The Strolling Astronomer

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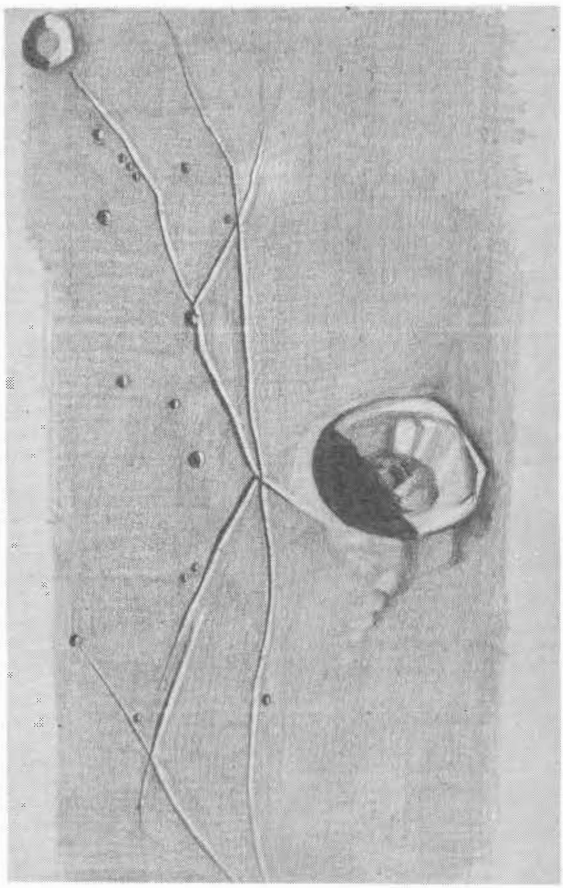

Lunar Crater Triesnecker and System of Clefts to its West. Drawing by Charles M. Cyrus on July 21, 1961, 0 hrs., 55 mins., to 1 hr., 45 mins., Universal Time. 10-inch reflector, 316X, seeing 6, transparency 4. Colongitude 8.4 degrees (low morning lighting).

THE STROLLING ASTRONOMER

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ASSOCIATION OF LUNAR & PLANETARY OBSERVERS

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IN THIS ISSUE

VENUS SECTION NOTES FOR 1962

By: William K. Hartmann

I. Introduction

Another evening apparition of Venus is upon us, with dichotomy scheduled for the end of August, 1962. The interest in Venus during the evening apparition of 1960-61 leads me to believe that there is a chance for quite useful work to be done this year. We have large numbers of observers, including a few with rather sophisticated equipment. Although, as is usual in A.L.P.O. observing, a large fraction of the contributors are beginners, it is hoped that these members will decide now to make quality more important than quantity. To realize our potentialities, we need some sort of coordinated program.

II. Goals

What are the most important questions which we may help to answer? I think these include:

A. Can real markings be seen visually?
B. Is there a correlation between markings recorded visually and those recorded photographically at short wavelengths (blue and ultraviolet)?
C. Do the markings vary in prominence?
D. What is the nature of the ashen light?
E. When is dichotomy observed to occur?

III. Venus Section Observing Programs

A. Confirmation of visual detail. This program requires large numbers of observations made simultaneously but independently, with a later analysis being made for correlation. Therefore, we ask observers to follow this schedule:

Times for Venus Observations: 1962

1st priority: Saturday afternoons or evenings.
2nd priority: Friday or Sunday afternoons or evenings.

Anyone who plans to observe Venus at all should concentrate his efforts in this Friday P.M. to Sunday P.M. period. This emphasis is a radical departure from the traditional hit or miss methods but should considerably improve chances for meaningful analyses. For details of observations to be made at these times, see below.

B. Correlation of visual and photographic detail.

1. Photographic: Perhaps the most important work that can be done on Venus with a well-mounted telescope of greater than, say, eight inches in aperture is photography in the blue or ultraviolet (where markings are often recorded). Although the optimum period for photography each night is short due to sky light and poor seeing, the A.L.P.O. with its wide distribution in longitude could provide very valuable records over a period of several hours, perhaps revealing shifts (rotational or otherwise) in markings. I think that anyone with a little experience in planetary photography will not find short-wave Venus work too difficult.[1,2,3] Blue or ultraviolet filters will be needed (see Kodak Catalogue or Fish-Schurman Corp. ads in recent Sky and Telescopes). We will want large enough image sizes to avoid confusion of detail with grain patterns, implying eyepiece projection or a Barlow Lens. However, note that glass lenses in the system must be minimized in order to prevent excessive U.V. absorption. A friend of mine and I arranged a system of fair capability last summer using an ultraviolet filter and eyepiece projection upon 35mm. Plus X film. Image size was about 3mms. on a 12½-inch f7 reflector. I strongly urge anyone with experience along these lines to make them his major work on Venus this year. Preference should be

given to the observation times above, but daily photographic coverage of good quality would be of exceptional value. Observations submitted should consist of a good negative plus a shaded drawing showing what the observer thinks the negative shows. Wavelength intervals transmitted by the filter system should also be included. Visual observations made along with the photographs would likewise be useful.

2. Visual: To those who lack the equipment for the photographic work will go the task of providing most of the visual observations. These will consist of the usual drawings and notes (see also below). While the traditional A.L.P.O. policy has been not to dictate drawings styles, let me mention that drawings made in a rough, overly contrasty manner invariably produce unfavorable impressions in onlookers. (This opinion is based on experiences in showing the Venus Section files to others.) Some of my own drawings reproduced in the 1959 report (Str. A., Vol. 16, p. 9), for example, tend to be in error in this way. Liberal smudging to produce dusky tones, preferably with an artist's stump, and erasure to produce light areas is beneficial in making realistic Venus sketches.

C. Variations in prominence of markings. The observing schedule above is very well suited to the study of this problem, provided that observers give clear records of the prominence of what they see. Thus it is requested that: (1) any markings be given conspicuousness ratings[4], and (2), each observation be accompanied by a written comment as to whether the markings were, in the observer's experience, of exceptional, average, or less than average prominence.

D. Ashen light. Each observation should be accompanied by a written comment stating whether the dark side was brighter than, the same intensity as, or darker than, the background sky. If any anomaly is observed, it should be very clearly described in writing. It will be important here to follow Venus in the last months of 1962 through the thin crescent phase, since ashen light or illuminated atmosphere observations are then most likely.

E. Dichotomy. As the terminator begins to straighten, each observer should note whether it is convex, straight, or concave in his written remarks. Observers securing a good series of observations near dichotomy should make estimates of the date of that event. Daily observations are extremely desirable here.

IV. Final Notes

A. Since the A.L.P.O. now uses a stellar magnitude scale for transparency estimates, the sign and the abbreviation "mag." should be added to each estimate to show clearly that the new system is being used. (E.g., T= +5 mag.)

B. The most reasonable use of our intensity scale as it is now defined (0=sky black, 10=brightest) is to let a value of, say, 9.0 be the mean surface brightness. Typical estimates then range from about 8.5 to 9.5. The low end of the scale must be preserved in the Venus Section for the ashen light. Thus +0.5 is a substantial glow, and -0.5 is darker than the sky background.

C. Venus Section forms are available from the Recorder.

References

1. Ross, Frank E., "Photographs of Venus," Ap. J., 68, 57, 1928. (The classic U.V. photos.)
2. Smith, Bradford A., "Venus in the Ultraviolet," Str. A., 13, 91, 1959. (Description of U.V. photographic technique.)
3. Eastman, F. Jack, Jr., "A Planetary Camera for a 12½-inch Telescope," Str. A., 15, 149, 1961. (Recent description of planetary photographic technique.)
4. Hartmann, William K., "Current Venus Section Projects," Str. A., 14, 186, 1960. (Defines conspicuousness scale.)
5. "A New A.L.P.O. Transparency Scale," Str. A., 16, 40, 1962.

NOTE ON COMET HUMASON, 1961e

By: David D. Meisel, Comets Recorder

This object is now becoming available for detailed observation. The Comets Section is very desirous of obtaining a long series of photometric and photographic observations for correlation studies with solar activity. The object should be visible in small instruments and is well placed for southern observers. The following ephemeris is provided from Marsden's elements.

Date 1962		Position R.A.	Dec.	Distance Geocentric Δ	Distance Heliocentric r	Stellar Magnitude
June	15	$0^h\ 05^m.64$	$+\ 5^\circ\ 22'.5$			
	25	0 02.17	+ 4 06.2	2.668	2.866	8.2
July	5	23 55.52	+ 2 16.4			
	15	23 44.60	- 0 18.8	2.128	2.725	7.5
	25	23 27.98	- 3 54.0			
Aug.	4	23 04.07	- 8 40.7	1.682	2.593	6.8
	14	22 31.66	-14 34.6			
	24	21 51.25	-20 57.5	1.471	2.472	6.2
Sept.	3	21 06.40	-26 41.9			
	13	20 23.06	-30 55.3	1.588	2.366	6.2
	23	19 46.32	-33 33.1			
Oct.	3	19 18.13	-35 02.3	1.926	2.276	6.5
	13	18 57.94	-35 51.8			
	23	18 44.22	-36 21.7	2.323	2.205	6.8
Nov.	2	18 35.39	-36 43.4			
	12	18 30.16	-37 03.1	2.678	2.157	7.0
	22	18 27.53	-37 24.3			
Dec.	2	18 26.73	-37 48.8	2.933	2.134	7.1

It is hoped that all A.L.P.O. observers will attempt observations of this unusual object. Reports may be submitted to the Comets Section during or after the observing period.

REPORT ON DR. K. KORDYLEWSKI'S "CLOUD SATELLITES:" A NEGATIVE OBSERVATION OF THE L 4 POSITION

By: Richard G. Hodgson

News of the alleged discovery of faint satellite clouds revolving around the Earth in the Moon's orbit, approximately at the libration points (60° ahead of and also 60° behind the Moon) by Dr. K. Kordylewski of Crakow Observatory, Poland, first came to my attention through a brief announcement in Sky and Telescope magazine, Vol. XXII, No. 1 (July, 1961), p. 10. This was followed by a more detailed report in the same magazine in Vol. XXII, No. 2 (August, 1961), p. 63f, and a note by G. Fielder in The Journal of the British Astronomical Association, Vol. 72, No. 1 (1962), p. 48. Dr. Kordylewsi claims discovery of two faint clouds near the L 5 point, 60° behind the Moon in its orbit. These he reports were visible to the naked eye on very dark, clear nights, and were first photographed early in 1961. He suspects that there may be also a cloud or clouds of satellites at the L 4 position, 60° ahead of the Moon in its orbit.

The first opportunity to observe the L 4 position favorably in the northern hemisphere was on October 18, 19, and 20, 1961. Unfortunately for me, clouds prevented observation on October 18 and 20; but I was afforded a very good opportunity to search the L 4 position on October 19, from 5^h30^m to 5^h50^m U.T. on Pigeon Hill (alt. 180 ft.), Rockport, Massachusetts. Seeing was very good (7 on a scale of 10); transparency was good to very good

(3 to 4 on a scale of 5). The area was quite dark, and in the country, away from city lights. After the Moon had set, I began to search Pisces, particularly the vicinity of ν Piscium, with 7 x 50 binoculars and with the naked eye. The search was carefully extended at least 15° and up to 20° in every direction from the L 4 position. The whole area was swept completely several times. There was no evidence of any clouds or whitish patches.

From this observation I conclude that if there is a cloud or clouds of satellites at or near the L 4 position, it or they must be quite faint, and well below the threshold of naked eye visibility.

I await with interest knowledge of any other observations of the L 4 and L 5 positions.

ADDITIONAL DRAWINGS AND PHOTOGRAPHS OF JUPITER IN 1961

Mr. Philip R. Glaser, the Jupiter Recorder, supplied a large number of drawings of the Giant Planet to illustrate his article "Jupiter in 1961--Part II" on pp. 89-95 of our March-April, 1962 issue. Unfortunately, space was not available to publish most of them in that issue. We accordingly present in this present issue five full pages of Jupiter drawings, pages 101 to 105, inclusive. While we greatly regret this separation of text and illustrations, we still urge all students of Jupiter to study this material with some care; it will illustrate many of the points discussed in the two earlier articles about Jupiter in 1961.

We also publish on this page several photographs of Jupiter by Mr. Glaser. It must be appreciated that there is invariably some loss of photographic detail in reproduction.

Our Jupiter Recorders, Messrs. Glaser and Reese, urge all Jupiter observers who have not yet done so to begin systematic studies of Jupiter as soon as they can.

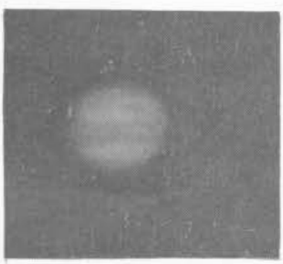


FIGURE 30.* Photograph of Jupiter with an 8-inch reflector by Philip R. Glaser. August 11, 1961. $4^h 35^m$, U.T. C.M.$_1$=299°. C.M.$_2$=346°. Note Red Spot and dark spots to its south.

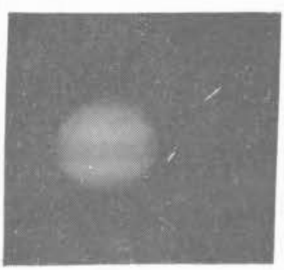


FIGURE 31.* Photograph of Jupiter with an 8-inch reflector by Philip R. Glaser. August 17, 1961. $3^h 36^m$, U.T. C.M.$_1$=131°. C.M.$_2$=132°. Note STeZ bright oval BC and much darker section of STB.

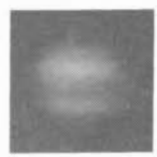


FIGURE 32.* Photograph of Jupiter with an 8-inch reflector by Philip R. Glaser. September 16, 1961. $1^h 45^m$, U.T. C.M.$_1$=120°. C.M.$_2$=253°. Note bright bay on north edge of NEB.

While recognizing that photographs of the quality of the originals of Figures 30, 31, and 32 are of limited scientific value, Mr. Glaser also stresses that such photographs are extremely helpful to him in the analysis of Jupiter Section visual data.

*These numbers are in sequence after Figures 1 to 29 on pages 101-105.

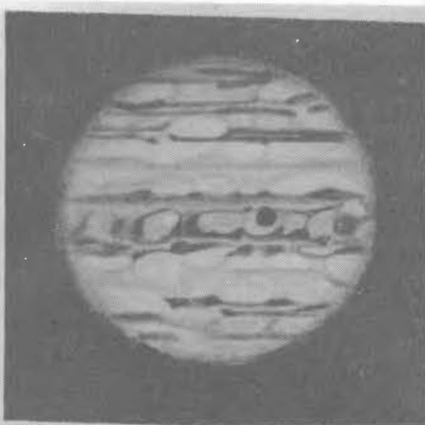


FIGURE 1. Jupiter. Clark Chapman. 10" refl. Aug 17,1961. 3^h 33^m U.T. C.M.I=129°. C.M.II=130°. Note BC & dark sect. STB;EB; JI shadow.

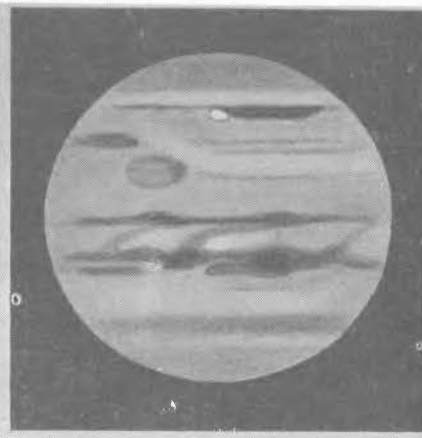


FIGURE 2. Jupiter. William K. Hartmann. 12½" refl. Aug. 6,1961. 6^h 45^m U.T. C.M.I=308°. C.M.II= 32°. Note EZsB proj. FA & RS.

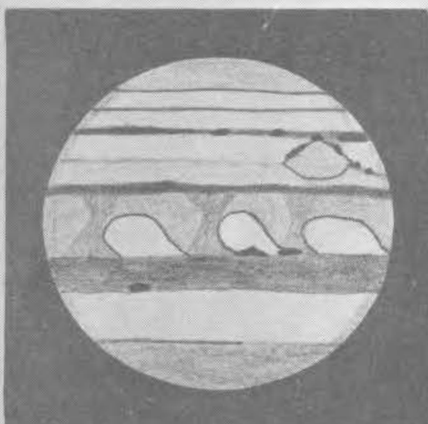


FIGURE 3. Phillip W. Budine. 4" refr. Aug. 4,1961. 3^h 45^m U.T. C.M.I=242°. C.M.II=343°. Note dark spots on RS following shoulder.

