| September | 2 | 1969 | January | 18 |  |
|  |  |  |  |  | Total | 119

As can be seen, most of the observational data was obtained during the latter part of the 1968-69 apparition, from January to early April. Only a small number of the observations were used in the present analys is because of a tremendous lack of continuity of technique among participating individuals. This should obviously be an invitation for those not trained in the methods of making planetary observations to enroll in the very effective Lunar and Planetary Training Program of the ALPO. It should be noted here that the numerical values under the column headed, "Number of Observations", represent actual observations, not observing dates. One will see immediately that very early portions of the apparition were totally neglected, a most unfortunate situation indeed. The Recorder would like to urge all individuals who become part of the ALPO observing program to begin their work as soon as they can after a superior conjunction of Venus (for evening apparitions) or an inferior conjunction (for morning apparitions). The Section would like to extend its thanks to those participating members mentioned in this report for their continued interest and enthusiasm.

## Visual Observations of Surface Details

Thn ordinary method of studying the elusive dusky shadings of the planet in detail involves making a continous series of drawings of the planet, recording any readily apparent or suspected detail seen at visual wavelengths with the utmost precision. Markings often reported by observers typically fall into one of five somewhat distinct categories:

1. Banded dusky markings (dusky streaks which characteristically run nearly parallel with one another across the planet's disc).
2. Radial dusky markings (resemble the "spider-web" pattern).
3. Irregular dusky markings (elongated or roughly linear streaks with no obvious pattern).
4. Amorphous markings (dusky features with no detectable form or pattern).
5. Bright spots or regions (aside from the cusps and cusp-caps, these brightenings frequently appear much lighter in intensity than the surrounding illuminated disc).

It has been shown that there is usually only a very minimal degree of correlation between those markings seen visually and the ones so frequently photographed at ultraviolet wavelengths. It is possible that the visual observer may detect features which can be assigned to one or more of the roughly-defined categories just discussed, but it is apparent that the radial pattern for the streaky features seen on Venus is more commonly encountered in ultraviolet light.


Figure 4. Representative Drawings of Venus by A.L.P.O. Members during the 1968-69 Eastern (Evening) Apparition.

Comb. filter - combination of several color filters used.
S-Seeing on a scale of 0 to 10 , with 10 best.
T-Transparency, limiting stellar magnitude.
D- apparent angular diameter of Venus.
The orientation is that of a simply inverted telescopic view with south at the top.


Figure 5. Representative Drawings of Venus by A.L.P.0. Members During the 1968-69 Eastern (Evening) Apparition. See also description of Figure 4 on page 16.

Certainly, it is important for the obsering record to consist of a great number of drawings made at visual wavelengths and of photographs taken in ultraviolet light. Any attempt to obtain simultaneous identifications of specific features at various wavelengths should not be ignored.

Most unfortunate is the fact that no ultraviolet photographs of Venus were sent in to the A.L.P.O. Venus Section during the 1968-69 period. The report which is presented here,

as a consequence, has been derived from the analysis of work done by the visual observer entirely. There were a few instances in which simultaneous observations of surface features were noted, adding to the overall worth of the contributed data for the 1968-69 apparition. Even so, there was still a critical lack of genuinely coherent data, making a thorough analysis of the observational sample exceedingly difficult and the final results somewhat questionable.

Upon a detailed study of the small number of acceptable drawings of Venus contributed to the Section during the 1968-69 period, it became clear that nearly all types of dusky features categorized earlier in this report were frequently apparent to observers. Only a very slight hint of the curious radial nattern for a number of rather diffuse markings on Venus was noted, perhaps as a consequence of the lack of ultraviolet photographs.

With the employment of blue (W38A) and violet (W47) filters, as well as in integrated light, a few individuals recorded banded shadings that ran across the disc of the planet almost parallel with each other and perpendicular to the line of the cusps (McClowry, Krisciunas). On at least one occasion these banded markings showed a tendency to expand and to merge with the shading along the terminator of the planet (McClowry). In view of the absence of ultraviolet photographs, no specific examples of the curious radial pattern exhibited by a number of banded features on the disc of Venus were expected. No observers submitted visual observations which could be clearly assigned to this category. With and without the use of color filters, observers reported a tremendous variety of dusky bands and streaky features on the bright hemisphere of the planet. These greyish markings, the majority of which were definitely linear or at least highly elongated, assumed a number of orientations on the planet's bright disc (Krisciunas, Simmons, and Thiede). It was impossible to derive any specific pattern for these highly irregular features seen rather clearly at times of both good and bad seeing throughout the apparition (Krisciunas, Thiede).

Observational evidence supports the view that the majority of the markings seen and drawn by Venus observers during the 1968-69 period were amorphous and highly diffuse greyish patches, may of them likely to have been the result of very slight
differences in intensity between adjacent regions. Most individuals detected these vague features close to, and blending in with, the general shading associated with the terminator (Anderson, Cross, Delano, Heath, and Thiede). A few people reported that the dusky shadings were also apparent at the 1 imb areas (Simmons, Thiede). Several observers using red (W25) and green (W58) filters indicated that the diffuse markings were more obvious at these longer wavelengths (Anderson, Cross). One observer, on the other hand, remarked that the delicate shadings were darker and much clearer in a blue (Dufay) filter and less apparent in the red (Dufay) and green (Dufay) filters (Heath).

On a few occasions, participating observers reported several bright areas on the planet's illuminated portion, exclusive of the cusp regions, which usually were in the form of small to moderately large oval or irregular features adjacent to the limb or the terminator (Anderson, Cross, Delano, and Thiede). For the most part, these brightenings were seen around the time of dichotomy (Thiede, Anderson). Other observers saw bright regions on the planet at gibbous and crescent phases (Delano, Cross, and Thiede).

For a more thorough understanding of the foregoing discussion, reference should be made to Figures 4, 5, and 6 in the present report. Although there is a certain degree of style inherent in each drawing, every effort has been made to try to select those sketches which display the highest degree of objective continuity.
Cusps, Cusp-Caps, and Cusp-Bands

Usually, when the computed phase, $k_{c}$, of Venus falls somewhat between numerical values of 0.8 and 0.1 , an observer may detect "cusp-caps" and other related bright areas in the cusp regions of the planet. Throughout the 1968-69 apparition there were several instances when cusp-caps and associated brightenings were observed. It is perhaps of interest for one to consider the following reports and accompanying illustrative material (Figures 4, 5, and 6):

1968 November $30^{\mathrm{d}} 21^{\mathrm{h}} 35^{\mathrm{m}}$ UT, $151 / 2^{\prime \prime}$ refractor, 250 X , seeing $6-7$, light sky (Thiede). Cusp-caps prominent; northern and southern cusp-caps of unequal size and brightness; southern cusp-cap slightly brighter and larger than the one seen in the north.
1969 January $16^{\mathrm{d}} 21^{\mathrm{h}} 57^{\mathrm{m}}$ UT, $10^{\text {" }}$ reflector, $210-425 \mathrm{X}$, seeing $6-8$. light sky (Anderson). Cusp-caps exhibited a narrow and fairly distinct border; northern and southern cusp-caps were of equal brightness; northern cap slightly larger than the one to the south.
1969 January $18^{\text {d }} 20^{\text {h }} 15^{\mathrm{m}}$ UT, 15 1/2" refractor, 250 X , seeing 4-6, light sky (Thiede). Both southern and northern cusp-caps were observed; a dark, somewhat diffuse border to the northern cusp-cap was obvious.
1969 February $16^{\text {d }} 20^{\mathrm{h}} 00^{\mathrm{m}} \mathrm{UT}, 151 / 2^{\text {" }}$ refractor, 250 X , seeing $3-8$, light sky (Thiede). Northern and southern cusp-caps very obvious vith a slight extension suspected at their tips; the southern cusp-cap was somewhat brighter than the one in the north.

Extended cusps were seen by observers from late February (following the date of dichotomy) up to the time of inferior conjunction. Readers are provided with the following observational notes:

1969 February $16^{\mathrm{d}} 20^{\mathrm{h}} 00^{\mathrm{m}}$ UT, $151 / 2^{\text {" }}$ refractor, 250 x , seeing $3-8$, light sky (Thiede). Northern and southern cusps slightly extended around the limb of the planet into the dark hemisphere.
 light sky (Cross). Northern horn of crescent extended to a very slight degree; southern cusp regular and not extended.
1969 February $22^{\text {d }} 01^{\mathrm{h}} 05^{\mathrm{m}}-20^{\mathrm{m}}$ UT, $6^{\text {" }}$ refractor, 170 x , seeing fair, 1 ight sky (Cross). Northern cusp extended, but not to the degree observed on the previous evening; southern cusp normal.
1969 February $23^{\mathrm{d}} 23^{\mathrm{h}} 30^{\mathrm{m}}-24^{\mathrm{d}} 00^{\mathrm{h}} 10^{\mathrm{m}}$ UT, $6^{\text {" }}$ refractor, 170 X , seeing poor to fair, light sky (Cross). Northern cusp extended as was noted on previous two occasions, difficult in variable seeing conditions; southern cusp normal.

1969 February $26^{\text {d }} 02^{\mathrm{h}} 50^{\mathrm{m}}-58^{\mathrm{m}}$ UT, $121 / 2^{\text {il }}$ reflector, 310 x , seeing poor, 1 ight sky (Cross). Larger instrument reveals the same extension of the northern horn of the crescent as was the case earlier this month; the southern cusp remains normal.
1969 February $27^{\mathrm{d}} 02^{\mathrm{h}} 16^{\mathrm{m}}-20^{\mathrm{m}}$ UT, $12^{1 / 2^{11} \text { reflector, } 320 \mathrm{x} \text {, seeing fair, light } \mathrm{t}}$ sky (Cross). Northern cusp extended only slightly; southern cusp shows no extension.
1969 March $24^{\mathrm{d}} 21^{\mathrm{h}} 05^{\mathrm{m}}$ UT, 12 1/2" reflector, 310 x , seeing poor, light sky (Cross). Faint extensions of the northern and southern horns of the crescent visible in green-yellow light.
1969 March $25^{\mathrm{d}} 00^{\mathrm{h}} 46^{\mathrm{m}}$ UT, $6^{\text {" }}$ refractor, 170 x , seeing poor, light sky (Cross). Both horns of crescent slightly extended in violet light (W47B). The same effect was observed with red (W25) and yellow (W12) filters, as well as with no filter at all.
1969 March $30^{\mathrm{d}} 00^{\mathrm{h}} 32-53^{\mathrm{m}}$ UT, $6^{\text {n }}$ refractor, 170x, seeing fair to good, light sky (Cross). Extensions of the northern and southern cusps apparent in integrated light and with red ( W 25 ), yellow (W12), green (W58), and violet (W47) filters.

1969 April $05^{\mathrm{d}} 01^{\mathrm{h}} 44-51^{\mathrm{m}}$ UT, $6^{\text {" }}$ refractor, 170x, 260X, 310x, seeing fair, light sky (Cross). Cusp extensions appear to join as they proceed around the dark hemisphere of the planet, forming a halo.