FIGURE 4. Jupiter. Joseph P.Vitous. Sept. 2,1961. 8" refl. 1^h 47^m U.T. C.M.I= 71°. C.M.II= 311°.Note FA passing RS & preceded by DE.

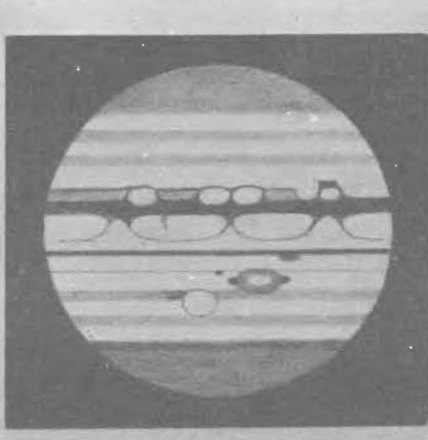


FIGURE 5. Jupiter. Carlos E. Rost. 6" refl. Sept.7,1961. 1^h 33^m U.T. C.M.I=145°. C.M.II=346°. North is at top. Preceding direction to left.

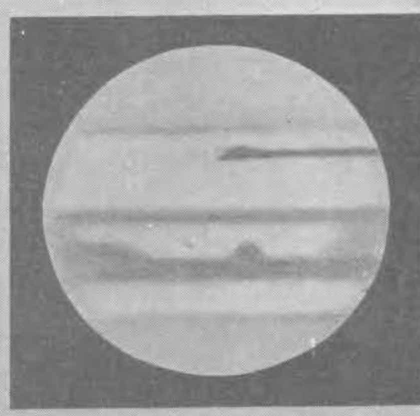


FIGURE 6. José Olivarez. 2.4" refr. Aug. 29,1961. 3^h 24^m U.T. C.M.I= 219°. C.M.II=129°. Note STB dark section.

FIGURE 7. David Meisel. 6" refl. June 14,1961. 7^h 35^m U.T. C.M.I=245°. C.M.II=11°. Note FA before conjunction with RS. Light RS interior.

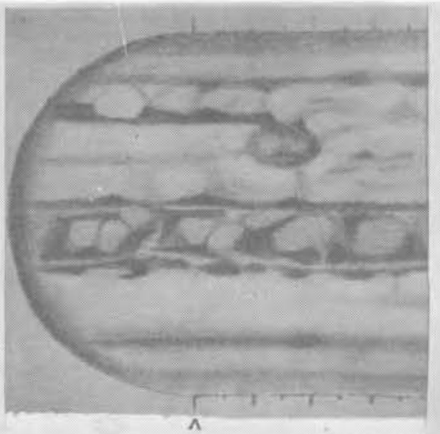


FIGURE 8. Clark Chapman. 10" refl. July 30,1961. 4^h 20^m U.T. C.M.I=194°. C.M.II=332°(start). Note FA over RS. EZ detail.

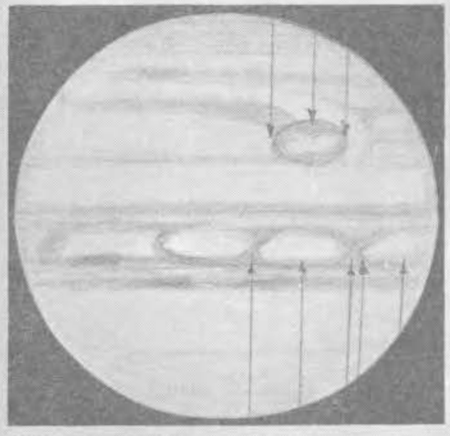


FIGURE 9. Jupiter. Charles M. Cyrus. 10" refl. Aug. 4,1961. 3^h 28^m U.T. C.M.I=232°. C.M.II=332°. Arrows indicate points of transits obtained.

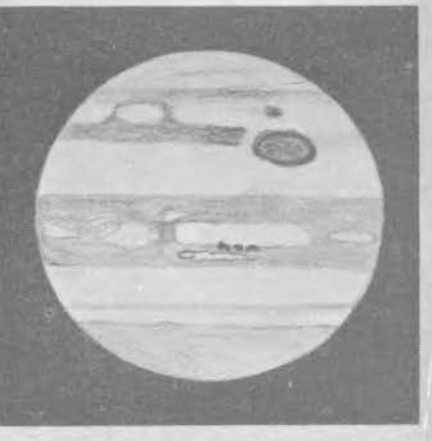
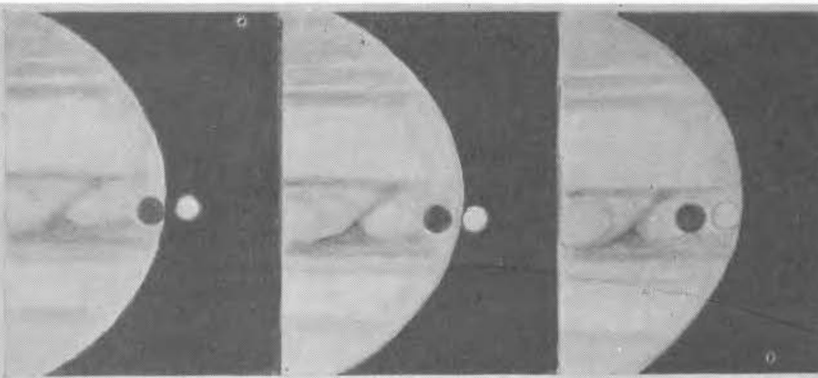


FIGURE 10. Jupiter. Harry Jamieson. 10" refl. Aug.11,1961. 4^h 40^m U.T. C.M.I=302°. C.M.II=349°. Note DE & dark RS border.

FIGURE 11. Charles L. Ricker. 6" refl. Aug. 16,1961. 3^h 13^m U.T. C.M.I=319°. C.M.II=328°. Note EZsB projection.

FIGURE 12. Jupiter. Charles H. Giffen. 12" refr. Aug. 30,1961. 6^h 10^m U.T. C.M.I=118°. C.M.II=19°. Note EB; JIII shadow.



05:06 U.T. 05:10 U.T. 05:15 U.T.

FIGURE 13. Klaus R. Brasch. 8" refl. July 22, 1961. JII and shadow enter transit near date of opposition.

FIGURE 14. William K. Hartmann 12½" refl. Sept. 2,1961. 4^h 45^m U.T. C.M.I=180°, C.M.II=59°. Note JIV in transit. Not shadow.

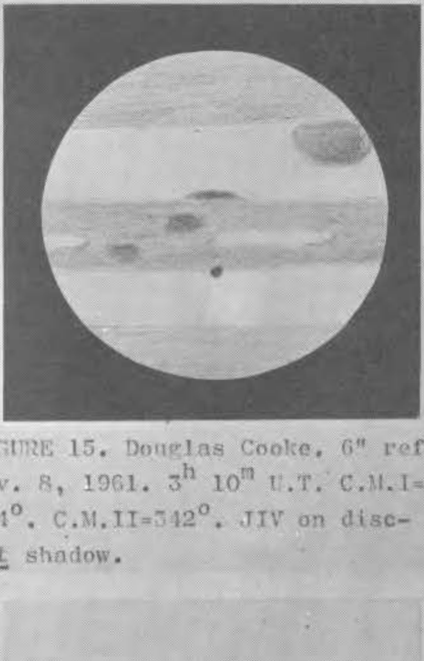


FIGURE 15. Douglas Cooke. 6" refl. Nov. 8, 1961. 3^h 10^m U.T. C.M.I=254°. C.M.II=342°. JIV on disc-not shadow.

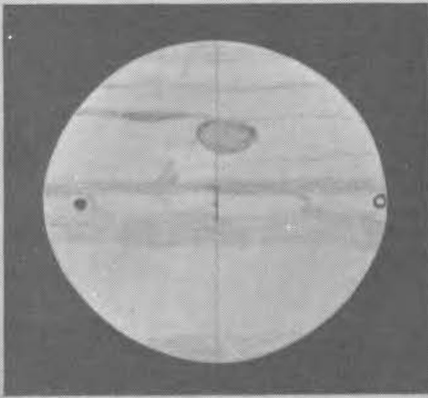


FIGURE 16. S. W. Bieda. 6" refl. Aug.30, 1961. 5^h 40^m U.T. C.M.I=100°. C.M.II=1°. JIII shadow & JII on disc.

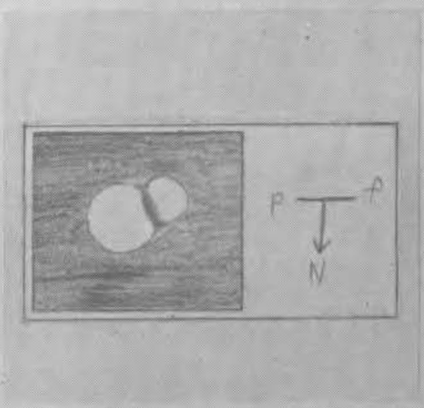


FIGURE 17. Craig L. Johnson. 7½" refr. Aug. 29,1961. 7^h 10^m U.T. Occultation JII by JIII. 4th contact.

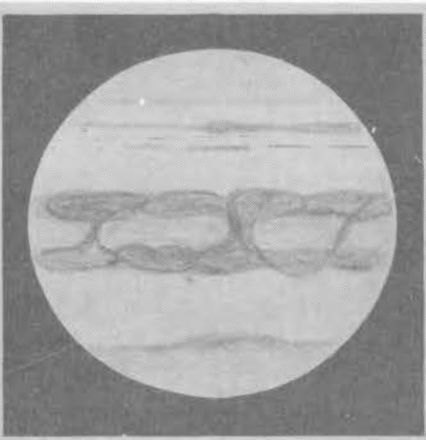


FIGURE 18. Jupiter. Jean Paul Boudreault. 5" refr. Aug. 24, 1961. 2^h 15^m U.T. C.M.I=107°. C.M.II=55°.

FIGURE 19. Jupiter. Jean Dragesco. 10" refl. July 23, 1961. 23^h 20^m U.T. C.M.I=143°. C.M.II=328°. Note JII just before eclipse.

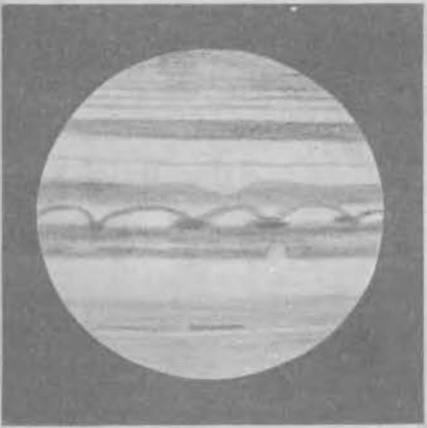


FIGURE 20. Jupiter. Jack Hills. 8" refl. Aug 17, 1961. 6^h 3^m U.T. C.M.I= 220°. C.M.II=221°. Note belts south of STB.

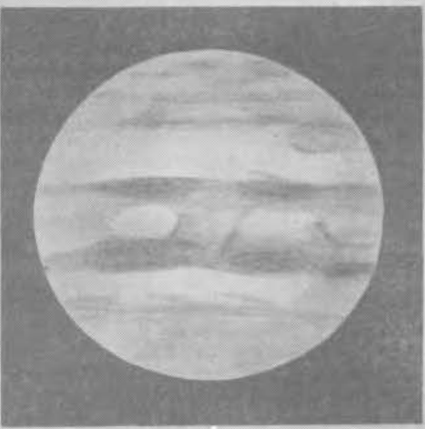


FIGURE 21. Jupiter. Anthony Sunseri. 4" refl. July 29, 1961. 8^h 23^m U.T. C.M.I=184°. C.M.II= 329°.

FIGURE 22. Jupiter. René Doucet. 5" refr. Sept. 17, 1961. 23^h 40^m U.T. C.M.I= 0°. C.M.II= 118°. RC & JI sh.

FIGURE 23. Jupiter. Joel Goodman. 10" refl. July 9, 1961. 8^h 25^m U.T. C.M.I=284°. C.M.II=202°. Note EB.

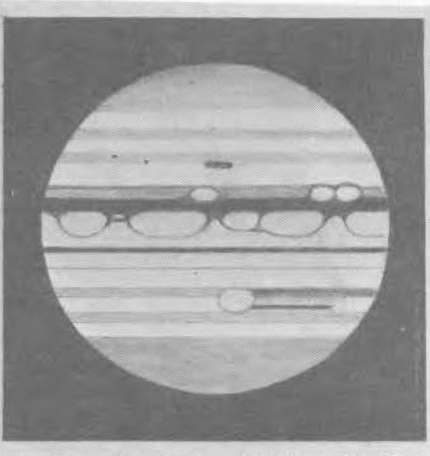


FIGURE 24. Jupiter. Carlos E. Rost. 6" refl. Aug. 8, 1961. 1^h 9^m U.T. C.M.I=59°. C.M.II=130°. Note BC and NNTB rod. Same orientation as Fig. 5.

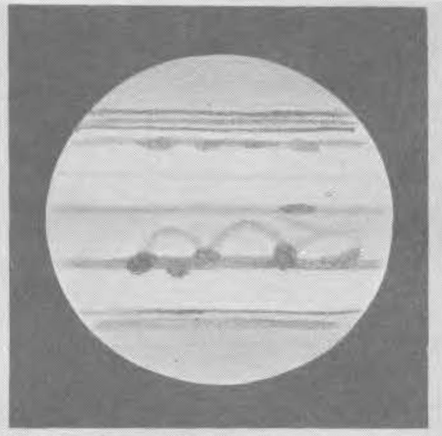


FIGURE 25. Jupiter. Gary Wegner. 10" refl. March 27, 1961. 13^h 34^m U.T. C.M.I=227°. C.M.II=236°.

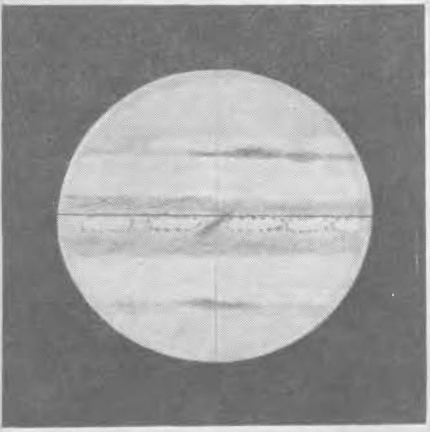


FIGURE 26. Jupiter. Stephen Zuzze. 8" refl. Aug. 15, 1961. 2^h 3^m U.T. C.M.I=118°. C.M.II=135°. Note BC & STB dark section.

FIGURE 27. Jupiter. Dick Fennelly. July 1, 1961. 7^h 5^m U.T. BC near preceding limb. C.M. I = 31.° C.M. II = 30.°

FIGURE 28. Jupiter. Gil Bisjak. 6" refl. July 30, 1961. 5^h 58^m U.T. Note lack of detail following RS. C.M. I = 253°. C.M. II =31°.

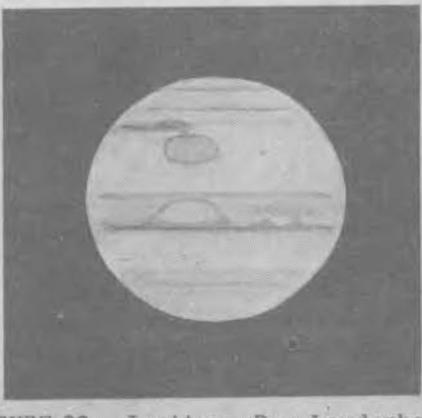


FIGURE 29. Jupiter. Don Louderback. 8" refl. Aug. 6, 1961. 6^h 25^m U.T. C.M.I=296°. C.M.II=30°, C.M. II = 20°.

VENUS SECTION REPORT: EASTERN APPARITION, 1960-1961. PARTS 1-5.

By: William K. Hartmann

Part 1: Observers and Observations

Thanks are due to the following observers who gathered the data on which this report is based:

Larry Anthenien, 3" & 6" refls., 1725 Hicks Ave., San Jose 25, Calif.

James C. Bartlett, Jr., 4¼" & 5" refls., 300 N. Eutaw St., Baltimore 1, Md.

Alan Binder, 4.1" refl., Lunar & Planetary Laboratory, University of Arizona, Tucson, Arizona.

Gilford Bisjak, Jr., 6" refl., P.O. Box 121, Chino Valley, Arizona.

Jack Borde, 6" refl., 4135 Pickwick Dr., Concord, Calif.

Klaus R. Brasch, 6" refr., 8" refl., 224 Montée Sanche, Rosemere, Quebec, Canada.

Clark Chapman, 10" refl., 2343 Kensington Ave., Buffalo 26, N.Y.

Clarion Cochran, 8" refr., 5095 Kenmore Dr., Concord, Calif.

Tom C. Constanten, 3¼" refr., 1650 Michael Way, Las Vegas, Nevada.

Thomas A. Cragg, 12" refl., 246 W. Beach Ave., Inglewood 3, Calif.

Lewis Dewart, 6" refl., 425 State St., Sunbury, Pa.

Louis R. Duchow, 6" refr., 224 Montée Sanche, Rosemere, Quebec, Canada.

Jack Eastman, Jr., 12½" refl., 747 26th St., Manhattan Beach, Calif.

Stanley Emig, 10" refl., Route 1, Leavenworth, Wash.

Stuart Emig, 10" refl., Route 1, Leavenworth, Wash.

Vincent H. Favalora, 4" refl., 804 Home St., Elmont, N.Y.

Geoffrey Gaherty, Jr., 6" refr., 8" refl., 636 Sydenham Ave., Montreal 6, Quebec, Canada.

William K. Hartmann, 6" refr., 8" refl., 1025 Manor Road, New Kensington, Pa.

Earl F. Hicks, 5" refr., Reed Point, Montana.

Harry D. Jamieson, 10" refl., 1222 19th St., Rock Island, Ill.

Craig L. Johnson, 4" refl., 5¼" & 10½" refrs., 765 S. 46th, Boulder, Colo.

George Lovi, 7" refr., 14 Eleventh St., Lakewood, New Jersey.

James V. Marshall, 2.4" refr., 1211 W. Smith, Odessa, Texas.

Dennis Milon, 8" refl., 2110 Huldy, Houston 19, Texas.

José Olivarez, 2.4" refr., 804 St. Marie, Mission, Texas.

Constantine Papacosmas, 6" refr., 3260 Barclay Ave., Apt. 11, Montreal 26, Quebec, Canada.

Owen C. Ranck, 4" refr., 112 Broadway, Milton, Pa.

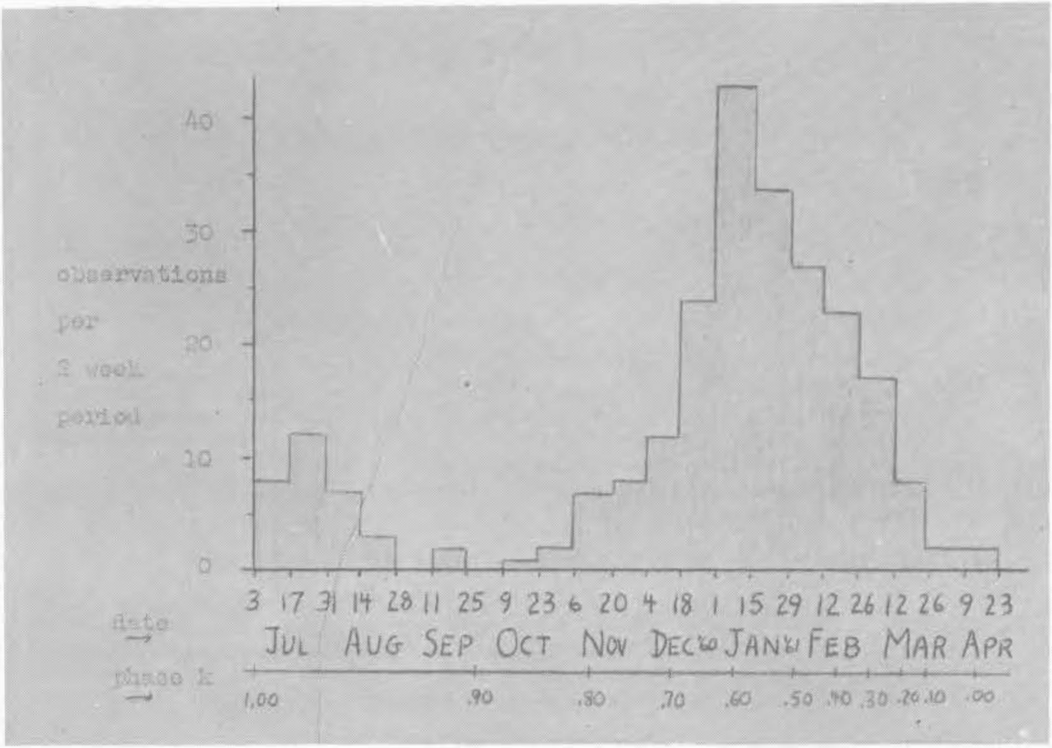


FIGURE 33* Frequency of A.L.P.O. Venus Observations, Eastern Apparition, 1960-61.

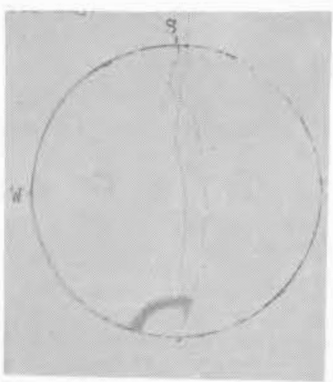


FIGURE 34a. January 3, 1961. $0^h\ 12^m$, U.T. 4" refl., 167X. S=6, T=4-3/4. William J. Westbrooke. Dotted line shows observed terminator deformation.

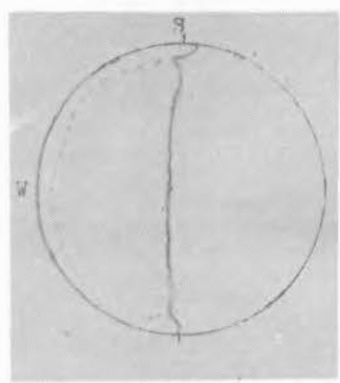


FIGURE 34b. February 5, 1961. $22^h\ 39^m$, U.T. 4¼" refl., 120X, 240X. S=6, T=5. James C. Bartlett, Jr.

FIGURE 34. Drawings of Venus showing no dusky markings outside of cusp areas.

*Mr. Hartmann urges that similar frequency diagrams be given in published Reports of other A.L.P.O. Sections, especially on Mars and Jupiter.

L. J. Robinson, 10" refl., 1411 Amapola Ave., Torrance, Calif.

Minick Rushton, 6", 8" & 30" refls., 1133 Hancock Dr., Atlanta 6, Ga.

Takeshi Sato, 10" refl., Rakurakuen Planetarium, Itsukaichi, Hiroshima, Japan.

Richards F. Tompkins, 8" refl., 1911 Lambert Rd., Baederwood, Pa.

George Wedge, 6" refr., 3821 Mackenzie St., Montreal 26, Quebec, Canada.

Gary Wegner, 10" refl., 9309 N.E. 191st St., Bothell, Wash.

William J. Westbrooke, 4" refl., 4525 Lincoln Way, San Francisco 22, Calif.

David B. Williams, 3" & 4¼" refls., 714 Dale St., Normal, Illinois.

Over two hundred visual observations have been received. The histogram in Figure 33 shows the distribution in time of 242 Venus observations by A.L.P.O. members during this apparition. Craig L. Johnson is responsible for the early series covering from phase parameter k = 1.0 to 0.9 in the summer of 1960. A maximum of observational coverage was reached shortly before the time of dichotomy.

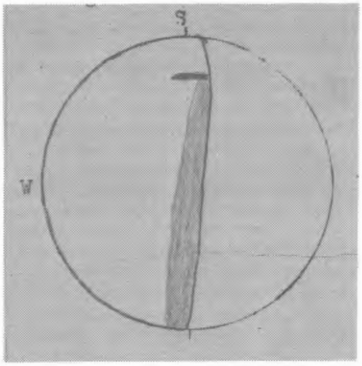
Part 2: Markings on the Disk, Exclusive of Cusp Areas

Two experienced observers wrote that the dusky markings seemed unusually difficult during this evening apparition. Thomas A. Cragg wrote on Jan. 23, 1961, "This apparition so far has found Venus as devoid of detail as I ever remember seeing (back to 1948)." James C. Bartlett, Jr., on Feb. 5, 1961, wrote, "...it has seemed to me that markings on Venus have been very scarce this apparition."

Experiences on the conspicuousness of the markings have varied, however. The recently proposed 0 to 10 conspicuousness scale was used by a few observers. Cragg writes that "...what few vague dusky patches I've seen could never be rated better than 3!" The Recorder generally put the conspicuousnesses at about 3 and 4. Clark Chapman and William J. Westbrooke gave generally intermediate values. Craig L. Johnson usually rated markings above 5, once (Feb. 1, 1961) recording, "General conspicuousness nearly 10 after using both 'scopes" (a 4-inch and a 10½-inch); likewise, José Olivarez often reported high conspicuousnesses of 5 to 10. Observers are strongly urged to use this conspicuousness scale to describe the visibility of the markings so that we may learn more about how plain they appear to be. The scale is described in Str. A., 14, Nos. 11-12, p. 187, 1960.

That at least a portion of the typical dusky detail is subjective is suggested by the experience of some observers. In his notes for August 13, 1960, Johnson writes "...while the markings on the other planets grow less intense with worse seeing, Venus' seem to do the opposite! In other words, are the Cytherean markings spurious only?" This sort of behavior of the markings has been suspected on occasion by the Recorder. Furthermore, along the same lines, Bartlett observed Venus under very good conditions (S=8, T=5) on Feb. 27, 1961, and wrote, "It is perhaps ironical that this evening should have provided one of the most beautiful images of Venus I have ever enjoyed--except that there was nothing to see." But, on the other hand, as we shall see in a later part of this report, there are several cases at hand where dusky markings seem to be confirmed by independent observers. Thus, perhaps not all of the dusky detail is subjective.

A study of 213 drawings from July 2, 1960 (k = .999) to March 25, 1961 (k = .101) gives the following rough breakdown of percentages of observations showing various sorts of features.



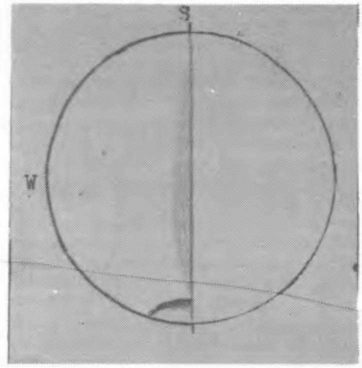
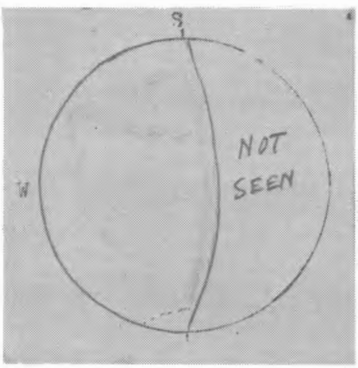


FIGURE 35a. January 19, 1961. 2^h 00^m, U.T. 8-inch refl., 168X. S=5-6. T=1. Stanley and Stuart Emig.

FIGURE 35b. January 28, 1961. 22^h 20^m, U.T. $4\frac{1}{4}$" refl., 120X, 240X, S=3, T=3. James C. Bartlett, Jr.

FIGURE 35. Drawings of Venus showing terminator shading.



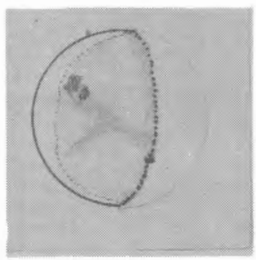


FIGURE 36b. December 6, 1960. 01^h 10^m, U.T. 10" refl., 241X, S=6±, T=4 to 2. Gary Wegner.

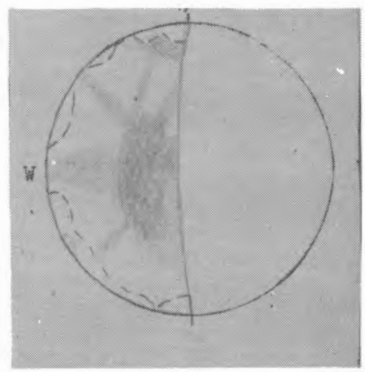


FIGURE 36a. November 19, 1960. 22^h 10^m, U.T. 4" refr., 120X, S=4, T=4. Owen C. Ranck.

FIGURE 36 c. January 30, 1961. 23^h 35^m, U.T. 4" refl., 135X. S=5-6, T=5. Craig L. Johnson.

FIGURE 36. Drawings of Venus showing radial patterns.

Table 1: Type of Dusky Markings, Exclusive of Cusp Bands vs. Frequency of Occurrence, k = .999 to k = .101.

Type of marking	Percentage of observations
No markings	8%
Terminator shading	16
Radial pattern	7
Band pattern	19
Streaky markings of any sort	51
Amorphous	59

Examples of each type of feature, as interpreted by the Recorder, are given in Figures 34 to 39. It can be seen that the radial patterns, which have been so often discussed, were here rarely recorded. However, as Bartlett reported for the 1957-58 apparition, streaky markings were common (Str. A., 14, Nos. 11-12, p. 173, 1960).

Bright areas are to be seen on many of the submitted drawings. Johnson shows numerous areas of intensity greater than the average for the disk. Larry Anthenien and others frequently show one or both cusp-caps stretched out along the limb, and a generally bright limb is often shown by many observers. Two near-coincident observations for Jan. 5, 1961, both show the often reported bright lobes on the limb (see Figure 40). These similar drawings appear to confirm, among other markings, one such area on the central west limb.

Part 3: Cusp Caps and Cusp Bands

The following approximate statistics summarize the observations of the cusp caps and bands. Also given are figures taken from Dr. Bartlett's 1958 studies. (Str. A., 12, Nos. 4-6, pp. 43-54, 1958; Str. A., 12, Nos. 10-12, pp. 123-135, 1958).

Table 2: Cusp Cap and Cusp Band Statistics, Percentage of Observations

	1960-61 apparition	1944-56 apparitions
South Cap Alone Visible	11%	11%
Both Caps Visible	42	35
North Cap Alone Visible	14	7
Neither Cap Visible	33	47
South Cap Larger	37	59
Caps Equal in Size	13	21
North Cap Larger	50	20
South Band Alone Visible	12	21
Both Bands Visible	13	12
North Band Alone Visible	10	4
Neither Band Visible	64	63

The following notes are relevant: (1) 212 observations were used for the 1960-61 results; 830 observations were used for the 1944-56 studies. (2) A cap was recorded as larger when it was the only one shown. (3) The concept of "Caps Equal in Size" may have been different to Bartlett as compared with the present Recorder. (4) Percentages giving relative size are based on the number of observations where one or both caps are visible; other percentages are based on all the observations.

The two sets of figures agree well, except that the north cap appears to have been unusually prominent in 1960-61. Note that occurrence of the north cap alone, a larger north cap, and the north band alone are all unusually frequent, while the frequency of a larger south cap and south band alone correspondingly decreases. It has been commonly reported that the south cap is usually the more prominent so that, in this instance at least, it seems that the observers have not been unduly influenced by the literature. From the evidence here it seems that the north cusp area of Venus has changed in some way from its usual state (one is tempted to say "has become more active," but this may be misleading), with a possible opposing change for the south cap. This possibility may bear further investigation.

Part 4: Ashen Light

Some of the more interesting and representative of the reported ashen light observations are summarized below.

Table 3: Ashen Light Observations

Date Time, U.T.	Phase k, Observer	Notes	Other Observations On Same Evening
1960, Dec. 4 01:36	.74 Westbrooke	First ashen light report; N. limb darker than sky.	none.

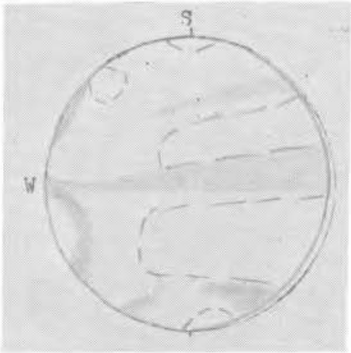


FIGURE 37a. July 23, 1960. $15^h\ 35^m$, U.T. 4" refl., 135X, S=up to 7, T=$4\frac{1}{2}$. Craig L. Johnson.

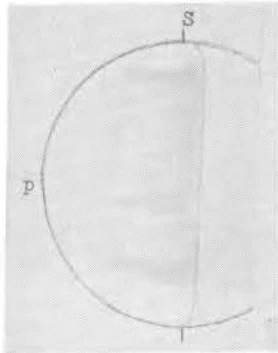


FIGURE 37b. Jan. 11, 1961. $21^h 10^m$-$21^h 40^m$, U.T. 8" refl., 165X. S=4-5, T=3. Klaus R. Brasch.