## Bright Limb Band

Attributed to an effect of contrast, the presence of a bright limb band was noted by a few individuals during the apparition. On every occasion during 1968-69 when he observed, Heath observed that the limb was bright from cusp to cusp, the greater portion of the phenomenon being confined to a narrow strip along the illuminated part of Venus. The limb band was noted by Heath to be particularly narrow in a yellow filter (Dufay Tricolor) and to be broadened somewhat in a blue filter (Dufay Tricolor). Observations of this feature were most common during the early part of February, according to the same individual. Anderson also observed a similar limb band in late December and early January, always describing it as a somewhat narrow border to the bright limb of Venus and very distinct. One should direct his attention to the apporpriate illustrations (Figures 4, 5, and 6) at this point in our discussion.

## The Ashen Light and Other Dark-Side Phenomena

During the 1968-69 apparition a few observers reported a faint illumination of the unilliminated portion of Venus, and the following are summaries of their impress ions:

1969 Fabruary $03^{\mathrm{d}} 17^{\mathrm{h}} 00^{\mathrm{m}}-10^{\mathrm{m}}$ UT, $12^{\mathrm{I} \mathrm{\prime}}$ reflector, 190 x , seeing fair, twilight sky (Heath). Unilluminated part of the planet suspected to be a little lighter than the background sky; this effect was not apparent in filters.
1969 March $18^{\mathrm{d}} 01^{\mathrm{h}} 28^{\mathrm{m}}-34^{\mathrm{m}}$ UT, $6^{\text {" }}$ refractor, $120 \mathrm{X}-260 \mathrm{x}$, seeing fair to good, light sky (Cross). Dark side visible as lighter than the surrounding field; ashen light?
1969 March $25^{\mathrm{d}} 00^{\mathrm{h}} 55^{\mathrm{m}}$ UT, $6^{\text {11 }}$ refractor, 170 x , seeing poor to fair, light sky (Cross). Ashen light'(?) visible faintly along "night" side limb.

1969 March $29^{\mathrm{d}} 21^{\mathrm{h}} 50^{\mathrm{m}}$ UT, $6^{\text {" }}$ refractor, 170 X , seeing fair to good, light sky (Cross). Entire night side visible as brighter than surrounding field, most conspicuous at dark limb. Ashen light visible in no filter and with yellow (W12) and red (W25) filters. Polaroid filter showed similar effect.

At best, any faint illumination of the dark hemisphere of Venus, if indeed actually present, is most difficult to detect. Most observations of the Ashen Light are obtained when Venus is observed against a dark sky; but as one will note, those instances cited here were light-sky observations of the phenomenon. If reports like these are to be trusted, then we may assume that the intrinsic brightness of the Ashen Light must be tremendous. In any case, simultaneous observations by a number of observers may greatly improve our chances for making brightness comparisons and for evaluating the threshold of visibility of the phenomenon.

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\section*{Terminator Irregularities}

In addition to the normally expected variations in the geometric appearance of the terminator with phase changes, observers have often reported a number of irregularities associated with this feature in past observing seasons. There were no reports received during the \(1968-69\) period which indicated any such phenomena. Indeed, most individuals reported the terminator as somewhat diffuse and regular, with no difference in phase in different wavelengths.

\section*{Phase and Dichotomy Estimates}

Throughout the 1968-69 apparition there were no observations submitted of the phase of Venus around the time of predicted half-phase (dichotomy) during the month of January. In past apparitions there has been a discrepancy between the observed and predicted times when Venus reaches dichotomy, known as the Schroeter Effect; this difference usually amounts to about seven days.

\section*{Conclusions}

One will note, upon reading this report, that the planet Venus received only a very small amount of attention during the 1968 - 69 period. As a result, the value of the present report is perhaps only minimal and the level of confidence which may be placed in the results small. Until a good number of individuals keep the planet under close scrutiny throughout any one apparition, it is doubtful that we will be able to derive very much from the data submitted. Perhaps in the coming years the Recorder can stimulate more people to undertake Venus work on a standardized and regular basis.

Acknowledgement. We are much indebted to Dr. John E. Westfall of the A.l.P.O. staff, who copied and arranged the illustrations for Dr. Benton's Venus Report. Comments and criticisms on their format will be welcomed by Dr. Westfall and the Editor. It appears to the Editor, at least, that the arrangement selected is much superior to having separate captions for individual drawings and photographs of varying sizes scattered over many pages in a report.

\section*{THE STORM OVER ATLANTIS - JUNE 10, 1969}

By: Bruce Salmon, Curator of the Planetarium, John Young Museum
Martian winds laden with ochre dust cause the gross albedo changes that planetary students once suspected were seasonal variations in the Martian flora. Our present knowledge of the meteorology of the Red Planet is still based largely on the work of the patient telescopic observer, who can act as an unofficial Martian weatherman. However, the fickle weather on our own planet sometimes ruins the work of a host of Mars observers on a given night. This enhances the value of the work of those few observers who may have been blessed that \(n\) ight by good seeing.

In February, 1971 Sky and Telescope, Charles Capen wrote of "Martian Yellow Clouds - Past and Future." For 1969 only one storm was described, the Noachis-Hellespontus -Iapygia cloud of May 28 to June 4. Six days after that storm, I detected a fairly large disturbance elsewhere on the disc. The yellow cloud was striking enough to merit a description.

On the night of June 10, 1969, at 3:50 UT, I observed a desert-colored obscuration over the maria in the southern hemisphere between ca. \(160^{\circ}-180^{\circ} 1\) ongitude. Both Titanum Sinus and Laestrygonum Sinus were sealed over. From Zephyria the yellow cloud extended nearly to the south polar cap. With foreshortening in mind, I estimate that the S. boundary of the storm lay nearly two-thirds of the distance from the "north" shore of Mare Cimmerium to the cap. Northeast of the storm's center I noted a small, bright cloud at 5:50 UT.

Unfortunately, my observatory was itself clouded over on both June 9 UT (the night before the disturbance) and for four nights following June 10. Not until June 15 could I again view the Titanum Sinus region, and by then the storm had died away.

The yellow cloud was identical in color to the Zephyria desert - a fact that suggested the surface feature, Atlantis. That area, however, is "semi-desert" in tone,


Sketches of Mars by Bruce Salmon to illustrate a yellow cloud over Atlantis. See text of his article in this issue. Simply inverted views with south at the top. LCM is longitude of central meredian. \(S\) is seeing on a scale of 0 to 10 , with 10 best. \(T\) is transparency as a limiting stellar magnitude. Diam. is apparent angular diameter of Mars.
and was not prominent in 1969.
The top sketch on Figure 7 depicts the normal appearance of the Zephyria region, on June 8, 1969 UT. The middle and lower sketches reveal the storm near the C.M. and its rotation with the disc after two hours had passed. The rectangular map shows the maria obscured by the storm of June 10 (arrow) as well as two neighboring bright regions of probable storms in Zephyria and Aeolis.

A friend of mine, Howard Zeh of Toledo, Ohio, recorded the Atlantis dust storm on HCC film on the night of June 10, 1969, with his 8 -inch reflector. See Figure 8.


Figure 8. Photograph of Mars by Howard F. Zeh with an 8-inch reflector on June 10, 19.69, showing a yellow cloud over Atlantis. See text of Bruce Salmon's article on pages 21 and 22.

\section*{JUPITER IN 1971: ROTATION PERIODS}

By: Phillip W. Budine, A.L.P.O. Jupiter Recorder
The highlights of the 1971 apparition were the outbreak of two major Disturbances in the South Equatorial Belt of the Giant Planet, observations of the South Tropical Zone Disturbance, and the prominence of the Giant Red Spot.

Some data pertinent to the apparition follow:
\begin{tabular}{lrl} 
Date of Opposition: & 1971, May 23. \\
Dates of Quadrature: & 1971, & February 25 and August 21. \\
Declination of Jupiter: & \(20^{\circ} \mathrm{S}\). (at opposition). \\
Equatorial Diameter: & 45.3 seconds (at opposition). \\
Zenocentric Declination of Earth: \(-3.2^{\circ}\) (at opposition). \\
Magnitude of Jupiter: & 2.1 (at opposition).
\end{tabular}

This report is based on 806 visual central meridian transit observations submitted by 9 observers of the A.L.P.O. When plotted on graph paper, 758 transits form usable drifts for 55 Jovian spots distributed in 7 different atmospheric currents.