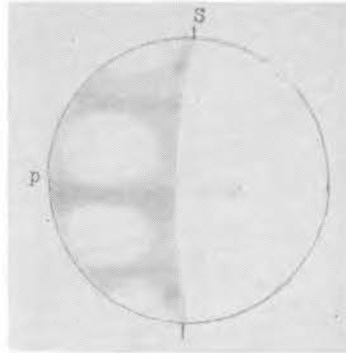
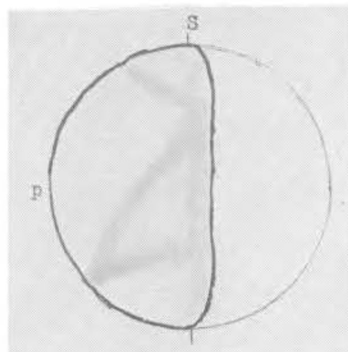


FIGURE 37c. Jan. 31, 1961. $20^h\ 50^m$, U.T. 6" refr., 220X. S=4-5, T=3. Constantine Papacosmas.

FIGURE 37. Drawings of Venus showing band patterns.

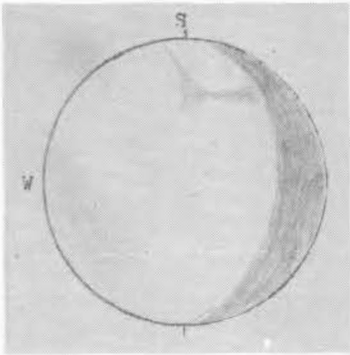


IGURE 38a. Nov. 19, 1960. $21^h\ 53^m$, .T. $4\frac{1}{4}$" refl., 120X, 240X. S=6, =4. James C. Bartlett, Jr. ote disagreement with 36a.

FIGURE 38b. Dec. 24, 1960. $17^h\ 52^m$, U.T. 6" refr., 150X. S=3-1, T=4. Geoffrey Gaherty, Jr.

IGURE 38. Drawings of Venus showing streaky markings.

Date, ime, U.T.	Phase k, Observer	Notes	Other Observations On Same Evening
.960, Dec. 21 23:00	.68 Olivarez	Lighter band adjacent to terminator.	1; doesn't confirm.
Dec. 30 00:21	.65 Anthenien	Lighter lune adjacent to terminator (Fig. 41).	2; 1 confirms, 1 doesn't.
Dec. 30 00:49	.65 Westbrooke	Glow in band adjacent to terminator (Fig. 41).	same as above.



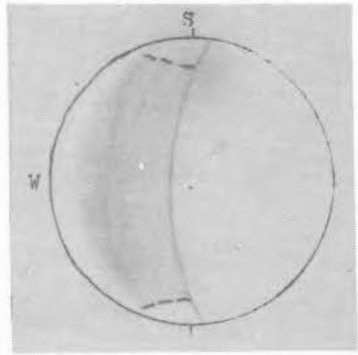
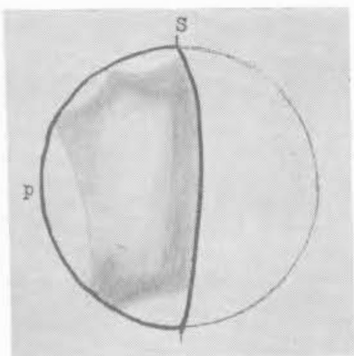


FIGURE 39a. Nov. 7, 1960. $20^h\ 04^m$, U.T. $3\frac{1}{4}''$ refr., 96X. S=7, T=5. Tom C. Constanten.

FIGURE 39b. March 2, 1961. $1^h\ 25^m$, U.T. 2.4" refr., 100X. S=3, T=4. José Olivarez.

FIGURE 39. Drawings of Venus showing amorphous markings.



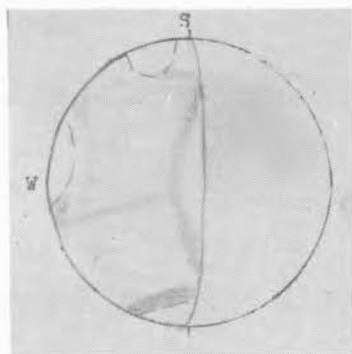
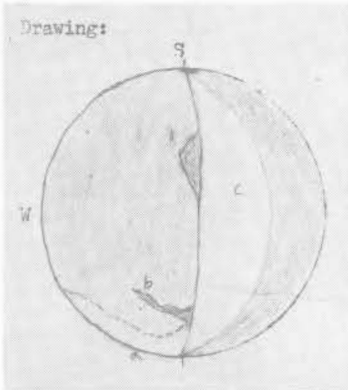


FIGURE 40a. Jan. 5, 1961. $22^h\ 00^m$, U.T. 8" refl., 180X. S=3, T=2-1. Geoffrey Gaherty, Jr.

FIGURE 40b. Jan. 5, 1961. $23^h\ 10^m$, U.T. 4" refl., 135X. S=5-7, T=5-. Craig L. Johnson.

FIGURE 40. Bright limb area recorded on Venus on Jan. 5, 1961. Bartlett also noted a bright limb band, brighter in red light, at $23^h\ 05^m$, U.T. on this same date. Johnson writes, "The darkest feature of the disk was the N. cap boundary collar...," a marking confirmed by Gaherty.

Date, Time, U.T.	Phase k, Observer	Notes	Other Observations On Same Evening
1961, Jan. 3 01:12	.63 Wegner	Glow along S. limb (Figure 42).	3; 1 confirms, 2 don't.
Jan. 3 01:14	.63 Johnson	Lighter grey mottling seen intermittenly for nearly 2 hours (Fig. 42).	same as above.



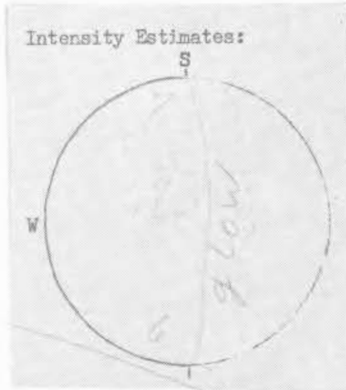
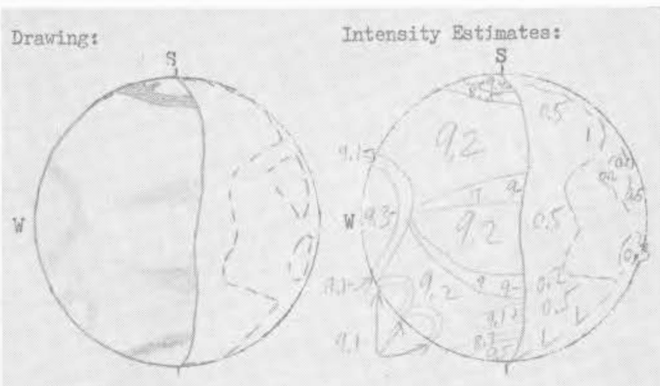


FIGURE 41a. Dec. 30, 1960. 00^h 21^m, U.T. 6" refl., 160X. S=7, T=?. Larry Anthenien.

FIGURE 41b. Dec. 30, 1960. 00^h 49^m, U.T. 4" refl., 167X. S=6, T=4½. William J. Westbrooke.

FIGURE 41. Independent ashen light Venus observations, Dec. 30, 1960.



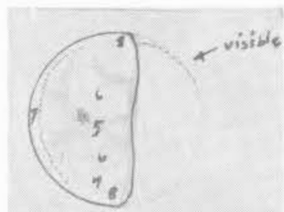


FIGURE 42b. Jan. 3, 1961. 01^h 12^m, U.T. 10" refl., 368X, Red filter. S=6+, T=5. Gary Wegner.

FIGURE 42a. Jan. 3, 1961. 00^h 20^m, U.T. 4" refl. 135X, 208X. S=6-7, T=4½. Craig L. Johnson.

FIGURE 42. Independent ashen light Venus observations, Jan. 3, 1961. Johnson recorded ashen light was "still evident", brighter than the sky from 01^h 10^m to 01^h 15^m. Note similarity in banded structure of dusky markings.

Date, Time, U.T.	Phase k, Observer	Notes	Other Observations On Same Evening
1961, Jan. 4 01:00	.63 Johnson	Irregular blue-grey area.	1; doesn't confirm.
Feb. 1 02:00	.50 Johnson	Irregular light areas suspected.	2; don't confirm.
Feb. 5 00:36	.48 Westbrooke	Night side "distinctly darker than sky".	2; don't confirm.

Date, Time, U.T.	Phase k, Observer	Notes	Other Observations On Same Evening
1961, Feb. 5 22:30	.47 Wedge	Lighter night side strongly suspected; intensity 0.5-1.0.	3; don't confirm.
Feb. 8 22:30	.45 Brasch	Dark side intensity 1.0-1.5; "well-visible."	none.
Feb. 10 01:05	.45 Johnson	Lighter silvery-grey lune, faintest near terminator, "rather strongly suspected."	none.
Feb. 13 00:27, 01:54	.43 Westbrooke	"dark portion distinctly seen against the sky" at 00:27; "very faint pink glow" at 01:54.	none.
Feb. 18 01:34, 02:10	.40 Westbrooke	Dark side projected against sky at 01:34; seen bright (intensity 1) at 02:10. Dark side projected.	2; don't confirm.
Feb. 20 00:58	.38 Westbrooke	Dark side projected.	4; don't confirm.
Feb. 20 23:45	.38 Lovi	Ashen light like earth-shine considered an optical (subjective) effect (Fig. 43).	1; confirms.
Feb. 21 00:30	.37 Bisjak	"Ashen light faintly visible", intensity 1, (Fig. 43).	same as above.
Mar. 11 03:20	.23 Anthenien	Lighter lune adjacent to terminator.	1; notes "No ashen light" at 00:48.
Mar. 11 17:45	.22 Gaherty	"Ashen light suspected."	3; 1 dark side proj., 2 don't confirm.
Mar. 12 02:06	.22 Westbrooke	"Dark side was seen projected."	3; 1 dark side glow, 2 don't confirm.
Mar. 12 22:30	.21 Brasch	"Ashen light over whole unilluminated surface," intensity 1.5.	2; don't confirm.
Mar. 17 00:50	.17 Rushton	"Ashen light seen relatively easily, conspicuousness 6."	1; doesn't confirm.
Apr. 3 18:30, 18:34	.03 Johnson	Lighter than sky at 18:30 changing to darker than sky by 18:34.	none.
Apr. 9 17:15	.01 Johnson	Two brighter patches.	1; doesn't confirm.

Besides these listed reports there were seven others of brightness of the unilluminated side on (rounded to nearest 0^h, U.T.) Dec. 9, Jan. 9, Jan. 13, Jan. 19, Feb. 3, Mar. 1, and Mar. 26, and one of projection on

Feb. 19 not described in detail. The earliest report is of dark side projection on Dec. 4, when k was .735. This value compares with the highest k values after superior conjunction for dark side projection in previous A.L.P.O. records, .701 by Bartlett in 1951, and several observations (some questioned) with k between .78 and .70 in 1957 (see Bartlett, Str. A., Vol. 14, Nos. 11-12, p. 169, 1960). Out of 230 observations with k less than .80, 27 (12%) report partial or complete glow of the dark side, and 8 (3%) report projection. A total of 32 (14%) indicate one or both phenomena (some observers reporting a transition during their observing period).

In the article mentioned above, Bartlett gave several multiple independent reports of ashen light on the same dates. During this apparition there were three cases of independent pairs of ashen light reports within one hour periods: (a) Anthenien-Westbrooke, Dec. 30, 1960, Fig. 41; (b) Johnson-Wegner, Jan. 3, 1961, Fig. 42; (c) Lovi-Bisjak, Feb. 20-21, 1961, Fig. 43. Cases (a) and (c) show surprisingly good agreement, with the two observers in each case reporting nearly identical forms for the ashen light. Another interesting case, (d), occurs on March 11-12, 1961, where we see four reports of dark side phenomena within 48 hours out of nine independent observations on the two night involved. Whether or not these observations show a real Venusian phenomenon cannot now be proven. Lovi reports that when the light crescent was moved just out of the field in his Feb. 20 observation, the ashen light "promptly disappeared," indicating an optical origin involving glare from the crescent. If the above observations are taken to describe real Venusian phenomena, then the fact that dark side projection is often reported close together in time with dark side glow, as on March 12, may indicate that the two phenomena are related. Baum, however, concluded the opposite, that dark side projection was a contrast effect while the glow was Venusian, in a 1956 paper (Baum, Str. A., 10, Nos. 1-2, pp. 11-13, 1956).

The ashen light is generally assumed, if real, to be akin to the terrestrial aurora or airglow. Thus it is of interest to look for solar-ashen light relationships. The writer tried several approaches to this problem with the above observations; and while some interesting possibilities turned up, nothing conclusive enough to be described in detail here was found. It is of interest to note, however, that cases (a) and (b) coincide with a rapid rise in sunspot numbers from 35 on Dec. 22 to 130 on Dec. 31 and back to 20 by Jan. 15, as based on the Zurich provisional mean relative sunspot numbers. More significant in discussions of the aurora are solar flares. Flare activity, based on the Fraunhofer Institute Daily Maps of the Sun, showed a weak rise and subsequent fall during this period. Diligent and careful observing with attention to the ashen light may supply the necessary data to draw some conclusions about the nature of this phenomenon.

Part 5: The Illuminated Atmosphere

Several observations of this phenomenon were made. Gilford Bisjak, Jr., reported it on March 2, 1961, at $1^h\ 10^m$, U.T. He writes, "Tonight I could just make out a ring of light encircling the planet." This observation was not confirmed by the one other observation available for this night, that of José Olivarez, observing 15 minutes after Bisjak. The phase value k for this date was 0.31, which seems unusually high for the illuminated atmosphere to be visible. On March 18, at $1^h\ 45^m$, U.T., Earl F. Hicks reports, "At one time I thought I could see a thin line of light encircling the dark part of the planet." Observing 47 minutes later, Larry Anthenien does not report this appearance. The value of k was .16. Craig L. Johnson reports cusp extension on April 3, at $18^h\ 40^m$, U.T. With moments of better seeing, the north cusp was extended about 75 to 80 degrees, the south cusp, about 50 degrees. The value of k was about .03. No other observations are available for that date.

A confirmed case of the illuminated atmosphere occurred on April 9, with two observations just over one hour apart. Geoffrey Gaherty (see Figure 44) reported the atmosphere as visible as a hairline all around the disk at $16^h\ 05^m$. At $17^h\ 15^m$, Johnson reported in his notes that the cusps

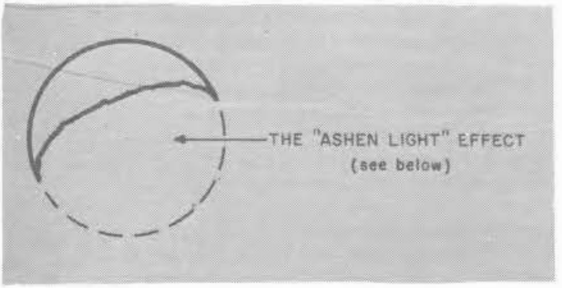


FIGURE 43a. Feb. 20, 1961. $23^h\ 45^m$, U.T.
7" refr., 315X, 525X. S=4-6, T=3.
George Lovi.

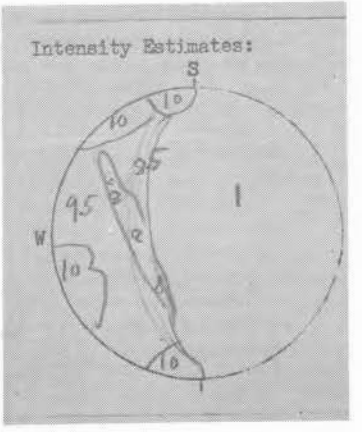


FIGURE 43b. Feb. 21, 1961. $00^h\ 30^m$, U.T. 6" refl., 150X. S=8, T=5.
Gilford Bisjak.

FIGURE 43. Independent ashen light observations, Feb. 20-21, 1961. Lovi regarded the appearance as due to optical effects. Both observers reported terminator irregularities.

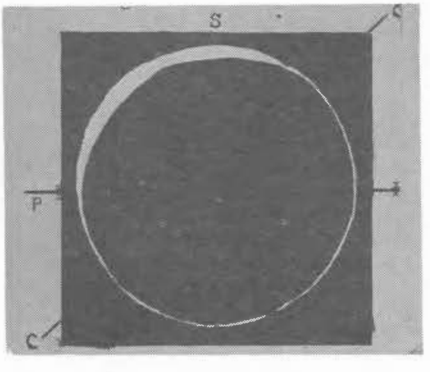


FIGURE 44 (to left). April 9, 1961. $16^h\ 05^m$, U.T. 8" refl., 90X. S=2, T=4-5. Geoffrey Gaherty, Jr.

The illuminated atmosphere of Venus.

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were greatly extended, with a possible full circle of light visible in moments of best seeing. These mutually confirmatory observations are the only ones available for the date involved.

This report will be concluded in several forthcoming parts in the next issue.

COMET BURNHAM 1959 k: FINAL REPORT, PART III. POSTPERIHELION PERIOD.

By: David D. Meisel, Comets Recorder

This observational report is a continuation of the report on Comet 1959k. Parts I and II have already been published (Str. A., Vol. 15, pp. 183-187, 1961), citing observers and references along with a short evaluation of the preperihelion material. Parts III and IV deal with the numerous postperihelion observations received. Part IV will deal with observations of special merit or interest. Because of space limitations many of the details of data reduction have been omitted from the following text. However, for those who wish a more detailed account of the current work on this object, three papers are now in preparation and will be published in other periodicals at a later date. Exact references to these papers will be published when known.

A. Determination of the Photometric Equations

According to the simple theory of comet illumination, the magnitude of a cometary object varies inversely as the square of the geocentric distance and inversely as the fourth power of the heliocentric distance. This formula is based on the assumption that the light is due entirely to ultraviolet secondary emission in the visible wavelengths. Empirically, it has been found that this law rarely holds over wide ranges of heliocentric distance. In terms of stellar magnitudes, the standard photometric equation is written:

$$m = m_0 + 2.5n \log r + 5 \log \Delta,$$

where r is the heliocentric distance in astronomical units, Δ is the geocentric distance in astronomical units, m_0 is a constant (to be determined from observation) corresponding to the unit distance magnitudes, and n is the index of variation, usually assumed to be a constant also derivable from observation. (This equation is written in logarithmic form as are all other magnitude equations in astronomy.)

In the attempt to find a least squares solution for the description of the brightness development of Comet Burnham 1959k, it was found that, in general, the value of the "constant" n obtained depended on the mean epoch of the observations rather than the interval length selected. This led to the conclusion that the value of n, in the case of Comet 1959k at least, was definitely not a constant, but increased steadily with increasing heliocentric distance. Without going into detail about how the form of the variation was actually determined, it was assumed finally that this variation with distance was expandable in a power series in r, the heliocentric distance. Neglecting second order terms, the photometric equation takes the form:

$$m = m_0 + 2.5n_0 r^b \log r + 5 \log \Delta,$$

where b is an additional constant to be determined, n_0 is the unit distance value of n, and the other symbols are as before. The assignment of variation to the n coefficient was a fairly lengthy process which will not be discussed here. Interested persons are referred to the paper now in preparation covering these details.

After the form was decided upon, a least squares analysis of the 170 available observations made between March 21, 1960, and May 19, 1960, gave the formula:

$$m = 8.5 + 15.6\, r^{0.41} \log r + 5 \log \Delta,$$

with the constants determined as:

$$\begin{aligned} m_0 &= 8.5 \pm 0.3 \\ n_0 &= 6.24 \pm 0.10 \\ b &= 0.41 \pm 0.05. \end{aligned}$$

The residuals of this fit compare favorably with those obtained using the standard equation piecewise over the entire interval. The maximum deviation found was $0^m.8$ occurring at the height of solar activity on May 4. The deviation of the standard equation covering the same interval was $1^m.4$ on the same date. Other least square determinations using the standard photometric equation have been published[1] but fail to describe the comet's behavior over the entire observational period. Likewise, the form called Lewin's formula[2] failed to reveal a satisfactory solution over the entire time interval. However, if one goes further into Lewin's work it is found that this formula is an approximation only. (See reference 2.) Without making approximations, Lewin's work leads to a variation of n with heliocentric distance of the form $n = n_0 r^{\frac{1}{2}}$. This result[3] obtained from theoretical considerations of the adsorption of gases of a comet by the solid material within the coma are in fair agreement with the results obtained empirically using the first order, power series approximation. The empirical formula gave b=0.41 while the theoretical formula gives b=0.50. The reasons for the difference are many and will not be detailed here. Suffice it to say that the real test of the empirical formula will be in its application to other comets. Of particular interest would be some dependence of the value of b on the perihelion distance of the object. Figure 45 shows the variation of visual magnitude with time (increasing heliocentric distance). The dotted line represents the brightness curve as observed. The solid lines indicate the least squares fits for various selected values of the constants b, n_0, and m_0.

B. Analysis of Photometric Fluctuations

Using the empirical formula set forth in the previous section as the standard mean of the comet brightness, it was possible to determine the fluctuations around this mean by an observed-minus-computed curve. This curve as found for the period of closest geocentric approach of the comet is shown in Figure 46. It may be seen from this figure that there were two definite variations superimposed upon the empirical least square fit curve. One, representing a slowly varying component, reached a maximum brightness value on May 4. This is shown by the "slow component" line. Other similar peaks were found outside the time interval specified. The mean period between these peaks of the slowly varying component was found to be 25.4 ± 0.6 days. A second component can be seen superimposed on the slowly varying component. Neither the period nor the duration of these rapidly varying components could be determined with any agreement. Hence it was concluded that they represented a random phenomenon. These short period variations were accepted as true variations only if sufficient observations were available to rule out the possibilities of random observer error. Five very short variation maxima were ruled out as due to error of estimation. However, eight maxima as numbered in Figure 46 were substantiated with some degree of certainty by comparison with published observations that were not available during the initial least squares determination. It should be pointed out in the figure that the brightness maxima occur for the greatest negative value of the (O-C) curve. The amplitude of the maxima are assumed to be accurate within the average observer deviation of $\pm 0^{m}.3$. With only a few exceptions, the slopes of the short term variations were nearly constant and were found to be between $0^{m}.03$ and $0^{m}.04$ change per hour of time. Changes with steeper slopes than this value were rejected. Variations of this type should be investigated in other objects using photoelectric detectors.

C. Physical Structure

During the preperihelion period, Comet Burnham 1959k exhibited a nearly spherical coma with two faint tails. After perihelion, the coma was definitely elliptical and the tail was not double, but only filamentary with extensive ray structure. In general, the maximum width of the tail was less than 1/50 its total length. However, this ratio was subject to some variation. The total length of the tail and the coma diameter were subject to extensive variation. Reduction of the data at hand gives the following dimensions during the period of closest geocentric approach.

Maximum Coma Diameter:	Apr. 24.5, 1960 U.T.,	200,000 mis.
Minimum Coma Diameter:	Apr. 21.5, 1960 U.T.,	15,000 mis.
Maximum Tail Length:	Apr. 27.1, 1960 U.T.,	3.9 million mis.
Minimum Tail Length:	Apr. 21.4, 1960,U.T.,	0.5 million mis.
Maximum Tail Width:	Farthest from Coma---	80,000 mis.
Minimum Tail Width:	Adjacent to Coma-----	5,000 mis.

Figure 47 is a graph of the mean dimensions of the comet as a function of time. The maximum number of tail rays was ten on Apr. 22, 1960. The gradual increase of mean coma diameter with time should be noted in contrast to the decrease of the mean tail length. This is in accord with the conclusions reached in Part I of this Report. The mean coma diameter is given approximately by:

$$D = 3.3 \times 10^5 r - 2.5 \times 10^5,$$

where D is the diameter in miles and r is the heliocentric distance in astronomical units. The central condensation of the coma was reported smaller at large heliocentric distances than at distances nearer the perihelion value.

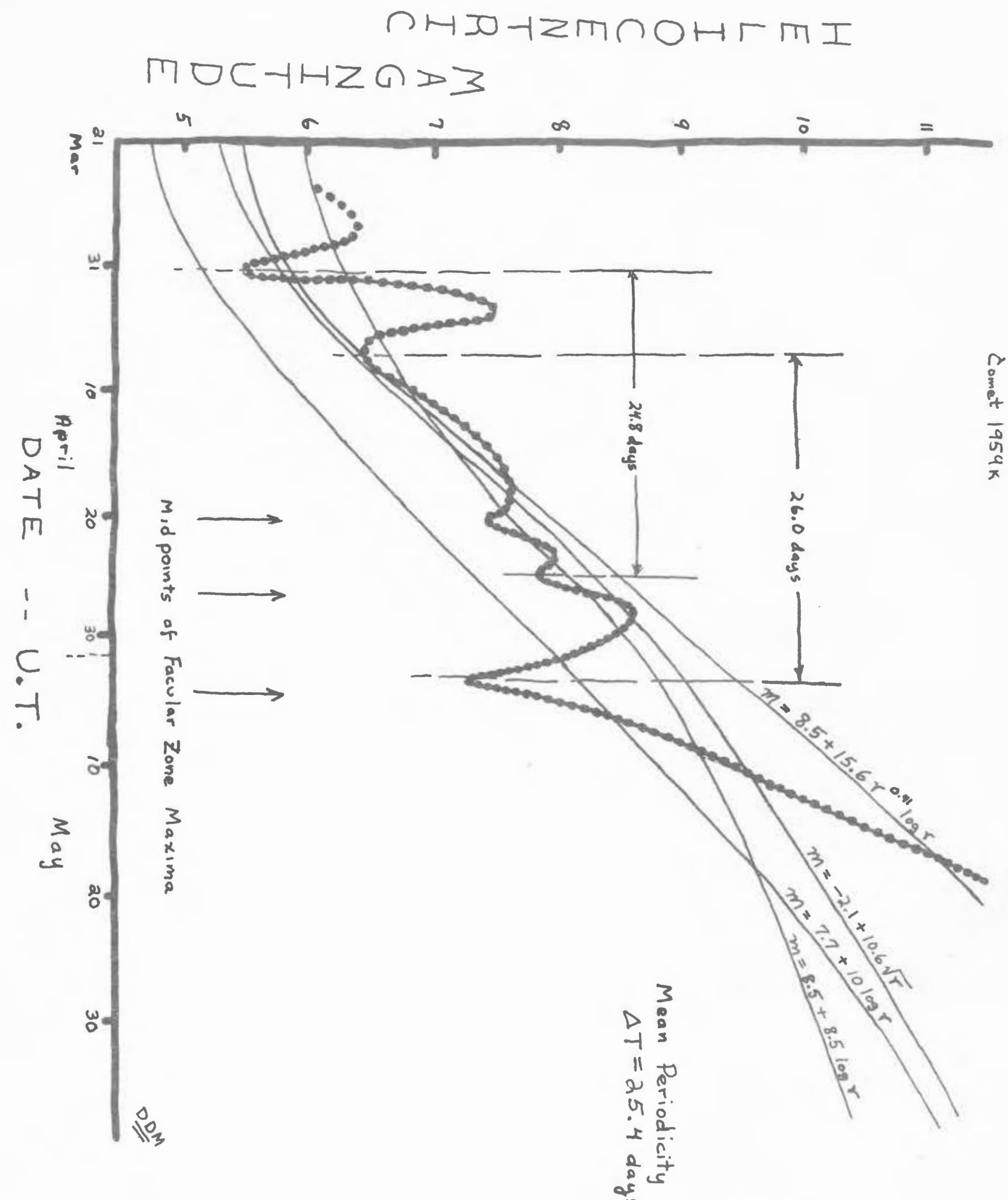

FIGURE 45. __Smoothed Mean Heliocentric Magnitudes of Comet 1959k, March-May, 1960.__ Calculated from visual magnitude estimates, these are reduced to a geocentric distance of 1 astronomical unit. The dotted line represents the observed variation. The light solid lines represent various statistical least square fits. See also text.

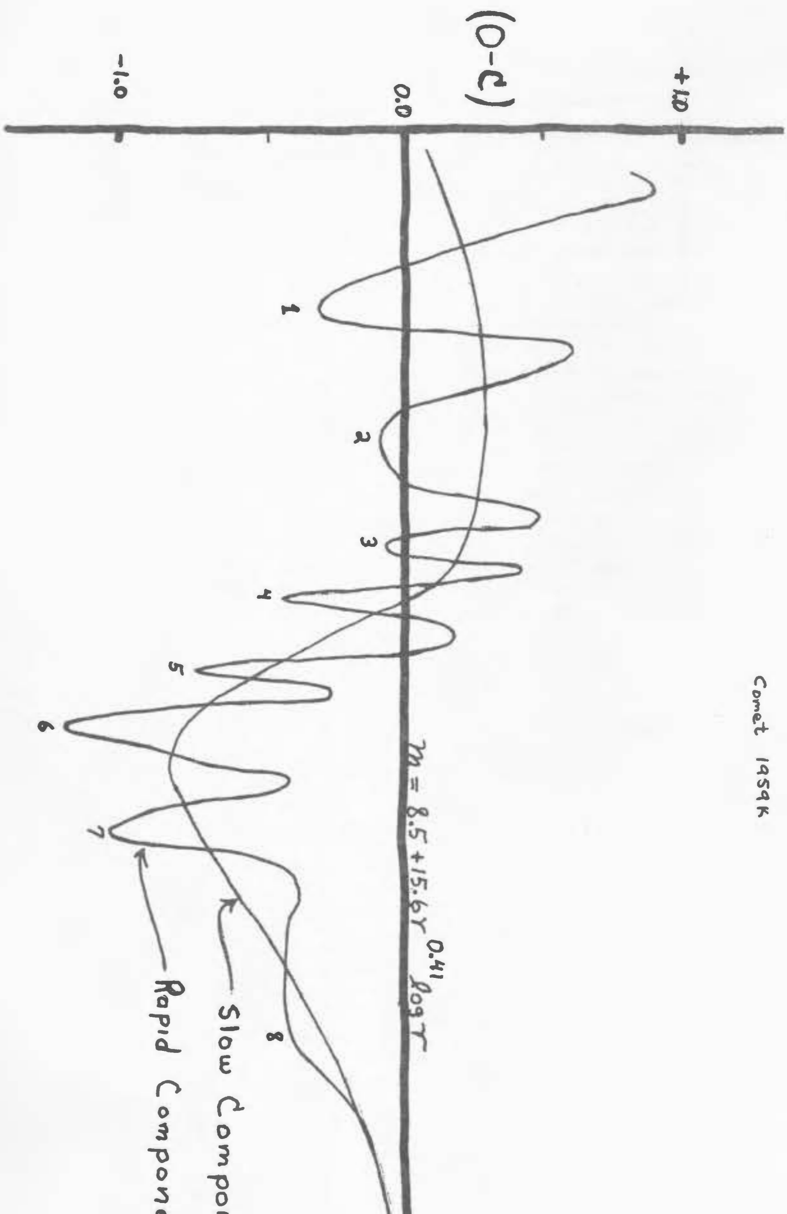

FIGURE 46. __Observed Minus Computed Magnitude Values Representing the Variations of Comet 1959k from a Least Squares Fit__. Both the slowly varying component and the rapidly varying component are shown. The eight brightness maxima are numbered. See also text.

*I.A.U. Circular 1730.

A nucleus was observed during the period of closest geocentric approach. From reports of stellar appearance in small telescopes it was possible to calculate upper limits for the diameter of this nucleus.

April 20, 1960, Mean Limit: 900 mis. Upper limit: 2800 mis.

May 2, 1960, Mean Limit: 160 mis. Upper limit: 180 mis.

D. Photographic and Nuclear Magnitudes

The analysis of section B included only visual observations for the derivation of fluctuation patterns. However, several photographic and photoelectric magnitudes are available. Bouska* found the following least squares fit for the photographic observations between Apr. 17 and May 6, 1960:

$$m = 8.1 + 6.25 \log r + 5 \log \Delta .$$

Bouska's analysis of visual estimates for the same period gave a value for n of 3.4. However, the Recorder's analysis of data of estimates of the visual magnitude of the nucleus gave:

$$m = 10.92 + 8.5 \log r + 5 \log \Delta .$$

It is possible that the identical n values are pure coincidence. On the other hand, this is highly unlikely. Thus one is led to suspect that most of the observations used in Bouska's analysis were made with large telescopes in which only the central regions of the comet were visible. The persistence of the photographic image during this period should also be noted. ($n \sim 2.5$).