The contributing observers are listed below by name and number of transits submitted, along with the station of observation and telescope(s) employed.
\begin{tabular}{|c|c|c|c|}
\hline Benton, Julius L. & Savannah, Georgia & 4-in. refr. & 127t. \\
\hline Budine, Phillip W. & Walton, N. Y. & 4-in. refr. & 450 t . \\
\hline Capen, Chick & Flagstaff, Ariz. & 24-in. refr** & 4 t . \\
\hline Gordon, Rodger W. & Nazareth, Pa. & 3.5 -in. and & \\
\hline Mackal, Paul K. & Mequon, Wisc. & 7-in. refls. & 99t. \\
\hline Smith, J. Russell & Waco, Texas & 8 -in. refl. & 44 t . \\
\hline Sopper, Reinhard & Burgsolms, West Germany & 16-in. refl. & 62 t . * \\
\hline Thiede, Eric & Madison, Wisc. & 15.5-in. refr.* & 15 t . \\
\hline Wacker, Wynn & Madison, Wisc. & 15.5-in. refr.* & *** \\
\hline
\end{tabular}
```

* Washburn Observatory
** Lowell Observatory
*** Made sectional drawings.

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The distribution of transit observations by months is as follows:
1971, January \(41 \quad\) 1971, May \begin{tabular}{lrrll} 
June & 53 & 1971, August & 129 \\
February & 9 & Jun & September & 14 \\
March & 25 & July & 310 & October \\
April & 45 & & &
\end{tabular}

In the tables which follow the first column gives an identifying number or letter to each object. The second column indicates whether the object was dark ( \(D\) ) or bright \((W)\) and whether the preceding end ( \(p\) ), center ( \(c\) ), or following end ( \(f\) ) was being observed. The third column gives the first and last dates of observation; the fourth column, the longitudes on those dates. The fifth column gives the longitude at opposition, May 23, 1971. The sixth column gives the number of transits. The seventh column indicates the number of degrees in longitude that the marking drifted in 30 days, negative when the longitude decreased with time. The eighth column shows the rotation period in hours, minutes, and seconds.

South Temperate Current (S edge STB, STeZ). System II.
\begin{tabular}{|c|c|c|c|c|c|c|c|}
\hline №. & Mark & Limiting Dates & Limiting L. & \(\underline{L}\) & Transits & Drift & Period \\
\hline F & Wp & Jan. 27-Sept. 21 & \(142^{\circ}-355^{\circ}\) & \(70^{\circ}\) & 24 & -18.6 & 9:55:15 \\
\hline 1 & WC & Jan. 27-Sept. 21 & 150-3 & \(78^{\circ}\) & 24 & -18.6 & 9:55:15 \\
\hline A & Wf & Jan. 27-Sept. 21 & \(157-10\) & \(85^{\circ}\) & 24 & -18.6 & 9:55:15 \\
\hline B & Wp & Jan. 16-Sept. 22 & 276-131 & \(203^{\circ}\) & 20 & -17.5 & 9:55:17 \\
\hline 2 & Wc & Jan. 16-Sept. 22 & 283-138 & \(210^{\circ}\) & 20 & -17.5 & 9:55:17 \\
\hline C & Wf & Jan. 16-Sept. 22 & 290-145 & \(217^{\circ}\) & 20 & -17.5 & 9:55:17 \\
\hline D & Wp & Jan. 30-Aug. 25 & \(28-247\) & \(312^{\circ}\) & 15 & -21.0 & 9:55:12 \\
\hline 3 & Wc & Jan. 30-Aug. 25 & 35-254 & \(319^{\circ}\) & 15 & -21.0 & 9:55:12 \\
\hline E & Wf & Jan. 30-Aug. 25 & 42-261 & \(326^{\circ}\) & 15 & -21.0 & 9:55:12 \\
\hline & & & & Mean & tion Per & & 9:55:15 \\
\hline
\end{tabular}

The three long-enduring white ovals of the STeZ \(N\) were well observed and continued to be seen as prominent white ovals along the south edge of the STB. It might be interesting to recollect here that the ovals were first observed in 1939, but have been prominent only since 1948. The designations FA, BC, and DC were used by E. J. Reese to distinguish them. Later it was suggested that the areas be named similarly to the way in which we name tropical storms (such as hurricanes) with female names. M. Tronfi suggested \(B C\) as Becky, DE as Dela, and FA as Fanny. Recently Paul Mackal suggested the following new names: \(B C\) as Bica, DE as Daren, and FA as Fabree. Then you see (1) Bica is too thin! (2) Daren is too fat! and (3) Fabree is just right!! What do our members think?

In any case the long-enduring ovals are still with us, and their mean lengths for 1971 were as follows: FA - \(15^{\circ}\), \(B C-14^{\circ}\), and \(D E-14^{\circ}\). Generally these values compare with the 1967-68 lengths and would indicate that the ovals are increasing their longitudinal lengths again. The oval FA was in conjunction with the center of the Red Spot on September 14, 1971 at \(7^{\circ}\) (II). The long-enduring oval DE was in conjunction with the Red Spot on March 6, 1971 at \(12^{\circ}\) (II).

Red Spot Region. System II.
\begin{tabular}{|c|c|c|c|c|c|c|}
\hline Mark & Limiting Dates & Limiting L. & L. & Transits & Drift & Period \\
\hline RSp & Jan. T-Oct. 14 & \(2^{\circ}-357^{\circ}\) & \(2^{\circ}\) & 43 & -0.52 & 9:55:40 \\
\hline RSc & Jan. 1-Oct. 14 & \(12-7\) & \(12^{\circ}\) & 43 & -0.52 & 9:55:40 \\
\hline RSf & Jan. 1-Oct. 14 & 22-17 & \(22^{\circ}\) & 43 & -0.52 & 9:55:40 \\
\hline
\end{tabular}

The Red Spot was again a prominent feature of the Giant Planet. Visual transits indicate a mean length of \(20^{\circ}\) in longitude. After the conjunction with the STrZ Disturbance on December 24, 1970, the Disturbance was dragging the Red Spot along in decreasing longitude in System II. During the period of June \(1-J u l y\) 16, 1971, the RS was shifted considerably in the direction of decreasing longitude as indicated by the longitudes for the preceding end as listed below:
\begin{tabular}{|c|c|c|c|}
\hline Date & \(\underline{R S p}\) (II) & Date & RSp (II) \\
\hline May 27 & \(2^{\circ}\) & Jul. 9 & \(357^{\circ}\) \\
\hline Jun. 3 & \(357^{\circ}\) & Jul. 14 & \(353{ }^{\circ}\) \\
\hline Jun. 16 & \(355^{\circ}\) & Ju1. 22 & \(357{ }^{\circ}\) \\
\hline Jun. 22 & \(353{ }^{\circ}\) & Aug. 5 & \(357{ }^{\circ}\) \\
\hline Jul. 2 & \(351{ }^{\circ}\) & Oct. 14 & \(357^{\circ}\) \\
\hline Jul. 6 & \(355^{\circ}\) & & \\
\hline
\end{tabular}

Close inspection of the Red Spot drift-line reveals that the Red Spot was again oscillating in longitude in 1971. The table below illustrates the dates and the longitudes of oscillation of the Red Spot center in System II.
\begin{tabular}{lcll} 
Date & RSC & Date & RSC \\
Jan. 1 & \(12^{\circ}\) & Jun. 25 & \(5^{\circ}\) \\
Mar. 28 & \(15^{\circ}\) & Jul. 4 & \(3^{\circ}\) \\
Jun. 1 & \(11^{\circ}\) & Jul. 12 & \(5^{\circ}\) \\
Jun. 6 & \(7^{\circ}\) & Jul. 30 & \(7^{\circ}\) \\
Jun. 14 & \(5^{\circ}\) & Oct. 2 & \(9^{\circ}\) \\
Jun. 22 & \(3^{\circ}\) & Oct. 14 & \(7^{\circ}\)
\end{tabular}

\section*{South Tropical Zone Disturbance. System II.}
\begin{tabular}{clllllllll} 
No. Mark & Limiting Dates & Limiting L. & L. & Transits & & Drift & Period \\
1 & Df & Aug. 15-0ct. 18 & \(231^{\circ}-215^{\circ}\) & -- & 15 & \(-7: 3\) & \(9: 55: 31\)
\end{tabular}

During the very early part of the apparition the South Tropical Zone Disburbance was passing the Red Spot with its initial conjunction of centers on December 24, 1970. Budine observed it on January 17, 1971 in conjunction with the Red Spot with its last following end at \(57^{\circ}\) (II) - see Mr. Mackal's report for 1971 in J.A.L.P.O., Volume 24, Numbers 3-4, page 47, Figure 2. After the STrZ Disturbance passed the Red Spot, it became much fainter and less active. It had a prominent following end which was followed by A.L.P.O. members during the period of August 15 - October 18, 1971. Marking No. 1. above is this feature. Its rotation period agrees exactly with Marking No. 2 of the STrZ Disturbance Table for the 1969-70 report concerning the South Tropical Zone Disturbance. Marking No. 1. is well illustrated by J. Dragesco, who observed it on August 15 and 27 and on September 8, 1971. See Figures 52, 54, and 56 of Mr. Mackal's report.

SEB 2 Branch of SEB Disturbance No. 1. System II.
\begin{tabular}{|c|c|c|c|c|c|c|c|}
\hline No. & Mark & Limiting Dates & Limiting L. & L. & Transits & Drift & Period \\
\hline 1 & Dc & Jun. 28-Ju1. 15 & \(48^{\circ}-335^{\circ}\) & -- & 5 & -119:9 & 9:52:57 \\
\hline 2 & Wc & Ju7. 3-Aug. 6 & 45-340 & -- & 12 & - 54.2 & 9:54:27 \\
\hline 3 & Dc & Jun. 28-0ct. 18 & 52-225 & -- & 18 & - 49.2 & 9:54:33 \\
\hline 4 & Dc & Jui. 16-Aug. 7 & 17-342 & -- & 5 & - 43.2 & 9:54:42 \\
\hline 5 & Wc & Jun. 28-0ct. 18 & 55-320 & -- & 22 & - 25.0 & 9:55:06 \\
\hline 6 & Dc & Jun. 28-0ct. 24 & 58-285 & -- & 19 & - 32.4 & 9:54:56 \\
\hline 7 & Dc & Jun. 28-0ct. 24 & 63-305 & -- & 21 & - 28.8 & 9:55:01 \\
\hline 8 & Wc & Jun. 26-JuT. 7 & 70-54 & -- & 9 & - 39.5 & 9:54:47 \\
\hline 9 & Wc & Jun. 28-Aug. 18 & \(70-23\) & -- & 17 & - 26.1 & 9:55:05 \\
\hline 10 & Dc & Jul. 3-Aug. 18 & 74-37 & -- & 12 & - 23.1 & 9:55:09 \\
\hline 11 & Wc & Ju1. 3-JuT. 26 & \(80-70\) & -- & 5 & - 12.7 & 9:55:23 \\
\hline 12 & Df & Jul. 10-Aug. 7 & \(75-75\) & -- & 6 & - 0.0 & 9:55:41 \\
\hline \multicolumn{7}{|l|}{\multirow[t]{3}{*}{\begin{tabular}{l}
Mean Rotation Period: \\
(Nos. 2,4,6,8) \\
(Nos. 5,7,9-12)
\end{tabular}}} & \\
\hline & & & & & & & 9:54:41 \\
\hline & & & & & & & 9:55:14 \\
\hline
\end{tabular}

Markings No. 1 and 2 are a dark spot and a very bright spot which represent the leading spots of the \(S E B_{n}\) Branch of the SEB Disturbance. Marking No. 3 is the advancing front of the SEBn Branch of the Disturbance. Markings No. 4-11 are dark and bright spots moving along the SEB \(Z\) and south edge of the SEB \({ }_{n}\). Marking No. 12 is the following end of the SEB Disturbance, located in the SEB \(Z\). Readers may wish to examine some of the above markings on the sketches publisned in Mr. Mackal's report cited above: Feature No. 7 is located on Figures 28 and 38. Marking No. 2 is illustrated on Figures \(24,25,26,27,28,29,30,31,32,35\), and 38 . Marking No. 12 is on Figure 37.