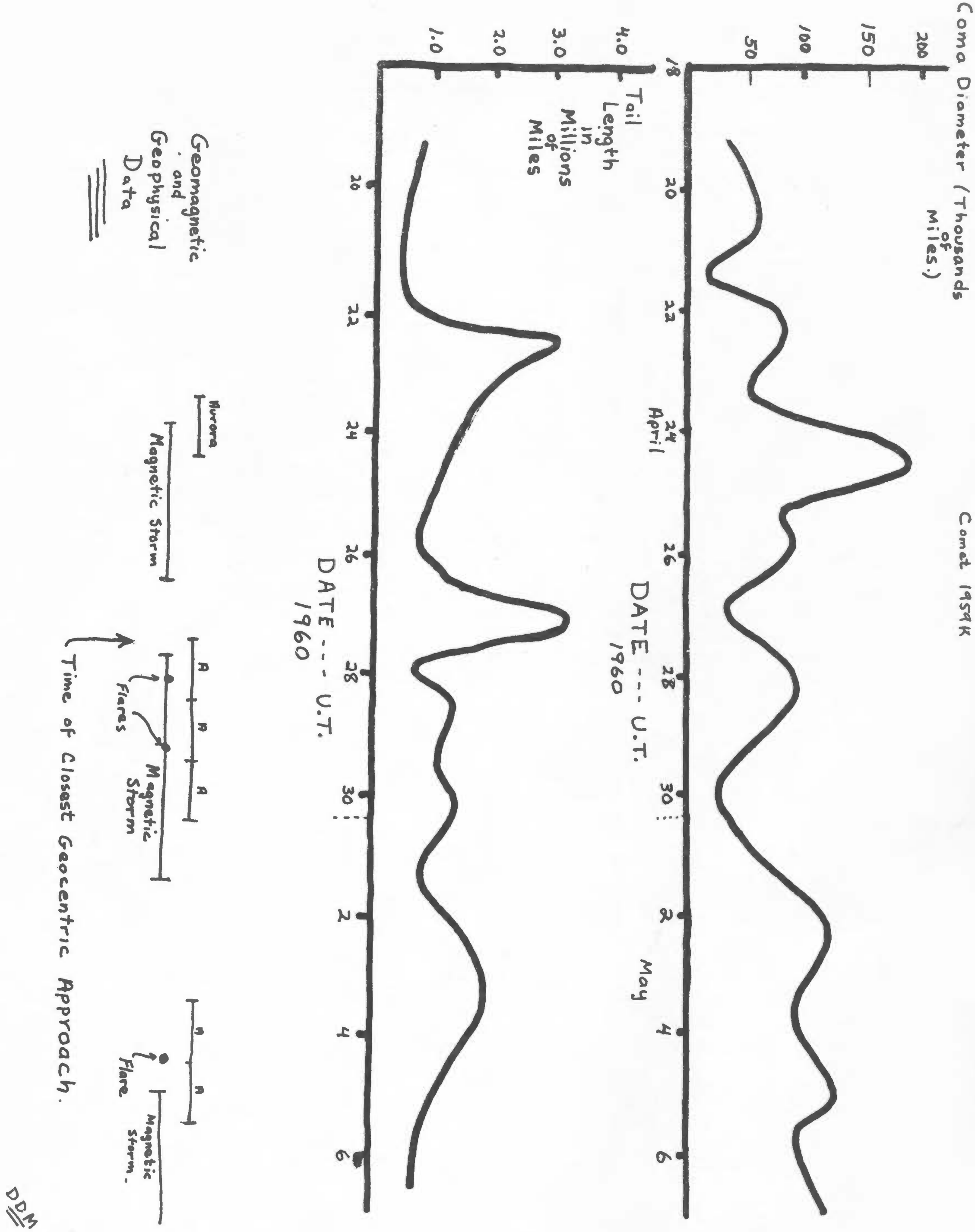

FIGURE 47. Mean Physical Dimensions of Comet 1959k as a Function of Time. Smoothed mean curves are given based on visual and photographic estimates. Certain geophysical and geomagnetic data are included for comparison. See also text.

The lack of rapid fading in the photographic wavelengths during the period considered is generally verified by the photoelectric observations. However, according to a photoelectric determination by Smetanova and Vanysek (I.A.U. Circular 1727) on May 5.01 U.T., the B-V value was then $+0\overset{m}{.}9$. Hence it seems that once, at least, Comet 1959k was much brighter visually than photographically, contrary to normal circumstances. The observation was made during a time of great photometric variation; it is, however, consistent with the mechanisms of excitation which will be discussed in greater detail later. This type of fluctuation demonstrates the uselessness of trying to employ photographic descriptions to predict visual appearances.

D. Phenomenological Correlations

I. Photometry

In section B, two definite components of the brightness fluctuation were identified. Since the slowly varying component has a period corresponding directly to the solar rotation rate as seen from the comet, the origin of this fluctuation is doubtless due to ultraviolet excitation from a solar spot-and-facular zone passing the solar meridian. Three separate maxima have been identified with these zone transits.

The assignment of the short term variations is not easy. This can be seen from Figure 48, which attempts to present a time dependent summary of the situation during the period of observation. In the left hand column is the description of the data. The solar and cometary data consist of time positions of the extremes, the length of the line denoting the relative amplitude of the extreme. If the mark is above the line it represents a maximum; if it is below the midline it represents a minimum. If the extreme is broad, the limits are connected by a horizontal dashed arrow. The 8 peaks of the rapidly varying component are indicated by numbers. Confirmed ultraviolet or X-ray excitations are indicated by the vertical, narrow shaded areas bounded by dashes. Related UV and radio fadeouts are indicated by light dotted lines. Phenomena connected with solar particle streams are indicated by the broad shaded areas. Durations of magnetic storms and aurorae are indicated by solid horizontal lines.

It is evident from this diagram (after considerable study!) that the major portion of the amplitude of the rapidly varying component is not due just to direct solar UV excitation. This is demonstrated by the lag time between the flares causing streams 4, 5, and 8. The flares producing streams 1, 2, 3, 6, and 7 were not observed. This lag is the time of flight required for the stream of particles to traverse the distance from the sun to the comet. With the exception of peak 4, the peaks observed were caused by intersection with plasma. The fact that only in the case of peak 4 did the flare burst contribute to the amplitude would seem to indicate that either the excitation is not induced directly by UV radiation or that the radiation from a flare is extremely directional. Since the latter is highly improbable, it is assumed that the solar plasma acts either as the excitation mechanism or the triggering agent for these brightness outbreaks. There is no information available regarding the true nature of these "flareless" streams. There is some evidence for rapid color index variations which would, under further study, give some clues to the excitation mechanism.

Also of interest is the appearance of two auroral storms that occurred nearly coincident with peaks 3 and 4. If the connection between the two phenomena can be definitely established, it would seem to indicate that the aurorae originate from direct stimulation by solar streams rather than indirectly through mechanisms such as the Van Allen belt. This view agrees with a recent theory due to Chapman and Akasofu.[4]

II. Structure

Variations in structure were even more obscure than those of brightness. This is due mainly to the lack of uniform observations of coma diameter and tail length. Referring again to Figure 47, it may be seen that the maximum tail length was antiperiodic to the maximum coma extent over the interval from April 20 to May 4, 1960. McClure's photographs show a constant decrease of the blue-light tail images. The coma diameters in blue light show a similar decrease up to April 30. Interaction with a solar

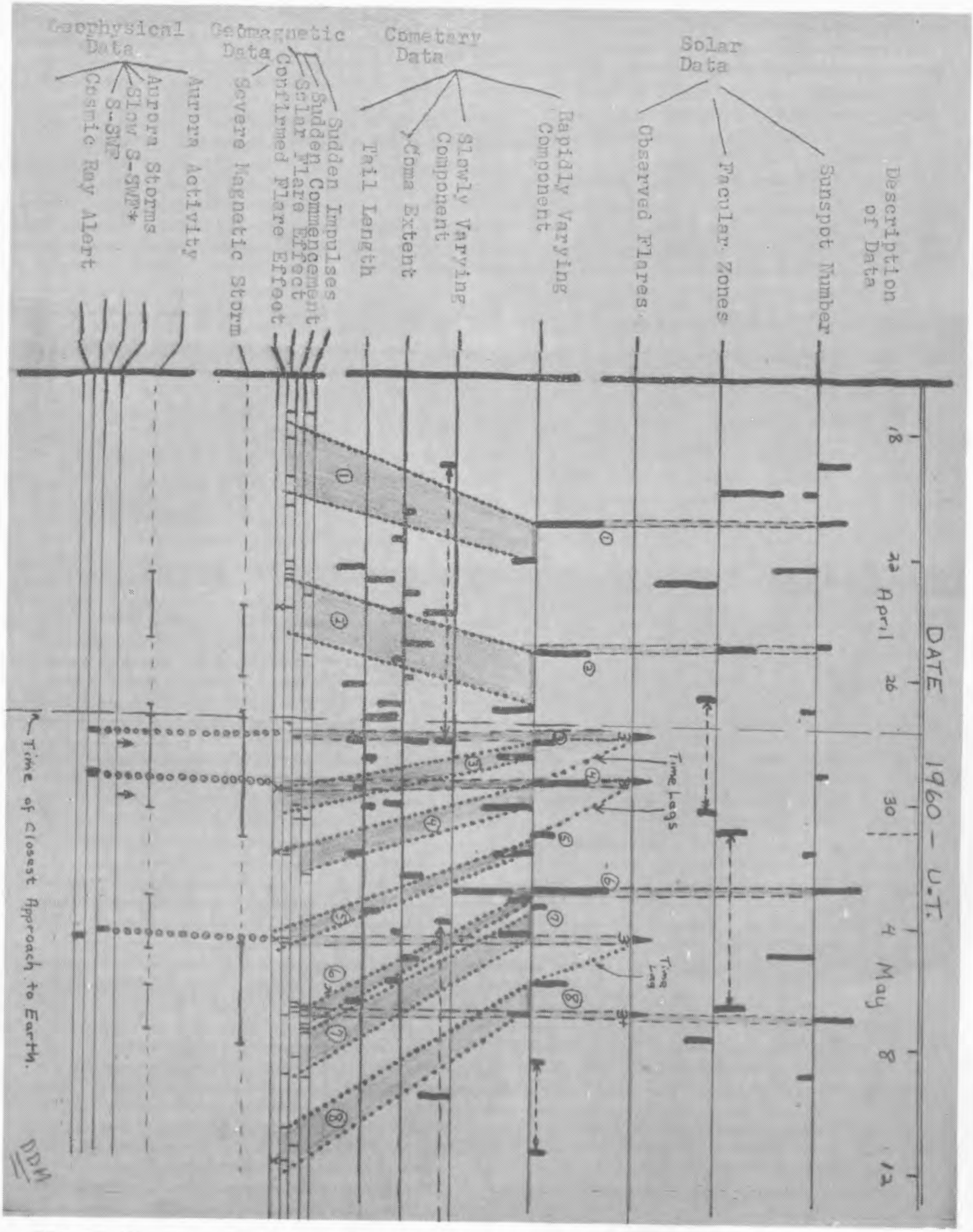

FIGURE 48. __Time Dependent Phenomenological Correlations for Comet 1959k.__ The left hand column lists the phenomenon. The lines represent the occurrence of the phenomenon and its relative amplitude. The circled numbers correspond to particle streams which probably are responsible for the observed sudden brightness variations. For a complete explanation see the text, Section D.

stream caused temporary coma expansion for several days after the 30th. Contrary to the behavior of the "blue" coma, the images in red light showed violent fluctuations of an apparently random nature. Since the visual appearance of the coma is dependent on the superposition of both the red and blue images, it would seem that the variations observed visually were due <u>mainly</u> to variations in the red-yellow coma and tail images. The tail length visually reached its greatest extent <u>after</u> a brightness maximum. On the other hand, the <u>maximum</u> coma extent nearly coincided with the time of <u>minimum</u> of the short-period brightness component. For the slowly varying component an opposite behavior seems to be indicated. On May 4 the slow component was at maximum. On the same date, the coma extent was nearly maximum as was the tail length. Since the brightness components have been identified, structural variations can be similarly assigned, which are:

1) A slowly varying, dimensional fluctuation going directly with the slowly varying brightness component is present, apparently induced by increased ultraviolet excitation affecting the blue coma and tail images.

2) A rapid variation of the red and yellow images varying in an opposite sense from that of the short term brightness variation. Apparently, corpuscular streams "tear off" the tail material, at the same time exciting the low luminosity outer coma regions. The exact excitation mechanism is still unknown.

3) Color index variations previously mentioned are apparently due to the red-yellow short-term variation.

It can be seen from the foregoing discussion that the volume of material received and collected on Comet Burnham 1959k was great. It is indeed fortunate that the comet was so close to the earth during the height of great solar activity. During this same period the Pioneer V space probe was functioning some 10 million miles away. This stresses the value of space experiments in solar and terrestrial-comet relations as it would have been nearly impossible to identify some of the flare actions without the preliminary data from the probe. Nevertheless, the data from the space probe pose a problem. Because there is so much information now available, the final results from this research on Comet Burnham and indeed on several other objects will be some time in emerging. Thus all those interested in final results will have to be even more patient now than while waiting for the appearance of this paper.

References

1. Bouska, I.A.U. Circular, No. 1730, June 15, 1960, and Z. Sekanina, I.A.U. Circular, No. 1735, July 19, 1960.

2. <u>Statistik and Physik der Kometen</u>, see Richter, pages 59-60. This formula is obtained from Lewin's theoretical formula by neglecting a factor of (r^{-4}) which apparently in the case of 1959k is significant.

3. Richter, op. cit., p. 61. Also, Lewin, "Variation der Helligkeit der Kometen in Abhängigkeit von ihrer Sonnendistanz," <u>Abh. Sowj. Astronomie</u>, Folge I, page 105, (1951) and Lewin, <u>Ber. Akad. Wiss.</u> UdSSR <u>38</u>, 82 (1942).

4. Akasofu and Chapman, "A New Theory of the Aurora Polaris," American Rocket Society Technical Paper 1444-60. Presented at the ARS 15th Annual Meeting, Dec. 5-8, 1960.

ABSTRACTS OF FOUR PAPERS GIVEN AT THE EIGHTH A.L.P.O. CONVENTION

By: Thomas R. Stoeckley

<u>Foreword by Editor</u>. The following four papers were presented at the Eighth A.L.P.O. Convention at Detroit, Michigan, in July, 1961. The

abstracting has been done by Mr. Thomas Stoeckley of Fort Wayne, Indiana. Mr. Stoeckley attended the 1960 Pan American College Summer Institute in the Astro-Sciences and is now a student at Michigan State University. We regret that available space does not allow us to publish these papers in full.

Molds, Mosses, and Martians

By: James C. Bartlett, Jr.

Many early writers attempted to describe the anatomy of extra-terrestrial races in terms of adaptation to the supposed environmental conditions on other worlds, leading to grotesque and ridiculous conceptions that are nowadays laughed at. Yet today, our knowledge of extra-terrestrial conditions, still meager, is constantly being modified by new determinations. When we reach Mars, we will undoubtedly find life forms completely different from anything we expected.

The whole concept of Martian life has rested upon the nature of the blue-green "maria"; yet, the Martian deserts may be equally good indications of life. The great uniformity of the color (attributed to iron oxides derived from the oxidation of granite) over so vast an area demands a suspiciously immense amount of weathering. Simple plants and animals manufacture substances which, when dissolved, greatly increase the weathering rate of many rock and mineral forms. Iron bacteria, for instance, have the property of oxidizing ferrous solutions, and apparently even iron metal, to insoluble ferric hydroxide. Higher forms of life are also known to concentrate mineral substances. Vital activities such as these could account for the mineral colors and extent of the Martian deserts, formerly believed to be devoid of life.

The Man from Space

By: Carlos E. Rost

We, as amateur astronomers, are well acquainted with the problem of trying to conduct astronomical research from the bottom of a turbulent atmosphere. Flustered by these adverse conditions, we would give <u>anything</u> to become one of those popularly conceived "men from space" of our popular literature and movies.

But, in a sense, we have already been able to throw off our atmospheric blanket and take to the heavens in the form of man-made instruments that can reach out and discover information that we, as yet tied to the earth, cannot seize. Lunar probes, high-altitude research programs, and many satellites orbiting the earth and sun are all present-day representatives of our "men from space". And tomorrow, <u>true</u> "spacemen" shall undoubtedly be operating astronomical research bases on the moon.

At the dawn of this new age we still find widespread misbeliefs and misconceptions about astronomy and related sciences. Yet, as Science advances, mankind will change his thinking in the light of newfound knowledge; and the fictional "man from space" shall be replaced by a closer realization of the true mysteries of the universe.

Remarks on A New Interpretation of Martian Phenomena

By: Minick Rushton

Recently a new interpretation of Martian pehnomena has been advanced, based on the spectroscopic evidence that the oxides of nitrogen may be present in large quantities in the Martian atmosphere. The polar caps may consist of solid nitrogen tetroxide, and the observed darkening as the polar cap recedes can be attributed to reactions of southward-flowing nitrogen dioxide with surface deposits. Blue clouds may be a mixture of NO_2, NO, and N_2O_3; yellow clouds, a high concentration of NO_2; and white clouds, a condensation of N_2O_4. The blue clearing can be explained, but not without flaws, as a change of yellow NO_2 to colorless N_2O_4 due to a sudden drop in temperature.