S. Component South Equatorial Belt. Retrograding Branch of SEB Disturbance No. 1. System II.
\begin{tabular}{|c|c|c|c|c|c|c|c|}
\hline No. & Mark & Limiting Dates & Limiting L. & L. & Transits & Drift & Period \\
\hline 1 & Dc & Jun. 28-Jul. 29 & \(89^{\circ}-210^{\circ}\) & -- & 12 & +121:0 & 9:58:27 \\
\hline 2 & Dc & Ju1. 1-Jul. 29 & 87-200 & -- & 14 & +113.0 & 9:58:16 \\
\hline 3 & DC & Jul. 5-Jul. 29 & 93-190 & -- & 9 & +106.2 & 9:58:07 \\
\hline 4 & Dc & Jul. 7-Jul. 29 & 83-175 & -- & 7 & +113.2 & 9:58:16 \\
\hline 5 & Dc & Ju1. 25-Aug. 7 & 100-143 & -- & \multicolumn{2}{|l|}{\multirow[b]{2}{*}{Mean Rotation Period (Wi thout No. 5):}} & 9:57:37 \\
\hline & & & & & & & 9:58:17 \\
\hline
\end{tabular}

Marking No. 1 is indicated as Feature B of Figure 28 by Budine in Mr. Macka?'s report. The object is the leading spot of the retrograding current of the SEB \(_{S}\). Marking No. 5 can be located on Figure 36 of Mr. Mackal's report of the 1971 apparition.

SEB Z Branch of SEB Disturbance No. 2. System II.
\begin{tabular}{|c|c|c|c|c|c|c|c|c|}
\hline No. & Mark & Limiting Dates & \multicolumn{2}{|l|}{Limiting L.} & L. & Transits & Drift & Period \\
\hline 1 & WC & Ju1. 18-0ct. 23 & \(140^{\circ}\) & - \(15^{\circ}\) & -- & 15 & -37:9 & 9:54:49 \\
\hline 2 & DC & Ju1. 18-0ct. 14 & 144 & - 38 & -- & 22 & -36.6 & 9:54:51 \\
\hline 3 & DC & Ju1. 28-0ct. 14 & 135 & - 43 & -- & 15 & -36.8 & 9:54:50 \\
\hline 4 & DC & Ju1. 28-0ct. 14 & 140 & - 49 & -- & 17 & -36.4 & 9:54:51 \\
\hline 5 & DC & Aug. 11-0ct. 20 & 133 & - 60 & -- & 12 & -30.4 & 9:54:59 \\
\hline 6 & WC & Sept. 5-0ct. 20 & 135 & - 80 & -- & 9 & -36.7 & 9:54:50 \\
\hline 7 & Dc & Jul. 22-Aug. 26 & 144 & - 139 & -- & 7 & - 4.2 & 9:55:35 \\
\hline 8 & Df & Jul. 21-Aug. 31 & 149 & - 149 & -- & 9 & - 0.0 & 9:55:41 \\
\hline & & & & & & \begin{tabular}{l}
ean Rotat \\
Nos. \\
Nos. 7 -
\end{tabular} & riod: & \[
\begin{aligned}
& 9: 54: 52 \\
& 9: 55: 38
\end{aligned}
\] \\
\hline
\end{tabular}

Markings No. 1 and 2 are the preceding or leading features of the \(S\). edge \(\operatorname{SEBn}\), SEB \(Z\) Branch of the SEB Disturbance No. 2. The objects can be seen and are illustrated on Figures 47, 48, 49, 50, and 57. No. 2 is also shown on Figure 46 of Mr. Mackal's report. Markings No. 3-6 were found along the S. edge of the SEBn and in the SEB Z. Markings No. 7 and 8 were located in the SEB Z; also, No. 8 represents the following end of SEB Disturbance No. 2.
S. Component South Equatorial Beit. Retrograding Branch of SEB Disturbance No. 2. System II.
\begin{tabular}{ccllcccccc} 
No. & Mark & & Limiting Dates & & Limiting L. & L. & Transits & & Drift
\end{tabular} Period

Markings No. 1, 2, and 3 are illustrated on Figures 49 and 50 of the 1971 Descriptive Report. Feature No. 4 can be seen on Figure 50 of Mr. Mackal's report. These features were moving in the retrograding \(\mathrm{SEB}_{\mathrm{s}}\) current of Disturbance No. 2.

Readers should refer to the excellent series of strip sketches (Figure 11) by Reinhard Sopper of West Germany, who was employing a 16 -inch Newtonian reflector at magnifications of 250 X and 330 X with very good seeing conditions. I am now going to describe in detail the features of the two SEB Disturbances. In some cases reference is also made to sketches in Mr. Mackal's report.

\section*{Description of the SEB Disturbances of 1971}

Figure 1: Early stage development of Disturbance No. 1. This Disturbance erupted on June 20, 1971. Note the bright oval preceding the festoon in the SEB Z. This oval is No. 2 in the Rotation Period Table. It is also illustrated on Figures 19-30 of Mr. Mackal's report.

Figure 2: Oval No. 2 is shown. The effect of a double festoon is apparent. Note the central brignt spot in the north-central region of the festoon, also the three retrograding dark spots of the SEBs. Readers should compare this figure with Figure 28 in Mr. Mackal's report, where Budine records Oval No. 2, a double festoon, the central bright area, and three retrograding dark spots. Budine's sketch illustrates the preceding retrograde \(\mathrm{SEB}_{5}\) spot at \(80^{\circ}\) (II). Mr. Sopper in a later view shows it at about \(130^{\circ}\) (II). Mr. Sopper comments that "the SEB spots were red - brown in color and had a diameter of \(0.5-1.0\) seconds!"

Figure 3: Oval No. 2. is still prominent. Double aspect still seen. Central oval is shown, but fainter in intensity. Note festoon deveioping in the SEB Z. Note the absence of SEB \(_{S}\) spots in this view, which is also confirmed on Figure 30 of Mr. Mackal's report.

Figure 4: Oval No. 2, moving in a decreasing longitude, is now near the following end of the Red Spot. Compare this view with Figure 31 of Mr. Mackal's report.


Figure 9. Drift-lines, longitude (II) vs. time, of selected features on Jupiter in 1971. Observations by the A.L.P.O. Jupiter Section. Graph prepared and contributed by Phillip W. Budine. See also text of Mr. Budine's Jupiter Report in this issue.

Figure 5: Oval No. 2 is in conjunction with the Red Spot. Figure 32 of Mr. Mackal's report confirms this appearance.

Figure 6: Oval No. 2 is in conjunction with the preceding end of the RS. Two dark spots are seen erupting from the eruption source located near the center of the SEB \(Z\). The leading spot is on the north edge of the \(\mathrm{SEB}_{S}\) and will be moving into


Figure 10. Drift-1ines, longitude (II) vs. time, of selected marks in two major SEB Disturbances on Jupiter in 1971. Observations by the A.L.P. 0 . Jupiter Section. Graph prepared and contributed by Phillip W. Budine. See also text of Mr. Budine's Jupiter Report in this issue.
the SEB \(_{S}\) Retrograding Current. The following spot is moving away from the source of the eruption.

Figure 7: Disturbance No. 2 is seen as a dark festoon located at \(144^{\circ}\) (II). This Disturbance was first seen on July 18, 1971. The leading retrograding dark spot is seen at \(170^{\circ}\) (II). As the SEB \(_{S}\) dark spots passed the longitude source of Disturbance No. 2, the second major Disturbance developed. Note that the following retrograding spot is located at the source longitude of Disturbance


Figure 11. Strip sketches by Mr. Reinhard Sopper of development of two major SEB Disturbances on Jupiter in 1971. 16-inch reflector, 250 X and 330X. See also Mr. Budine's Jupiter Report in this issue. The figure numbers on the left margin refer to the text on page 26 et seq.

No. 1. There were no \(\mathrm{SEB}_{\mathrm{S}}\) dark spots observed preceding the eruption source longitude. Note the dark spots along the \(S T B_{n}\); these are moving in the Circulating Current - South Branch.

Figure 8: Note the dark festoon still at the source of the SEB Disturbance No. 1, which is constant in longitude in System II. Retrograding SEBS dark spots are seen moving along the SEBs. Leading dark spots of the SEB S \(_{s}\) Retrograding Branch of the Disturbance No. 1 are seen at \(260^{\circ}\) (II) longitude.

Figure 9: Note the dark \(\mathrm{SEB}_{\mathrm{S}}\) retrograding spots now seen erupting from both Disturbances. Very dark festoons mark the sources of both Disturbances. Note the dark spot moving along the festoon of Disturbance No. 1 and, most important, its latitude in the southern portion of the SEB 2 : Also illustrated are the \(S T B_{n}\) spots moving in the decreasing longitude direction in the southern branch of the Circulating Current.

Figure 10: Bright ovals are seen in the SEBn at \(250^{\circ}\) and \(310^{\circ}\) (II). SEB \(Z\) festoons and \(S T B_{n}\) spots are prominent. Note \(S E B S_{S}\) retrograding spots at \(230^{\circ}\) and \(250^{\circ}\) (II). Compare this sketch with Figures 38 and 39 of Mr. Mackal's report, al so with Figure 50 by Doel, which illustrates Disturbance No. 2, some of the \(S T B_{n}\) dark spots, the \(S_{S B}\) retrograding spots, and the preceding end of the South Tropical Zone Disturbance.

Figure 11: Note the prominence of the source festoons of both Disturbances. The \(\mathrm{SEB}_{\mathrm{S}}\) retrograding spots are seen moving along the \(\mathrm{SEB}_{\mathrm{S}}\) from Disturbance No. 2 to longitude \(260^{\circ}\) (II). Two large bright ovals are seen near \(210^{\circ}\) (II) and one at \(270^{\circ}\) (II); all are located in the SEBn. Compare this figure with Figures 51 and 52 of Mr. Mackal's report in JALPO, Volume 24, Nos 3-4.

Figure 12: A most interesting view, with this sketch illustrating a weal th of information! The long-enduring South Temperate Zone oval FA is in conjunction with the Red Spot. The preceding end of the South Tropical Zone Disburbance is at \(144^{\circ}\) (II). The South Branch of the Circulating Current is evident with the \(S T B_{n}\) dark spots seen from the preceding end of the South Tropical Zone Disturbance to the following end of the Red Spot. The North Branch of the Circulating Current is also prominent with the \(S_{S B}\) retrograding spots seen from \(330^{\circ}\) to the preceding end of the South Tropical Zone Disturbance. Also, note the very brilliant oval at the preceding end of the Disturbance in the \(S E B_{n}\). It is also interesting to note that on this sketch the preceding end of the South Tropical Zone Disturbance and the dark festoon at the source of the SEB Disturbance No. 2 are both located at longitude \(144^{\circ}\) (II)! Compare this sketch with Figures 52, 54, and 56 of Mr. Mackal's report. All of these sketches are by Dragesco, and all show the preceding end of the South Tropical Zone Disturbance and Disturbance No. 2.