Although these explanations fit well the observed characteristics, two assumptions contrary to present belief are required: (1), Water must be totally absent on Mars, since water reacts with all nitrogen oxides to form nitric acid; and (2), the atmospheric pressure must be at least 140 mms. to account for the melt band. Both assumptions, unfortunately, are opposed by evidence to the contrary.

Although it represents a radical departure from current thought, this new theory should at present be considered along with presently accepted beliefs.

The Lunar Programme of the Montreal Centre, R.A.S.C.

By: George Wedge

The lunar program of the Montreal Centre, Royal Astronomical Society of Canada, is divided into four different projects:

The first is a lunar training course for new observers, designed to familiarize the beginner with lunar topography and to help him acquire experience in sketching at the telescope.

Pencil sketching of lunar formations is the second project. In special cases, continuous study of single formations is being undertaken.

The third project consists of searching for lunar domes and plotting their positions on a map.

Lunar cartography, the fourth and most ambitious project, is being limited to mapping only a few small regions at a time. Each observer records his observations on a base map, obtained by tracing regions from high-quality photographs and enlarging to a scale of 200 inches to the moon's diameter. The base maps of all observers will be used to compile the final map.

BOOK REVIEW

The Planet Venus. Third Edition. Written by Patrick Moore. Published by Faber and Faber, London, June 26, 1961. 18 shillings (Macmillan, N.Y., $3.75). 151 pages, 8 plates, 8 figures, fifteen chapters plus four appendices.

Reviewed by William K. Hartmann

Most readers of this review will be familiar with Mr. Patrick Moore's series of astronomical books. Thus, let me first say only that this one is a typical Moore product: very readable, full of interesting historical notes, designed for and of interest to, (1) the beginning amateur or young student of astronomy, say from junior high school level on, (2) the more advanced amateur without any technical training in physics, math, and/or astronomy, who wants to learn more about what is known and what he might see on the planet, and (3) the advanced amateur or professional with technical knowledge who wants to know more about the history of his subject especially before about 1900, and who may want handy bibliographic references to more advanced articles in the "learned journals."

Like the earlier editions, the third edition of The Planet Venus is divided into a series of chapters covering various topics such as movements of Venus, dark areas, rotation, ashen light, etc. However, the new edition has been considerably expanded and revised. Some new developments, such as the evidence for water vapor resulting from the 1959 balloon work, have been added. Also, the results of Mr. Moore's recent visit to the U.S.S.R. are evident: a great many fascinating references to Russian work, both historical and contemporary, are included. It is of further interest to note that a Russian edition is being prepared. A final advance over the older edition is an expansion of the bibliography. References from points in the text to the literature now number 385 (not all different) versus the 155 of my first edition.

Traditionally, reviewers keep an eye peeled for flaws. The best I can do is this: in a discussion of attempts to determine the obliquity of the axis of Venus, pp. 57-58, no reference is made to a 1955 paper by R. S. Richardson, giving what is probably one of the better modern determinations, although this paper is listed twice in another chapter as references 142 and 146.

Next, I will comment on some statements which I thought were a little strong: "...it seems...best to dismiss the [cusp-collars] as optical effects..." (p. 62); "The terminator seldom appears entirely regular..." (p. 74); and "...when two observers show linear streaks, there is never any real agreement..." (p. 94). In answer to these statements, respectively, I would suggest that the cusp-collars often seem to fit in with the ultraviolet photographic bands, that only a minority of observations show the terminator as other than a regular curve, and that the last statement applies no more strongly to linear streaks than to any other kind of marking (see comparisons of simultaneous observations in the 1960-61 Venus Section Report, prepared before this review was written, Parts 1-5 appearing elsewhere in this issue). This paragraph has concerned matters of interpretation. Thus, it does not demonstrate errors in the book, but rather highlights points of controversy which serve as examples of fields where groups like the A.L.P.O. and the B.A.A. may do useful work.

Perhaps the most basic criticism that someone might make of a book like this one is the charge that it puts too much emphasis on historical and amateur work and too little on modern astrophysical investigation. However, there is an answer to this charge. In the first place, Mr. Moore recognizes this problem in the foreword to the second edition, and has expanded coverage of modern results. But the real answer, I think, is that the book does not pretend to be an advanced astrophysical text. It is aimed at those readers described in the first paragraph. It mentions modern results (of which there are precious few) but does not attempt to explain in detail modern methods. Similarly, it does not go into the physics of planetary models, and in this sense is not on the level of de Vaucouleurs' Physics of the Planet Mars. It does not attempt to provide the answers to all the mysteries of Venus, but instead points out clearly that little is really known. In short, it does what it sets out to do and does that well.

The third edition is new and different enough that it would make a good replacement for the first edition as well as a worthy addition to any planetary library. If you fit into one of the categories mentioned in the first paragraph, then it may be said that you should read Moore.

PROGRESS REPORT ON THE A.L.P.O. LUNAR METEOR PROJECT: DEC. 1, 1960 TO JAN. 31, 1962

By: Robert M. Adams

This paper presents a summary of the observations covering the period from Dec. 1, 1960, to Jan. 31, 1962. As in previous years, all participating stations were located at a distance from each other sufficient to distinguish lunar flashes from earthly meteors. The bulk of the observations were again obtained from the several stations comprising the Montreal Groups, those of the Montreal Centre and those of the so-called French Center of Montreal.

The following individual observers were engaged in the meteor search program for the stated total amounts of observing time:

Larry Anthenien, San Jose, California, 6" reflector, hours unknown.
H. M. Blake, Tracy, California, $4\frac{1}{4}$" reflector, 1.8 hours.
Dick Nelson, Northridge, California, 16" reflector, hours unknown.
Bruce Weaver, Catskill, New York, 6" reflector, 4.5 hours.

Observers from the Manchester, Connecticut, group: Eugene Spiess with his 5" reflector and Dan and Doris Fraher, who operate a 3" reflector. Spiess 1 hour, Frahers 1 hour.

The Montreal Centre comprised 9 active stations. These are: Miss I. K. Williamson, C. M. Good, E. M. Towne, operating station 1 using an 80 mm. refractor; G. Gaherty, G. Wedge, K. Chalk, C. Papacosmas, J. Low, operating station 4 using a 6" reflector; G. Gaherty, K. R. Brasch, G. Wedge, operating station 5 using an 8" reflector; W. A. Warren, operating station 8 using a 6" reflector; Miss E. Sundell, R. Sundell, operating station 13 using a 6" reflector; V. Williams, operating station 14 using a 6" reflector; K. R. Brasch, operating station 17 using an 8" reflector; Mrs. E. E. Bridgen, operating station 18 using a 4¼" refractor; K. Chalk, operating station 19 using a 6" reflector; W. A. Warren, operating temporary station X using a 6" reflector. Each observer contributed the following hours of observations: Brasch 2.6 hours, Mrs. E. E. Bridgen 1.7 hours, Chalk 2.4 hours, Gaherty 3.9 hours, Good 1.7 hours, Low 0.25 hours, Papacosmas 1.7 hours, Miss E. Sundell 1 hour, R. Sundell 0.5 hours, Towne 0.4 hours, Warren 5.4 hours, Wedge 5.8 hours, V. Williams 11.25 hours, and Miss I. K. Williamson 7.2 hours.

The French Center comprised one station which usually worked in coordination with the Montreal Centre. Using 3-1/4", 3-7/8", 6", and 8" telescopes, the observers were Mrs. J. P. Jean (the group leader), Father Buist, Mr. A. Rousseau, Mrs. Y. Cahrest, Mr. Mailloux, Mr. Lemieux, Miss E. Guay, Mrs. L. Pideaux, Pierre O'Keefe, Miss F. A. Laforest, Brother DaMasse and Raymond Masse. Each observer contributed as follows: Jean 2.5 hours, Buist 0.15 hours, Rousseau 0.03 hours, Charest 0.1 hours, Mailleux 0.15 hours, Lemieux 0.1 hours, Guay 0.16 hours, Pideaux 0.16 hours, O'Keefe 0.16 hours, Laforest 0.16 hours, DaMasse 0.16 hours, and Masse 0.21 hours.

There were a few reports of individual flashes and light trails; but since this project is concerned with overlapping observations, only those observations where there was actual overlapping will be described. All times are given as <u>Universal Time</u>.

On Dec. 20, 1960, two or more of Montreal stations 1, 5, 8, and 17 overlapped for over 15 minutes from 23:00 to 23:16. On Jan. 19, 1961, two or more of stations 1, 5, and 8 observed from 23:12 to 24:00. As Mr. Brasch states, "I'm freezing." Three cheers for our Canadian friends! On the 21st when it was 3 below zero four stations overlapped most of the time: 1, 4, 5, and 8. The times were from 23:00 to 24:00 with at least two of the stations at their 'scopes. As Mr. Brasch reports, there was "much detail on the dark side." On March 20, with transparency fair, stations 14 and 18 overlapped from 0:00 to 0:14. On March 21, 1961, when the transparency was good to very good stations 4 and X observed with continuous overlapping from 00:10 to 00:32. On the 22nd stations 4 and 14 observed continuously from 00:00 to 01:00. On April 19, 1961, stations 1, 4, and 14 managed to overlap between the three of them from 00:30 to 01:30. As Wedge states, "observations abandoned because of cloud and refractor cramp." On the 20th four stations, 1, 4, 8, and 14, were on duty from 00:30 to 01:30 with continuous overlapping coverage by at least three of the stations. On the 21st stations 4, 8, and 14 reported continuous coverage from 00:30 to 01:30 with excellent transparency. G. Wedge at station 4 reported an object at 01:16 moving northwesterly across the field of his 6" refractor and red in color. Mr. Wedge realized it to be a terrestrial phenomenon. Mrs. J. P. Jean, not then a contributor to the A.L.P.O. meteor search project, reported to Mr. Gaherty that she had seen two more similar objects moving in a northeast direction and seeming to originate on the dark side of the moon from the Herodotus and Boscovich regions. The time of this observation was about an hour later than that of the one seen by Wedge, thus 02:20. A 3" refractor was used, and the object was believed to be of the 5th magnitude. On June 19, 1961, stations 1, 4, and 18 overlapped their observations from 01:30 to 02:15 for most of the time with rather poor seeing conditions consisting of clouds and haze. C. Papacosmas reported flash activity at 02:05:47 at station 4, consisting of a point flash of duration one second, white in color and in the vicinity of Descartes; and this was seen twice in the following two minutes. When Mr. Gaherty took over the 'scope at 02:11 to relieve Papacosmas "there were still hints of some sort of activity in this region. Papacosmas and I feel this effect might have been caused by a sunlit peak, although the flash was quite a distance from the terminator." Stations 1 and 18 did not confirm this phenomenon although they were observing at the same time. On July 19, 1961, stations 4 and 17 overlapped from 01:38 to 01:56 with the exception of from 01:45 to 01:50. On the 20th stations 4 and 8 overlapped from 01:33 to 02:00. The Montreal Centre was a buzz of activity in August, 1961. On the 17th at least two of the stations 4, 13, and 14 overlapped from 00:30 to 01:15. On the 18th stations 1, 4, 13, and 14 observed for most of the time from 00:30 to 01:30 while there was overlapping for the whole one hour period. On Aug. 19, 1961, the same was true for stations 1, 13, and 14 from 00:30 to 01:30. Mrs. J. P. Jean's observers observed, taking turns overlapping with stations 1, 13, and 14 on the 18th from 00:30 to 01:30. Mrs. Jean saw a point of light of about the 5th magnitude at 00:53 lasting some two minutes, but this object was not detailed by any one of the three Montreal Centre stations observing at the same time. Two stations searched during the partial lunar eclipse of Aug. 26 but under very poor seeing conditions; stations 8 and 17 overlapped from 03:27 to 03:36. On Sept. 16 stations 1 and 17 watched from 00:00 to 00:30 except from 00:18 to 00:23 when only station 17 observed. Station 14 watched from 00:00 to 00:12. On the 17th stations 5, 14, 19, and X all observed from 00:00 to 01:00 so that at least two stations were watching all the time. Mr. Chalk saw a 4th magnitude short trail, but it was not picked up by the others. On the 18th stations 1, 5, 14, and 17 were all overlapping from 00:00 to 01:00 except for part of the time when only two were watching. On the 15th of October stations 5, 8, and 14 overlapped from 23:00 to 23:28. Mrs. Jean and one of her assistants also watched from 23:00 to 23:20. On November 13 stations 1 and 8 observed from 23:07 to 23:44(?) except for 5 minutes from 23:30 to 23:35. On December 11 there was overlapping between 23:09 and 23:15 at stations 14 and 19. On December 13 there was overlapping from 23:30 to 24:00 as between stations 14, 18, and 19. On January 9, 1962, stations 1 and 14 observed from 23:30 to 00:25 except for 4 or 5 minutes; and on the 10th stations 1, 14, 18, and 19 assured overlapping between them from 23:30 to 00:30.

Thus once more we are confronted with the fact that there were no lunar meteor verifications, and this negative evidence was achieved as the result of very diligent and coordinated observing by as scientific a minded group of observers as exists anywhere. There were several instances of discoveries of short trails or streaks of light, some of which were mentioned above. These were of the order of the third to the sixth stellar magnitude. Those might easily have been judged lunar meteors had we not had negative results from others observing at the same time. These no doubt were earthly meteors coming head on or nearly so. An interesting by-product is the glow reported in the vicinity of Descartes by the seasoned observers Gaherty and Papacosmas.

The writer must report that the leader of the Montreal group, Geoff Gaherty, has had to resign because of the press of college work. Great praise is due to this young man for his indefatigable efforts to keep the Montreal group going. He has turned over his "torch" to his successor, Kenneth Chalk.

Now then a plea is in order for more American observers and for a continuation of the project as a whole. We have seen some rather rough days. I have heard some rather lame excuses and have had some rather critical letters, the gist of which is that it is impossible to tell the difference between an earthly meteor and a lunar meteor. Mr. Chalk has worked up a time schedule for the Montreal group and the French Center. Using this as a basis I add a suggested "universal" time schedule below. The suggestion is to observe on the three nights preceding the 1st night before the moon's First Quarter in every month as follows:

<u>Based on Standard Time</u>

	EST	CST	MST	PST
Dec. and Jan.	18:30 to 19:30	18:00 to 19:00	18:30 to 19:30	18:00 to 19:00
Nov. and Feb.	18:30 to 19:30	18:00 to 19:00	18:30 to 19:30	18:00 to 19:00
Oct. and Mar.	19:30 to 20:30	19:00 to 20:00	19:30 to 20:30	19:00 to 20:00
Sept. and Apr.	19:30 to 20:30	19:00 to 20:00	19:30 to 20:30	19:00 to 20:00
May and Aug.	20:30 to 21:30	20:00 to 21:00	20:30 to 21:30	20:00 to 21:00
June and July	21:00 to 22:00	20:30 to 21:30	21:00 to 22:00	20:30 to 21:30

It will be noted that this plan affords one-half of overlapping between any two adjacent time zones.

CONCERNING THE SPEED OF THE POLAR MOVEMENT DURING THE EARTH'S HISTORY

By: Péter Hédervári, Budapest, Hungary.

According to modern palaeomagnetical research, it is well known that the poles of the Earth have had significant movements in relation to the continents during the Earth's history. Using the data of several explorers, we can calculate how great was the speed of the polar movement in a number of geological periods. In Table I we show the average coordinates of the North Pole, calculated from the data of Hramov, Creer, Irving, Runcorn, Doell, Graham, Campbell, Gough, Du Bois, Wegener, and Köppen respectively.

In accord with the average coordinate-values from the authors mentioned, we calculated the path of the North Pole relative to Europe-Asia, North America, Africa, and Australia. We determined the movement of the pole in kilometers to intervals of 5 million years. Later, we carried out an adjustment of these values. The results were then weighted according to the length of several geological periods, expressing the time-unit in 5 millions of years. Finally, we derived from these results the speed of the polar movement for different periods of the Earth's history.

We also calculated the polar movement in centimeters per year. Table II shows the results. The average value for Europe-Asia is 4.25 cms./yr., for North America 2.97, for Africa 5.26, and for Australia 4.85. It is evident that <u>the order of the polar movement is some centimeters per year</u>. According to the calculations of Wanach, <u>the real movement of the North Pole is 14±2 centimeters per year in the present Century</u>. The agreement between this value and the result of our calculations is excellent, the more so since Wanach's data originated by geodetic methods, but our results from palaeomagnetic and palaeoclimatic data.

Table I

The average geographical coordinates of the North Pole, calculated from palaeomagnetic and partly palaeoclimatic data.