Mr. Sopper comments on this sketch and says: "the SEBs dark spots were seen in conjunction with the Red Spot on September 7 and 9". He also says: "the \(S E B_{S}\) retrograding spots were running north of the RS along the SEBS, here they lost their brown wisps, and got an elongated form. Just below the RS they got accelerated. Following the RS the brown wisps (projecting south from the dark spots) were to be seen again and the spots continued with their original velocity. Very interesting is the optical appearance of these spots. Their outlines are not limited sharply. They appear with soft outlines but a rather dark center that is only to be seen as a point, not an area, with the l6-inch reflector at 330x. The brown wisps originating in these little spots lie in a northsouth direction. They show differences in size and intensity just as the SEBs spots do".

Figure 13: Note the STBn dark spots approaching the following end of the Red Spot. Also, note the dark spots and their projections located at the preceding end and the following end of the RS. SEB \(_{S}\) spots can be seen between \(150^{\circ}\) and \(210^{\circ}\) (II).

Figure 14: This figure illustrates the oval FA near the RS, the \(S T B_{n}\) dark spots now preceding the \(R S\), and the \(S E B_{S}\) retrograding spots.

Note the features connecting the following end of the RS with the SEBs and the bright oval in the SEB \(Z\) at \(40^{\circ}\) (II). Mr. Sopper says concerning this sketch: "The Red Spot has always been a perfect ellipse. The preceding and following end often showed dark red condensations; sometimes a dark red ring surrounded the Red Spot. At the condensation of the following end was sometimes to be seen an outflow of material in the latitude of the SEBS. It passed along the SEB s and changed its color over a longitude of \(40^{\circ}\) from dark red to orange. Aside from this effect there were often observed so called pointed ends". Figure 15 can also be compared with Figure 43 of Mr. Mackal's report. Later views of the Disturbances were obtained by Budine on October 14 and 18 as illustrated on Figures 44 and 57 of Mr. Mackal's report.

\begin{abstract}
Comments: Readers should study the above descriptions; the beautiful and detailed strip sketches by Mr. Sopper, and the tables and graphs concerning the two major SEB Disturbances of 1971 for a complete understanding of the development and progress of these Disturbances. Not since 1943 have we had this opportunity!

Some very interesting results have been obtained, and we hope that with the next outbreak of SEB activity more observers will apply themselves to a concentrated study of these phenomena of the Giant Planet: In conclusion the Recorder would like to express sincere thanks to all who participated and contributed to this Rotation Period Report of the Jupiter Section. Also in closing, I feel the most important results of the 1971 observational evidence support the thinking and theories of Elmer J. Reese; and that is that with both of the 1971 SEB Disturbances the source of eruption remained constant in System II longitude, and the SEB Retrograding Spots originated not in the \(S E B_{S}\) but rather in the southern portion of the SEB Z:
\end{abstract}

North Equatorial Current (S. edge NEB, N. Part EZ). System I.
\begin{tabular}{|c|c|c|c|c|c|c|c|c|}
\hline No. & Mark & Limiting Dates & \multicolumn{2}{|l|}{Limiting L.} & L. & Transits & Drift & Period \\
\hline 1 & Dc & Jun. 12-Jun. 28 & \(57^{\circ}\) & - \(56^{\circ}\) & - & 6 & -0.6 & 9:50:29 \\
\hline 2 & DC & Apr. 20-Jun. 19 & 89 & - 89 & \(89^{\circ}\) & 9 & 0.0 & 9:50:30 \\
\hline 3 & Dc & Jun. 3-Jul. 5 & 149 & - 143 & - & 5 & -5.5 & 9:50:23 \\
\hline 4 & Dc & Jun. 3-Jun. 26 & 165 & - 165 & - & 5 & 0.0 & 9:50:30 \\
\hline 5 & Dc & Jun. 12-Jul. 26 & 173 & - 173 & - & 8 & 0.0 & 9:50:30 \\
\hline 6 & Dc & Jul. 6-Aug. 14 & 196 & - 197 & - & 7 & +0.7 & 9:50:31 \\
\hline 7 & Dc & May 28-Ju1. 12 & 219 & - 211 & - & 8 & -5.3 & 9:50:23 \\
\hline 8 & Dc & May 19-jul. 25 & 247 & - 243 & 247 & 9 & -1.7 & 9:50:28 \\
\hline 9 & Dc & Jun. 2-Aug. 7 & 285 & - 291 & - & 12 & +2.6 & 9:50:34 \\
\hline 10 & Dc & Jun. 20-Jul. 6 & 305 & - 305 & - & 5 & 0.0 & 9:50:30 \\
\hline 11 & DC & Jun. 6-Jun. 22 & 310 & - 311 & - & 5 & +1.7 & 9:50:32 \\
\hline & & & & & n Ro & Period: & & 9:50:29 \\
\hline
\end{tabular}

The most prominent features of the North Equatorial Current in 1971 were very dark festoons with their bases located on the south edge of the NEB. They extended in almost all cases to the north edge of the SEB \(_{n}\). All the features in the above table are these prominent festoons. Marking No. 1 is a very dark festoon extending from the south edge of the NEB to the north edge of the \(\mathrm{SEB}_{\mathrm{n}}\). Scholks shows it extending as far south as the SEB \(_{s}\). It is well illustrated on Figure 11 of Mr. Mackal's report. No. 2 is an even darker, wide-base festoon on the south edge of the NEB and extended southward to the SEB \(_{n}\). Mrs. Beck shows it well on her sketch as Figure 7 of Mackal's report. Scholks recorded it on May 29, 1971 as extending to the \(S E B B\) and curving back northward to the south edge of the \({S E B B_{n}}\). See Figure 11 of Mackal's report. Nos. 3, 4, and 5 are all well illustrated by Mackal on June 28, 1971 and can be seen on Figure 25 of his report. Dragesco had fine views of objects Nos. 6, 7, 8, and 9. No. 6 is seen on Figures 26 and 47 of Mackal's report. Figure 26 also illustrates marking No. 7. No. 8 is on Figure 27 of Mackal's report, and No. 9 is illustrated on Figure 32 of the same report.

North Tropical Current B (N. edge NEB, NTrZ). System II.
\begin{tabular}{|c|c|c|c|c|c|c|c|}
\hline No. & Mark & Limiting Dates & Limiting L. & L. & Transits & Drift & Period \\
\hline 1 & Dc & Apr. 20-Jul. 3 & \(165^{\circ}\) - \(90^{\circ}\) & \(133^{\circ}\) & 7 & -30.0 & 9:55:00 \\
\hline 2 & Wc & Apr. 19-Jul. 3 & 170-95 & 138 & 9 & -30.0 & 9:55:00 \\
\hline 3 & Wc & Apr. 20-Jun. 30 & 178-110 & 146 & 14 & -27.2 & 9:55:03 \\
\hline
\end{tabular}

Marking No. 2 started its appearance as a bright gap in the north edge of the NEB; later it developed into a bright white oval on the north edge of the NEB. It is recorded as a bright gap by Dragesco on Figure 8 of Mackal's report. It is shown as a white oval on June 29, 1971 by Dragesco on Figure 27 of that report. Nos. 2 and 3 are well illustrated on Figures 12 and 27 by Dragesco in the same report. No. 1 was a very dark, tall projection preceding oval No. 2; it is seen on Figure 27 by Dr. Dragesco of Mr. Mackal's report for 1971.

Postscript by Editor. The intensive long-time student of Jupiter, Mr. Elmer J. Reese, considers that the present aspect of Jupiter (as of late July, 1974) suggests the imminent occurrence of another major South Equatorial Belt Disturbance. The Giant Planet should be observed closely for signs of the familiar early stages of such events, as discussed by Mr. Budine above and as illustrated by Mr. Sopper on Figure 11. In truth, the Disturbance might even be in full swing by the time this issue reaches our readers!

\section*{BRIGHTNESS RANKINGS OF JUPITER'S SATELLITES IN 1971 By: Phillip W. Budine, A.L.P.O. Jupiter Recorder}
J. Lankford of Columbia, Mo., made 24 sets of observations of the relative rankings (brightnesses) of the four Galilean satellites of Jupiter from June 22,1971 to September 15, 1971, with an average transparency of 5 to 6 and average seeing of 4 . The observations were made in regular light without a filter, with red, blue, green, and violet filters, in polarized light through the angle of extinction, and then through the angle of revisibility. Note that \(n=19\), since one set was dropped because J. I was not visible, and 4 sets were dropped because J. II was in transit, in eclipse, or not visible. By "missed" is meant fade-out. The \(f\) column is the frequency or the number of times a satellite was assigned the rank shown.


Sat. III:
\begin{tabular}{|c|c|c|c|c|c|}
\hline \multicolumn{2}{|r|}{Violet} & \multicolumn{2}{|r|}{Pol. ex.} & \multicolumn{2}{|l|}{\[
\text { Rank } \frac{\text { Pol. rt. }}{}
\]} \\
\hline 1 & 13 & 1 & 15 & 1 & 15 \\
\hline 2 & 3 & 2 & 0 & 2 & 0 \\
\hline 3 & 0 & 3 & 3 & 3 & 3 \\
\hline 4 & 1 & 4 & 1 & 4 & 1 \\
\hline Missed & 2 & Missed & 0 & Missed & 0 \\
\hline
\end{tabular}

Sat. IV:
\begin{tabular}{|c|c|c|c|c|c|}
\hline Rank & f & Rank & f & \multicolumn{2}{|l|}{\[
\text { Rank Blue } \quad f
\]} \\
\hline 1 & 1 & 1 & 0 & 1 & 2 \\
\hline 2 & 2 & 2 & 2 & 2 & 4 \\
\hline 3 & 10 & 3 & 7 & 3 & 3 \\
\hline 4 & 6 & 4 & 9 & 4 & 10 \\
\hline Missed & 0 & Missed & 2 & Missed & 0 \\
\hline \multicolumn{2}{|l|}{\multirow[t]{2}{*}{Rank Yiolet}} & \multicolumn{2}{|l|}{Pol. ex.} & \multicolumn{2}{|r|}{Pol. rt.} \\
\hline & & Rank & f & Rank & f \\
\hline 1 & 7 & 1 & 6 & 1 & 6 \\
\hline 2 & 5 & 2 & 7 & 2 & 7 \\
\hline 3 & 4 & 3 & 3 & 3 & 3 \\
\hline 4 & 0 & 4 & 3 & 4 & 3 \\
\hline Missed & 3 & Missed & 0 & Missed & 0 \\
\hline
\end{tabular}

These results are quite interesting for at least two reasons: (1) Sat. II has a tendency to have rank 2 more often than Sat. I, and (2) Sat. IV reverses ranks with sat. I in violet light.

\section*{BOOK REVIEWS}

Planets, Stars and Nebulae Studied with Photopolarimetry. T. Gehrels, Editor. University of Arizona Press, Tucson, Arizona. 1133 pages. 1974, Price \(\$ 27.50\).

\section*{Reviewed by Dale P. Cruikshank}

When light waves are preferentially oriented in one direction or another, the light is said to be polarized. Polarized light occurs commonly in nature; the daytime sky, rainbows, reflections from smooth surfaces, and light transmitted by sheets of plastic are all polarized, as can be seen by examination with polaroid sunglasses. Light from most astronomical sources is also polarized, though to a much lesser degree; and the amount and direction of the polarization give important information on surface roughness and albedo (in the case of a satellite or asteroid), the particles and gases in the atmosphere of a planet, the grains in a dust cloud surrounding a star, and the magnetic fields of stars, just to name a few examples. The polarization of light from astronomical objects has been studied for over a century.

Recognizing the need for a comprehensive text-like book on the subject of astronomical polarization studies, Tom Gehrels of the University of Arizona organized a conference in November, 1972; this encyclopedic volume of papers, discussion, and references is the outcome of the conference. The Gehrels volume is intended for scientists wanting a detailed overview of the entire subject and for specialists wishing to delve into a particular facet of polarimetry; it is not for beginners. Readers with an interest in the planets, satellites, and asteroids will find nearly a fourth of the book devoted to these topics, though the articles are highly detailed with physics and mathematics.

Books resulting from conferences are typically far less successful than the Gehrels volume; the high quality of this book is clearly due to strict editorial attention to each paper and the discussions. Gehrels' book will surely stand for many years as the fundamental reference source for polarization studies in astronomy as well as in atmospheric physics.

Meteorites and their Origins, by G. J. McCall, New York: John Wiley \& Sons, Inc. 1973. 352 pages. Price \(\$ 12.95\).

\section*{Reviewed by Fred J. Lazor}

In Meteorites and their Origins, Dr. McCall has attempted "to condense the vast spectrum of meteoritics into a single readable volume." In this comprehensive volume he has covered all phases of meteoritics but in varying degrees, reflecting his personal interests. Dr. McCall only briefly discusses historical and astronomical aspects of meteorites while he exhaustively deals with meteorite classifications, mineralogies, and morphologies. In many instances Dr. McCall uses examples from his native Australia, which are both interesting and are not found in other references.

The author deals with astroblemes, tektites, and organic matter in meteorites, all very controversial subjects, in an unsatisfactory manner. Rather than presenting all available data and discussing the various theories, Dr. McCall only presents his opinions which are at times substantiated by only the most tenuous of data. A good example is his denial of any large impact features on the Earth, including the famous Canyon Diablo Crater in Arizona, where he suggests a possible volcanic origin for this crater.

Dr. McCall has hardly accomplished his goal of a readable volume on meteoritics. Many of his sentences are extremely long and rambling. Picking a page at random reveals one sentence of 123 words and one of 58 , and only one sentence of less than 30 words.

Meteorites and their origins contains an excellent bibliography and touches on all phases of meteoritics. However, due to its biased handling of controversial topics and a general lack of readability, it must be concluded that this book has not accomplished its goal; and it should be read with an open mind and, preferably, a strong background in geology.

Mars and The Mind of Man, by Arthur C. Clarke, Ray Bradbury, Bruce Murray, Carl Sagan, and Walter Sullivan. Harper and Row, New York, New York, 1973. 143 pages. Price \(\$ 7.95\).

\author{
Reviewed by Rodger W. Gordon
}

Mars and The Mind of Man is a neat little compilation of a panel discussion, held in November, 1971 at the California Institute of Technology, by the five aforementioned authors just before Mariner 9 began to orbit Mars. There is also a series of afterthoughts written in the latter half of 1972. It is a scientific, romantic, and poetic look at our neighbor red planet describing in a chatty, informal manner our ideas of Mars circa 1900, pre-1971, and post-1971. It reflects the optimism, pessimism, and resurgent optimism about the possible chances that Mars is a "living" (biologically speaking) world and discusses how Lowell's ideas, though wrong, have inspired a host of science fact and science fiction writings. It also indicates how Lowell's deep seated impressions have, to this day, influenced the minds and hearts of men who have designed the biological probes to 1 and on Mars later this decade. We see the enormous influence Lowell has wielded (through his writings) over Man's thinking about the cosmos and the possibility of life "out there" somewhere.

Each author gives an account of how Lowell influenced his own early thinking about Mars and how his views have changed (regrettably so) as the myth receded and concrete evidence came to show Mars to be typically un-Lowell-like.

The social aspects of manned and unmanned space hardware, the discoveries, and how they may affect the thinking about future science and technology are discussed. Lamentably, the authors point out that space exploration is now made the brunt or scape-goat of all that seems wrong with our society by many critics, who do not understand what science is and therefore blame all of today's troubles on it.

There is a fascinating section by Murray and Sagan in which each gives his own interpretation of the data by Mariner 9. The two hypotheses are almost diametrically opposed to each other. Non-scientists should particularly read this part of the book. It demonstrates that when two outstanding scientists differ so remarkably on the same data, it is necessary to continue exploring and searching for the truth.

There are some fifty Mariner 9 close-ups of the planet in the second half of the book, and all are well reproduced. Many persons will buy the book just for the pictures, though no technical data are given for any of them.

The end of the book by Ray Bradbury has to rank as one of the most inspired pieces of writing this reviewer has seen in some time. Combining science, religion, poetry, and some famous Hollywood dialogue from H. G. Wells' "Things to Come", he states an eloquent appeal for Man's spirit to continue the search for truth out to the stars and beyond. I would have paid \(\$ 7.95\) for this part of the book itself.

If you have \(\$ 7.95\) to spend, I can't think of a better book to spend it on!

\author{
By: John E. Westfall, A.L.P.0. Lunar Recorder \\ Additions to the A.L.P.0. Lunar Photograph Library: Apollo-16 Photographs
}

The most recent addition to the A.L.P.O. Lunar Photograph Library consists of 77 photographs taken during the Apollo-16 lunar orbit (April 20-24, 1972). All photographs received, three of which are reproduced with this report (one on the front cover), are in the form of \(8 \times 10\)-inch black-and-white enlargements. These photographs are listed below, with data given as follows:
(a) Format--M refers to the metric camera, \(H\) to the Hasselblad camera. \(\underline{V}\) indicates a near-vertical view, while \(H^{-1}\) and \(L\) refer to high oblique (horizon visible) and low oblique (below horizon) views, respectively. In the case of obliques, \((N)\) or (S) indicate whether the camera was pointing north or south. Note that the metric camera high obliques, being wide-angle views, actually show the Moon's surface from the nadir area (directly below the camera) to the horizon.
(b) Scale--Given as follows: \(960 \mathrm{~T}=1 / 960,000\) (for vertical views only), 900TV \(=\) approximately \(1 / 900,000\) in the nadir area only (for metric obliques). Due to extreme foreshortening, scales are not given for Hasselblad obliques.
(c) Description-- Following the feature description and the longitude/latitude (IAU system), photographs forming part of a series ("strip"), or overlapping other single or group photographs, are noted (with a strip series, each photograph overlaps the preceeding, and the following, photograph). With metric verticals, overlap areas may be viewed stereoscopically. Further data on strip coverage are given at the end of this report.

Table 1. Apollo-16 Photographs.
\begin{tabular}{|c|c|c|c|c|}
\hline Code Number & Format & Sun Angle & Scale & Description \\
\hline AS16- & & & & \\
\hline 120 & M, V & High & 9607 & Maclaurin M ( \(68^{\circ} \mathrm{E} / 05^{\circ} \mathrm{S}\) ) (\#1 of strip of 15) \\
\hline 124 & M, V & High & 985 T & Langrenus \(-\mathrm{C}, \mathrm{T}\left(63^{\circ} \mathrm{E} / 05^{\circ} \mathrm{S}\right)(\# 2\) of strip of 15) \\
\hline 128 & M, V & High & 10007 & Langrenus - \(\mathrm{B}, \mathrm{F}, \mathrm{K}\left(58^{\circ} \mathrm{E} / 06^{\circ} \mathrm{S}\right)(\# 3\) of strip of 15) \\
\hline 132 & M, V & High & 980 T & Messier G ( \(53^{\circ} \mathrm{E} / 07^{\circ} \mathrm{S}\) ) (\#4 of strip of 15) \\
\hline 136 & M, V & High & 960 T & Goclenius-A ( \(48^{\circ} \mathrm{E} / 07^{\circ} \mathrm{S}\) ) (\#5 of strip of 15) \\
\hline 140 & M, V & High & 940 T & Gutenberg-Goclenius ( \(43^{\circ} \mathrm{E} / 08^{\circ} \mathrm{S}\) ) (\#6 of strip of 15) \\
\hline 144 & M, V & Medium & 930 T & Capella ( \(37^{\circ} \mathrm{E} / 08^{\circ} \mathrm{S}\) ) (\#7 of strip of 15) \\
\hline 148 & M, V & Medium & 940 T & Is idorus -Mädler ( \(33^{\circ} \mathrm{E} / 09^{\circ} \mathrm{S}\) ) (\#8 of strip of 15) \\
\hline 152 & M, V & Medium & 920 T & Mädler-Theophilus ( \(27^{\circ} \mathrm{E} / 09^{\circ} \mathrm{S}\) ) (\#9 of strip of 15) \\
\hline 156 & M, V & Medium & 905 T & Kant-ŻOllner F ( \(22^{\circ} \mathrm{E} / 09^{\circ} \mathrm{S}\) ) (\#10 of strip of 15) \\
\hline 160 & M, V & Medium & 885 T & Descartes-Z0̈llner ( \(17^{\circ} \mathrm{E} / 09^{\circ} \mathrm{S}\) ) (\#11 of strip of 15) \\
\hline 164 & M, V & Low & 875 T & Andel-Dollond B,C ( \(12^{\circ} \mathrm{E} / 09^{\circ} \mathrm{S}\) ) (\#12 of strip of 15) \\
\hline 168 & M, V & Low & 8707 & Albategnius-Hind ( \(07^{\circ} \mathrm{E} / 09^{\circ} \mathrm{S}\) ) (\#13 of strip of 15) \\
\hline 172 & M, V & Low & 885 T & Albategnius-Müller ( \(02^{\circ} \mathrm{E} / 09^{\circ} \mathrm{S}\) ) (\#14 of strip of 15) \\
\hline 174 & M, V & Low & 885T & Ptolemaeus ( \(01{ }^{\circ} \mathrm{W} / 09^{\circ} \mathrm{S}\) ) (\#15 of strip of 15) \\
\hline 986 & M, V & Medium & 9007 & Albategnius ( \(02^{\circ} \mathrm{E} / 09^{\circ} \mathrm{S}\) ) \\
\hline 994 & M, V & Low & 895 T & Davy Y ( \(07^{\circ} \mathrm{W} / 09^{\circ} \mathrm{S}\) ) (0verlaps AS16-998) \\
\hline 998 & M, V & Low & 8707 & Parry M ( \(12^{\circ} \mathrm{W} / 09^{\circ} \mathrm{S}\) ) (Overlaps AS16-994) \\
\hline 1340 & \(\mathrm{M}, \mathrm{H}(\mathrm{N})\) & High & 800Tv & Neper-M. Marginis ( \(91^{\circ} \mathrm{E} / 06^{\circ} \mathrm{N}\) ) (\#1 of strip of 17) \\
\hline 1345 & \(\mathrm{M}, \mathrm{H}(\mathrm{N})\) & High & 800 Tv & Neper-Schubert ( \(84^{\circ} \mathrm{E} / 04^{\circ} \mathrm{N}\) ) (\#2 of strip of 17) \\
\hline 1350 & \(\mathrm{M}, \mathrm{H}(\mathrm{N})\) & High & 800 Tv & Schubert X-Condorcet F ( \(77^{\circ} \mathrm{E} / 02^{\circ} \mathrm{N}\) ) (\#3 of strip of 17) \\
\hline
\end{tabular}


Figure 12. An Apollo-16 metric camera vertical photograph, showing the ruined ring Letronne ( 120 km .), on the southern margin of Oceanus Procellarum. The low sun (Colong. \(=47^{\circ}\), solar altitude \(=4^{\circ}\) ) highlights the 1,000-meter high crater wall. The small crater to the right (north) is Flamsteed A ( 12 km .). Photo. AS16-2995. See also John Westfall's report on the A.L.P.O. Lunar Photograph Library.
\begin{tabular}{|c|c|c|c|c|}
\hline \begin{tabular}{l}
Code \\
Number
\end{tabular} & Format & Sun Angle & Scale & Table 1--Continued \\
\hline \multicolumn{5}{|l|}{AS 16-} \\
\hline 1355 & M, H(N) & High & 800 Tv & Maclaurin K-M. Undarum ( \(71{ }^{\circ} \mathrm{E} / 02^{\circ} \mathrm{N}\) ) (\#4 of strip of 17) \\
\hline 1360 & \(M, H(N)\) & High & 800 Tv & M. Spumans-M. Undarum-M. Crisium ( \(64^{\circ} \mathrm{E} / 00^{\circ} \mathrm{N}\) ) (\#5 of strip of 17) \\
\hline 1365 & \(\mathrm{M}, \mathrm{H}(\mathrm{N})\) & High & 800 Tv & Webb-Apollonius ( \(57^{\circ} \mathrm{E} / 01^{\circ} \mathrm{S}\) ) (\#6 of strip of 17) \\
\hline 1370 & \(M, H(N)\) & High & 800 Tv & Messier-Taruntius ( \(50^{\circ} \mathrm{E} / 02^{\circ} \mathrm{S}\) ) ( \#7 of strip of 17) \\
\hline 1375 & \(\mathrm{M}, \mathrm{H}(\mathrm{N})\) & High & 800 Tv & Lubbock-Secchi ( \(43^{\circ} \mathrm{E} / 03^{\circ} \mathrm{S}\) )( \#8 of strip of 17) \\
\hline 1380 & M, \(\mathrm{H}(\mathrm{N})\) & High & 800 Tv & Isidorus B-Maskelyne D ( \(37^{\circ} \mathrm{E} / 03^{\circ} \mathrm{S}\) )( \#9 of strip of 17) \\
\hline 1385 & \(\mathrm{M}, \mathrm{H}(\mathrm{N})\) & High & 800 Tv & Torricelli-Maskelyne ( \(30^{\circ} \mathrm{E} / 04^{\circ} \mathrm{S}\) )( \#10 of strip of 17) \\
\hline
\end{tabular}


Figure 13. The 59-km. diameter crater Bullialdus, as photographed by the Apollo-16 Hasselblad camera ( \(250-\mathrm{mm}\). lens). This crater is 2,400 meters deep; its 1,000-meter central peak and terraced inner walls are well shown. Beyond Bullialdus are the craters Bullialdus A and \(B\), and Kies (low ring). On the southern horizon (right) are the craters Mercator and Campanus. Photo. AS16-19094. See also John Westfall's report on the A.L.P.O. Lunar Photograph Library.
\begin{tabular}{|c|c|c|c|c|}
\hline \multicolumn{4}{|l|}{} & Table 1--Continued \\
\hline Code Number & Format & Sun Angle & Scale & Description \\
\hline \[
\begin{array}{r}
\hline \text { AS16- } \\
1390
\end{array}
\] & M, H(N) & Medium & 800Tv & Hypatia-Arago ( \(23^{\circ} \mathrm{E} / 05^{\circ} \mathrm{S}\) ) ( \#11 of strip of 17) \\
\hline 1395 & M, \(\mathrm{H}(\mathrm{N})\) & Medium & 800Tv & Taylor-Delambre ( \(16^{\circ} \mathrm{E} / 05^{\circ} \mathrm{S}\) )( \#12 of strip of 17) \\
\hline 1400 & M, H(N) & Medium & 800 Tv & Hind-Godin ( \(09^{\circ} \mathrm{E} / 06^{\circ} \mathrm{S}\) ) (\#13 of strip of 17) \\
\hline 1405 & \(M, H(N)\) & Medium & 800 Tv & Hipparchus-Triesnecker ( \(03^{\circ} \mathrm{E} / 06^{\circ} \mathrm{S}\) ) ( \#14 of strip of 17) \\
\hline 1410 & M, \(\mathrm{H}(\mathrm{N})\) & Medium & 800 Tv & Ptolemaeus-S. Medii ( \(04^{\circ} \mathrm{W} / 06^{\circ} \mathrm{S}\) )( \#15 of strip 17) \\
\hline 1415 & M, H(N) & Low & 800 Tv & Lalande-Schröter ( \(11^{\circ} \mathrm{W} / 06^{\circ} \mathrm{S}\) )( \#16 of strip of 17) \\
\hline 1420 & M, H(N) & Low & 800 Tv & Fra Mauro-Gambart ( \(18^{\circ} \mathrm{W} / 06^{\circ} \mathrm{S}\) )( \#17 of strip of 17) \\
\hline 1679 & M, V & Low & 930 T & Davy-Parry M ( \(\left.09^{\circ} \mathrm{W} / 09^{\circ} \mathrm{S}\right)(\# 1\) of strip of 4) \\
\hline 1683 & M, V & Low & 945 T & Guericke-Parry ( \(13^{\circ} \mathrm{W} / 09^{\circ} \mathrm{S}\) )( \#2 of strip of 4) \\
\hline
\end{tabular}
\begin{tabular}{|c|c|c|c|c|}
\hline Code Number & Format & Sun Angle & Scale & Description \\
\hline AS16- & & & & \\
\hline 1687 & M, V & Low & 940 T & Parry-Bonpland ( \(18^{\circ} \mathrm{W} / 09^{\circ} \mathrm{S}\) )( \#3 of strip of 4) \\
\hline 1691 & M, V & Low & 940 T & E. M. Cognitum ( \(23^{\circ} \mathrm{W} / 09^{\circ} \mathrm{S}\) ) ( \#4 of strip of 4) \\
\hline 2205 & M, V & Medium & 985 T & Parry-Bonpland ( \(17^{\circ} \mathrm{W} / 09^{\circ} \mathrm{S}\) ) ( \#1 of strip of 4) \\
\hline 2209 & M,V & Low & 970 T & E. M. Cognitum-Bonpland E ( \(22^{\circ} \mathrm{W} / 09^{\circ} \mathrm{S}\) ) (\#2 of strip of 4) \\
\hline 2213 & M,V & Low & 975 T & Mts. Riphaeus-Euclides-D ( \(26^{\circ} \mathrm{W} / 09^{\circ} \mathrm{S}\) )( \#3 of strip of 4) \\
\hline 2217 & M, V & Low & \(975 T\) & Euclides-C ( \(32^{\circ} \mathrm{W} / 09^{\circ} \mathrm{S}\) ) ( \#4 of strip of 4) \\
\hline 2405 & \(\mathrm{M}, \mathrm{H}(\mathrm{S})\) & High & 900 Tv & M. Smythii ( \(89^{\circ} \mathrm{E} / 00^{\circ} \mathrm{S}\) ) ( \#1 of strip of 20) \\
\hline 2410 & \(\mathrm{M}, \mathrm{H}(\mathrm{S})\) & High & 900 Tv & M. Smythii-Kastner ( \(82^{\circ} \mathrm{E} / 02^{\circ} \mathrm{S}\) )( \#2 of strip of 20) \\
\hline 2415 & \(\mathrm{M}, \mathrm{H}(\mathrm{S})\) & High & 900 Tv & Gilbert-Kastner ( \(75^{\circ} \mathrm{E} / 03^{\circ} \mathrm{S}\) ) ( \#3 of strip of 20) \\
\hline 2420 & M, H(S) & High & 900 Tv & Maclaurin-La Peyrouse ( \(70^{\circ} \mathrm{E} / 04^{\circ} \mathrm{S}\) ) ( \#4 of strip of 20 ) \\
\hline 2425 & \(\mathrm{M}, \mathrm{H}(\mathrm{S})\) & High & 900 Tv & Langrenus-A ( \(64^{\circ} \mathrm{E} / 05^{\circ} \mathrm{S}\) ) ( \#5 of strip of 20) \\
\hline 2430 & \(\mathrm{M}, \mathrm{H}(\mathrm{S})\) & High & 900 Tv & Langrenus \(-\mathrm{B}, \mathrm{F}, \mathrm{K}\left(58^{\circ} \mathrm{E} / 06^{\circ} \mathrm{S}\right)(\# 6\) of strip of 20) \\
\hline 2435 & M, \(\mathrm{H}(\mathrm{S})\) & High & 900 Tv & Messier G-Crozier ( \(52^{\circ} \mathrm{E} / 07^{\circ} \mathrm{S}\) )( \#7 of strip of 20) \\
\hline 2440 & \(\mathrm{M}, \mathrm{H}(\mathrm{S})\) & High & 900 Tv & Goclenius-Colombo ( \(45^{\circ} \mathrm{E} / 08^{\circ} \mathrm{S}\) ) ( \#8 of strip of 20) \\
\hline 2445 & \(\mathrm{M}, \mathrm{H}(\mathrm{S})\) & High & 900 Tv & Gutenberg-Mts. Pyrenacus ( \(39^{\circ} \mathrm{E} / 08^{\circ} \mathrm{S}\) ) ( \#9 of strip of 20) \\
\hline 2450 & M, \(\mathrm{H}(\mathrm{S})\) & High & 900 Tv & M. Nectaris ( \(32^{\circ} \mathrm{E} / 09^{\circ} \mathrm{S}\) ) ( \#10 of strip of 20) \\
\hline 2455 & M, H(S) & High & 900 Tv & Theophilus-Fracastorius ( \(26^{\circ} \mathrm{E} / 10^{\circ} \mathrm{S}\) ) ( \#11 of strip of 20) \\
\hline 2460 & M, H(S) & High & 900 Tv & Kant-Tacitus ( \(20^{\circ} \mathrm{E} / 11^{\circ} \mathrm{S}\) ) ( \#12 of strip of 20) \\
\hline 2465 & \(\mathrm{M}, \mathrm{H}(\mathrm{S})\) & High & 900 Tv & Andêl-Abul feda ( \(13^{\circ} \mathrm{E} / 12^{\circ} \mathrm{S}\) ) ( \#13 of strip of 20) \\
\hline 2470 & \(\mathrm{M}, \mathrm{H}(\mathrm{S})\) & Medium & 900 Tv & Albategnius-Airy ( \(\left.07^{\circ} \mathrm{E} / 12^{\circ} \mathrm{S}\right)(\# 14\) of strip of 20) \\
\hline 2475 & \(\mathrm{M}, \mathrm{H}(\mathrm{S})\) & Medium & 900Tv & Ptolemaeus-Arzachel ( \(01^{\circ} \mathrm{E} / 12^{\circ} \mathrm{S}\) ) ( \#15 of strip of 20) \\
\hline 2480 & M, \(\mathrm{H}(\mathrm{S})\) & Medium & 900 Tv & Davy-Thebit ( \(06^{\circ} \mathrm{W} / 12^{\circ} \mathrm{S}\) ) (\#16 of strip of 20) \\
\hline 2485 & M, \(\mathrm{H}(\mathrm{S})\) & Medium & 900Tv & Guericke-Birt ( \(12^{\circ} \mathrm{W} / 13^{\circ} \mathrm{S}\) ) ( \#17 of strip of 20) \\
\hline 2490 & M, \(\mathrm{H}(\mathrm{S})\) & Low & 900 Tv & Guericke F-Bullialdus ( \(18^{\circ} \mathrm{W} / 13^{\circ} \mathrm{S}\) ) ( \#18 of strip of 20) \\
\hline 2495 & M, \(\mathrm{H}(\mathrm{S})\) & Low & 900 Tv & M. Cognitum-Bullialdus ( \(25^{\circ} \mathrm{W} / 13^{\circ} \mathrm{S}\) ) ( \#19 of strip of 20) \\
\hline 2499 & M, \(\mathrm{H}(\mathrm{S})\) & Low & 900 Tv & Euclides C-Agatharchides ( \(30^{\circ} \mathrm{W} / 13^{\circ} \mathrm{S}\) ) (\#20 of strip of 20) \\
\hline 2831 & M, V & Medium & 1015 T & Euclides-C, D ( \(28^{\circ} \mathrm{W} / 11^{\circ} \mathrm{S}\) ) ( \#1 of strip of 4) \\
\hline 2836 & M, V & Low & 1025 T & Wichmann \(P\)-Herigonius ( \(35^{\circ} \mathrm{W} / 11^{\circ} \mathrm{S}\) )( \#2 of strip of 4) \\
\hline 2840 & M, V & Low & 1020T & Letronne-Wichmann ( \(39^{\circ} \mathrm{W} / 11^{\circ} \mathrm{S}\) )( \#3 of strip of 4) \\
\hline 2844 & M, V & Low & 1020T & Letronne-Flamsteed A ( \(\left.45^{\circ} \mathrm{W} / 10^{\circ} \mathrm{S}\right)(\# 4\) of strip of 4) \\
\hline 2991 & M, V & Low & 1015 T & Wichmann-Herigonius ( \(37^{\circ} \mathrm{W} / 11^{\circ} \mathrm{S}\) )( \#1 of strip of 3) \\
\hline 2995 & M, V & Low & 1015T & Letronne-Flamsteed \(A\left(43^{\circ} \mathrm{W} / 10^{\circ} \mathrm{S}\right)(\# 2\) of strip of 3) \\
\hline 2999 & M, V & Low & 1015T & Billy B ( \(48^{\circ} \mathrm{W} / 10^{\circ} \mathrm{S}\) )( \#3 of strip of 3) \\
\hline 19094 & H, \(\mathrm{H}(\mathrm{S})\) * & Medium & ----- & Bullialdus ( \(22^{\circ} \mathrm{W} / 21^{\circ} \mathrm{S}\) ) \\
\hline 19224 & H, \(\mathrm{H}(\mathrm{S}) *\) & Low & ----- & Straight Wall (08\% \(/ 22^{\circ} \mathrm{S}\) ) \\
\hline 19242 & H,H(S)* & Medium & & Bullialdus ( \(21{ }^{\circ} \mathrm{W} / 20^{\circ} \mathrm{S}\) ) \\
\hline 19319 & H,L(S)* & & -- & W. Gassendi-N. W.M. Humorum ( \(43^{\circ} \mathrm{W} / 19^{\circ} \mathrm{S}\) ) (Overlaps AS16-19323,-19327,-19331) \\
\hline 19323 & H,L(S)* & & ----- & W. M. Humorum-Mersenius D ( \(44^{\circ} \mathrm{W} / 21^{\circ} \mathrm{S}\) ) (Overlaps AS16-19319,-19327,-19331) \\
\hline 19327 & H,L(S)* & & ----- & \begin{tabular}{l}
N. W. M. Humorum ( \(43^{\circ} \mathrm{W} / 20^{\circ} \mathrm{S}\) ) \\
(Overlaps AS16-19319,-19323,-19331)
\end{tabular} \\
\hline 19331 & H,L(S)* & & ----- & Rimae Mersenius I,II, \&III ( \(45^{\circ} \mathrm{W} / 21^{\circ} \mathrm{S}\) ) (Overlaps AS16-19319,-19323,-19327) \\
\hline & *250-mm & . lens & & \\
\hline
\end{tabular}

Table 2. Apollo-16 Strip Coverage.
\begin{tabular}{|c|c|c|c|c|c|c|}
\hline Code Number & \multicolumn{3}{|r|}{Longitude/Latitude} & \multirow[b]{2}{*}{Colong.} & \multirow[t]{2}{*}{\begin{tabular}{l}
No. \\
Frames
\end{tabular}} & \multirow[b]{2}{*}{Scale} \\
\hline Range & Format & Start Point & End Point & & & \\
\hline \[
\begin{aligned}
& \overline{\text { AST16- }} \\
& 120-174
\end{aligned}
\] & M, V & \(68^{\circ} \mathrm{E} / 05^{\circ} \mathrm{S}\) & \(01{ }^{\circ} \mathrm{W} / 09^{\circ} \mathrm{S}\) & \(001{ }^{\circ}\) & 15 & 870T - 1000 T \\
\hline 994-998 & M, V & \(07^{\mathrm{O}} \mathrm{W} / 09^{\circ} \mathrm{S}\) & \(12^{\circ} \mathrm{W} / 09^{\circ} \mathrm{S}\) & \(012^{\circ}\) & 2 & 895T - 900T \\
\hline 1340-1420 & \(\mathrm{M}, \mathrm{H}(\mathrm{N})\) & \(91^{\circ} \mathrm{E} / 06^{\circ} \mathrm{N}\) & \(18^{\circ} \mathrm{W} / 06^{\circ} \mathrm{S}\) & \(021{ }^{\circ}\) & 17 & ca. 800Tv \\
\hline 1679-1691 & M, V & \(09^{\circ} \mathrm{W} / 09{ }^{\circ} \mathrm{S}\) & \(25^{\circ} \mathrm{W} / 09{ }^{\circ} \mathrm{S}\) & \(022^{\circ}\) & 4 & 930T - 945T \\
\hline 2205-2217 & M, V & \(17^{\circ} \mathrm{W} / 09^{\circ} \mathrm{S}\) & \(32^{\circ} \mathrm{W} / 09^{\circ} \mathrm{S}\) & \(031{ }^{\circ}\) & 4 & 970T - 985 T \\
\hline 2405-2499 & \(\mathrm{M}, \mathrm{H}(\mathrm{S})\) & \(89^{\circ} \mathrm{E} / 00^{\circ} \mathrm{S}\) & \(30^{\circ} \mathrm{W} / 13^{\circ} \mathrm{S}\) & \(032{ }^{\circ}\) & 20 & ca. 900Tv \\
\hline 2991-2999 & M, V & \(37^{\circ} \mathrm{W} / 11^{\circ} \mathrm{S}\) & \(48^{\circ} \mathrm{W} / 10^{\circ} \mathrm{S}\) & \(047^{\circ}\) & 3 & 1015T \\
\hline
\end{tabular}

\section*{ANNOUNCEMENTS}

Addendum to First Footnote (*) on page 217 of JALPO, Vol. 24, Nos. 11-12. The footnotecited concerns the date of a Christmas card photograph of Jupiter referenced by Mr. Paul Mackal in his article "Jovian Colors in 1973". The latest information from Mr. C. F. Capen, who took the photograph, is that he made up cards from photographs over the interval 1965-1969. Hopefully, then, the redbrown color found in the \(\mathrm{SEB}_{\mathrm{s}}\) may be representative of Jupiter in recent years.

Corrections to JALPO, Vol. 24, Nos. 9-10. On pg. 202 the telescope shown in Figure 23 is Michigan State University's 24-inch reflector, not the University of Michigan's 24 -inch reflector. On the same page the last sentence of the second paragraph should read: "On the other hand, the average value of \(n\) for this comet is very close to the average, which is between three and four."

New address for Phillip W. Budine. The address of one of our Jupiter Recorders has recently changed to: Phillip W. Budine

Box 68A, R.D. 3
Walton, New York 13856
All correspondence and all observational material should be sent to Mr. Budine at this new address.

Death of David \(P\). Barcroft. We announce with great regret the death of the ALPO Secretary, Mr. David P. Barcroft, on July 13, 1974. He had served in this capacity since the founding of the ALP0 in 1947. A commemorative article is being planned for the next issue.

New ALP0 Secretary. Mr. J. Russell Smith, 8930 Raven Drive, Waco, Texas \(76710^{\text {has }}\) agreed to take over the post of Secretary of our Association. Mr. Smith will need no introduction to our members. He has been an active contributor to this journal for many years and has served for some time as Book Review Editor. He has already assisted considerably in recent months with routine correspondence, letters with inquiries of various kinds, and other matters. We express our appreciation to him for his willingness to take on the post of Secretary.

A New Lunar Recorder. The Lunar Section staff has been increased by the addition \(\overline{0} \overline{\text { Mr. Michael Formarucci, }} 136\) Midland Avenue, Garfield, New Jersey 07026. His special project will be a study of the distribution of central peaks of lunar craters. He has al ready contacted for this purpose a number of individual observers as well as amateur organizations in Hungary and Hong Kong. He writes that comparatively small apertures appear to be adequate. Interested persons are invited to write to Mr. Fornarucci, who will describe the methods, goals, instrumentation, techniques, etc. for this research on central peaks in a later issue.

Availability of a Proposed ALPO Constitution. During the 1973 Business Meeting of the ALP0 a committee was formed, with Dr . John E. Westfall as Chairman, to draft a possible Constitution for the ALPO. Dr. Westfall and his helpers did so, and a number of copies were distributed to those persons present at our 1974 Convention with the W.A.A. in Los Angeles on August 9, 10, and 11. However, no definitive action was taken. Interested persons are invited to write

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to John E. Westfall, 2775-39th Ave., San Francisco, Calif. 94116 for a copy of the proposed Constitution, which will be considered at the 1975 Convention in the San Francisco area. There should be provided a return, stamped, self-addressed envelope. The proposed Constitution fills 14 typed pages, and its weight is between two and three ounces.

Appreciation to Mrs. Mary Horton. Since the middle 1960 's the typing of the pages of this journal for the publisher and related tasks have been carried out by Mrs. Mary Horton of Las Cruces, New Mexico. She has recently felt obliged to give up doing so. The Editor would here like to express his belated appreciation to Mrs. Horton for her carefulness in typing technical work, her patience with his highly irregular working habits, and her unfailing and cheerful cooperation in every way. He is sorry to see the end of what has been a singularly pleasant business relationship. In truth, our whole membership owe her a debt of gratitude.

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