Period	From European Data		From American Data			From African Data			From Australian Data	
Pleistocene	88°N.	147°E.								
Pliocene	76	202(?)	85°N.	150°E.	(?)	70°N.	300°E.	*	86°N.	282°E.
Miocene	80	126(?)	83	135	(?)	75	210	*	(?)	
Oligocene	72	140	82	88	(?)	(?)			67	303
Eocene	72	145	82	88	(?)	45	200	*	67	303
Cretaceous	66	168	74	131		47	220	*	(?)	
Jurassic	63	153	(?)			55	256	**	50	337
Triassic	51	144	58	104		50	235	*	39	323
Permian	46	165	36	115		35	245	*	32	351
Carboniferous	47	144	44	119		30	215	*	39	337
Devonian	34	156	39	124		0	230		66	192
Silurian	42	167	20	138		0	230		60	203
Cambrian	17	169	-1	177	***	0	230		35	197
Upper proterozoic	6	237	28	217		0	230		40	290
Lower proterozoic	35	244	32	216		0	230		6	14

*According to Wegener and Koppen (1924). Palaeoclimatic data.
**The average value of the data of Irving and Wegener.
***-1°N = +1°S (southern latitude).

Table II

The speed of the movement of the North Pole during the Earth's history, relative to different continents, in cms./yr.

Period	Europe-Asia	North America	Africa	Australia
Oligocene	7.73	2.77	12.67	4.29
Eocene	3.56	2.08	7.57	3.64
Cretaceous	1.90	1.53	3.01	2.51
Jurassic	3.59	3.04	6.15	2.95
Triassic	5.22	3.72	6.23	5.35
Permian	4.29	5.38	4.89	6.15
Carboniferous	2.64	1.99	4.38	3.97
Devonian	2.94	1.69	7.00	14.27
Silurian	3.00	2.57	0.68	2.39
Cambrian	7.61	4.94	0.00	2.97

Average = 4.33 cms./yr.

It can be concluded that the order of centimeters per year is characteristic of several motions in the development of the Earth. For instance, the isostatic elevation of Scandinavia is also at a rate of some centimeters in a year, and the theoretical speed of the magma-currents under the solid crust is of the same order of magnitude.

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Postscript by Editor. Our contributor's address is Geophysical Institut, VII Damjanich-str., 28b. II 19, Budapest, Hungary. Mr. Hédervári submitted this article in June, 1961; we regret the long delay in publication. Discussion of these ideas from students of historical geology and of the theoretical nature of the earth's interior, among others, are invited.

AN OCCULTATION OF BD-19°5925 BY SATURN AND ITS RINGS ON JULY 23, 1962: OBSERVATIONS REQUESTED

By: Joel W. Goodman, L. J. Robinson, and Walter H. Haas

Foreword. The article here published follows primarily a manuscript composed by Dr. Goodman. Mr. Robinson's contribution has been the description of advanced techniques, while the role of Haas has been the combination of the two articles and a little evaluation.

Times of Contacts and General Remarks. The following times at different stations are all given in Universal Time on July 23, 1962. (By local civil time in the United States the event occurs on the night of July 22-23.)

Event	Montreal	Lick Observatory	La Plata	Wellington
Ring A First Contact	$5^h\ 47^m$	$5^h\ 51^m$		
Ball Disappearance	5 56	6 00	$6^h\ 00^m$	Low
Ball Reappearance	7 28	7 27	7 22	$7^h\ 31^m$
Ring A Last Contact	8 14	8 19	8 16	8 22

The times above may be several minutes in error because of uncertainties in the position of Saturn. Times for stations other than the four listed may be found with sufficient accuracy by geographic interpolation. Approximate position angles, measured from 0° as the direction of north in the earth's sky through 90° as the direction of east and all the way around up to 360°, are: Ring A first contact 235°, ball disappearance 234°, ball reappearance 93°, and Ring A last contact 84°. It is recommended that observations begin, when possible, an hour before Ring A first contact and continue until an hour after Ring A last contact with the goal of detecting a possible dimming of the star by Ring D, a suspected dusky ring exterior to Ring A. Figure 49 shows the path of the star relative to Saturn as it will be at the Lick Observatory and nearly enough as it will be at other stations.

Since the magnitude of BD-19°5925 is 8.6, at least 12 inches of aperture will presumably be necessary to make the star visible through Ring B. However, it is still important that possessors of smaller telescopes should attempt observations because brightenings of the star at intensity minima in the rings may be visible to them. Even so, use all the aperture that you can.

A.L.P.O. members and other observers are urged to make every effort to observe this occultation, especially those able to employ apertures of 12 inches and more. (A few professional observatories have already granted requests from advanced A.L.P.O. members for the use of such telescopes.) Our main goal here is to determine the positions of intensity minima in the rings. A simple but effective procedure involves timing, as accurately as available means permit, first and last contacts of the star with the rings and any brightenings that occur during its passage behind the rings. Durations of such brightenings should also be determined. Desirable, though not essential, equipment for this purpose comprises, first, a tape recorder, and second, a short-wave receiver. The short-wave receiver should be tuned to Station WWV of the Canadian Broadcasting Company, which simply transmits time signals at one-minute intervals. These signals will be recorded on the tape along with spoken descriptions of the events mentioned above (contacts and brightenings). The times of these phenomena may later be accurately derived from the tape by interpolation. This procedure was widely employed by Moonwatch Stations throughout the United States during the International Geophysical Year. The original tape should be kept for a while by the observer and may be requested for use in the reduction of the data.

Other Observations. It will be of interest to try to observe the occultation emersion of the star from behind the ball of Saturn. Planetary atmospheric effects may there be expected. This reappearance, of course, is almost certain to be observed late. Occultation disappearance behind the ball will occur with the star already behind the rings (Figure 49) and hence cannot be observed to any purpose.

Photographic and photoelectric observations are likely to require very large apertures of 30 inches and more to be of value. Persons planning studies of these types should write to Dr. Goodman at once.

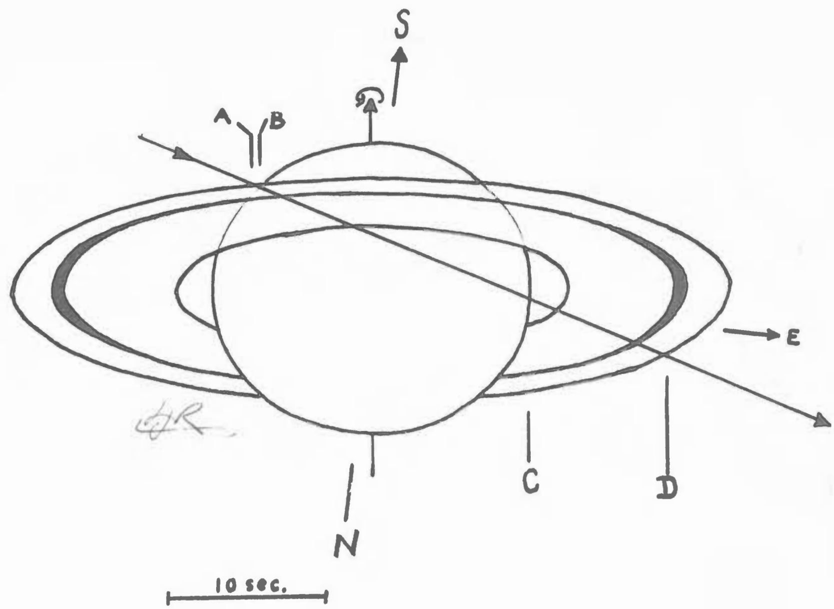

FIGURE 49. Diagram of the path of BD-19°5925 relative to Saturn on July 23, 1962, as presented at the Lick Observatory. Contributed by L. J. Robinson. Note angular scale at bottom, indicated directions in earth's sky, and location of axis of rotation of Saturn. See also article in this issue.

Persons having the use of a filar micrometer are requested to measure the position angle of the star at points A, B, C, and D on Figure 49. It may easily prove possible to get results only for points A and D. Accurate positional determinations upon the star at other times may also be valuable, the positions being observed relative either to Saturn or to one of its satellites.

<u>Submission of Observations</u>. All observations secured should be reported <u>as soon as possible</u> after July 23 to our Saturn Recorder, <u>Joel W. Goodman, Dept. of Microbiology, University of California School of Medicine, San Francisco 22, Calif</u>. He is in charge of this project. If enough observations of good enough quality are secured, an electronic computer may be used in the data reduction. Each report should include:

1. The usual information on the name and address of the observer, the telescope employed, magnification, seeing, transparency, etc.

2. The latitude and longitude of the station of observation to within a minute of arc and its altitude above sea level to within 5 meters (16 feet).

3. The make and model of the tape recorder used, if any, and any other information helpful in evaluating the observation.

References

Readers are invited to examine these papers for information on past occultations of stars by Saturn and its rings. The list could be extended.

1. Ainslie, <u>Monthly Notices</u>, Vol. 77, p. 456, 1917.

2. The Strolling Astronomer, Vol. 10, p. 122, 1956.

3. The Strolling Astronomer, Vol. 14, p. 58, 1960.

4. The Journal of the British Astronomical Association, Vol. 71, p. 8, 1961.

THE 1961 A.L.P.O. SIMULTANEOUS OBSERVATION PROGRAM--SECOND REPORT

By: Clark R. Chapman

I. Introduction

Thirty-six observers cooperated by making simultaneous observations of selected lunar craters and planets on fifteen target times in the summer of 1961. This is the second of two articles summarizing the 1961 Simultaneous Observation Program. The first report appeared in the March-April, 1962, Strolling Astronomer and summarized the observations themselves. Included with the article were sample illustrations of drawings made on six of the target times. This second report is devoted to interpretations, explanations, and suggestions toward improving observational accuracy. A number of A.L.P.O. members have written fairly lengthy letters with comments about the problem of observational accuracy. Some of these ideas are included in this report. I would like to thank the thirty-six observers and all the other people who offered suggestions and helped the Simultaneous Observation Program in other ways.

Some A.L.P.O. members have urged that a second Simultaneous Observation Program be undertaken this summer, but the response has not been great enough to warrant another program at this time. One prerequisite for another program is a well-organized simultaneous photographic patrol. No offers for one have been made.

II. The Lunar Observations

There were three simultaneous lunar observation target times. The first lunar target time was August 15, 1961; and the object under observation was the crater Gutenberg, 45 miles in diameter. Eleven observers submitted drawings. Of these, none show enough detail to better even fairly mediocre photographs, and the detail most of them show is distorted or erroneous. For instance, according to Wilkins the diameter of the intruding ring "E" is 14 miles (31% of the diameter of Gutenberg itself). Of ten completed drawings of Gutenberg, two drawings show no trace of the ring, two drawings have the diameter of "E" greater than 45% of the diameter of Gutenberg, and three drawings have the diameter of "E" about 20% of the diameter of Gutenberg. There is even disagreement on the actual shape of Gutenberg itself! Several observers saw Gutenberg practically round, others saw it elliptical, others saw it pear-shaped, and one saw it triangular. Concerning the detail on the floor there is no better agreement. Two observers show a single cleft, while the other observers show numerous arrangements of craters, mountains, hills, and domes. In fact, of all ten of the completed drawings, only one had a fairly close resemblance to the appearance of Gutenberg in the Kuiper Photographic Lunar Atlas. This particular drawing was made under very unfavorable conditions. According to the observer the moon was behind a tree from the position of the telescope mount so that the telescope was "lifted out of its cradle and carried to another part of the yard where it was propped on the back of a chair. The sketch could be a record for having been made under the worst possible conditions. The hour required for the observation consisted of 15 minutes observing, 15 minutes drawing, and 30 minutes cursing the rickety support."

The second lunar target was the crater Herodotus on August 24, 1961. Seven drawings were received. Again, there is practically no agreement on crater shape or on the finer detail. Three of the drawings have the longest dimension of the crater less than one inch in length! (It is usually considered to be impossible to make an accurate drawing on a scale this small.)

Ten drawings were submitted for the September 18 crater Cassini alert. There is agreement that Cassini contains two interior craters, but the observers disagree on the locations of the craters. Most observers saw some floor detail southwest of Cassini A, but the representations of the detail range from a series of dark spots to a white streak. Because Cassini is of a rather symmetrical shape, the drawings resemble each other considerably more than those of the first two lunar alerts, but none of the Cassini drawings comes close to adding any knowledge to selenography.

It would be unwise to publish a series of simultaneous lunar observations side by side in the same manner as simultaneous planetary drawings were published in the last article. I still plan, however, to send the observers themselves some comparative illustrations.

Why are the lunar observations of such poor quality in comparison with the planetary observations? There are several answers to the problem. Many observers have a great deal of difficulty in representing the proportions of a large object. Also, very few observers spend the time and care necessary for drawing a large and complicated object such as a lunar crater. Most amateur lunar observers tackle too much and finish with an incomplete and inaccurate drawing of a large object, rather than with an accurate drawing of a small object. Another reason why observers often have more difficulty with the moon is because of the much greater artistic ability necessary to represent realistically the heights, depressions, shadows, and shadings visible on the lunar surface.

Several conclusions about lunar observations may be reached from this study. The first and most important conclusion is that the making of single drawings of random craters is of practically no scientific use. If lunar studies are to be undertaken by the means of drawings, the observer should have a lengthy period of practice and training and should concentrate on the accuracy of smaller detail. He should trace the framework of the drawing from a photograph (or a <u>good</u> lunar map) and should just add to what is shown on the photograph. In no case should the observer undertake a large object. If an observer is to observe the moon by making drawings he would probably do best by selecting a single formation and then by studying it systematically. A.L.P.O. members should be especially wary of placing confidence in lunar drawings unless the observer has convincingly demonstrated that he has overcome the pitfalls common to most lunar observers. Newer students of the moon would probably do best by trying other types of lunar studies not involving drawings of the traditional type. Some of these ideas are being incorporated in the programs of the newly formed Lunar Sections of the A.L.P.O.

III. The Errors and the Reasons for Them

<u>Unconfirmed work</u>. Drawings of the planets comprise a large part of A.L.P.O. observational work. It is for this reason that I believe it is of primary concern to us that the drawings be accurate and reliable. It is not infrequent that the Recorders place considerable faith in a single observation in the final reports. (For instance, it is possible that the conflicting descriptions of the darkness of the NPR on Saturn in 1960, <u>Str. A.</u>, Vol. 15, Nos. 7-8, page 128, interpreted as actual day-to-day changes, were actually errors on the part of the observers. In the 1961 Saturn Report there is more similar confusion over the NPR: the Recorder reports that intensity estimates indicated that the NPR was the "darkest area on Saturn" while on the majority of 1961 Saturn drawings published on pages 66, 67, and 73 of the March-April, 1962, <u>Strolling Astronomer</u> the NPR is either inconspicuous or totally absent. These inconsistencies are probably the result of observers' errors.) Some people have suggested that the best way to counteract such errors is to disregard any unconfirmed observations. I believe that this principle would be very bad indeed. For instance, one of the most remarkable observations made in recent years was the observation reported on page 102 of the September-October, 1959, issue of <u>The Strolling Astronomer</u>. Mr. Tom Quinn reported seeing a Jovian festoon change position in a period of only twenty minutes on March 29, 1959. Although a friend of Mr. Quinn's was reported to have confirmed the observation, there was no really independent confirmation. Had this observation been disregarded for

lack of confirmation, it would be forever lost from published records. Actually this amazing observation is not erroneous: I happened to be observing at the same time and noted in my observing notebook that "the marking protruding south from the North Equatorial Belt grew very rapidly." This is the only time I have ever observed a rapid change of this type on Jupiter, but I did not report it to the A.L.P.O. because I was not a member at that time. There have been other single unconfirmed observations of importance in the past, and similar ones in the future should not go disregarded. In order to insure more accuracy, however, more discretion should be taken in the interpretation and reduction of observational data so that mistaken observations are excluded from the analyses as much as possible.

Careless drawings. In the past some fallacious drawings have been printed in The Strolling Astronomer. These errors were most obvious when two drawings happened to be made at precisely the same time and disagreed; in addition, several single drawings obviously were in error. The quantitative results of the Simultaneous Observation Program published at the end of the first report indicate, nevertheless, that drawings can be quite accurate in many respects. It seems likely, therefore, that a large factor in the cause of the errors is simple carelessness on the part of the observers. There are other causes of errors which should be investigated in the future.

Artistic styles. One important difference between drawings of different observers is the difference in artistic styles. Every observer has a separate drawing style--no observer successfully draws a photographic view. Some observers have cultivated rather extreme and unrealistic styles. Examples of these can be seen in collections of Jupiter drawings published in past Jupiter Reports. Differences in style can sometimes produce erroneous results in certain analyses while the same drawings can be very reliable in other studies. Differences in style result from many of the other factors discussed below. The different styles become exaggerated at times if the observer falls into a "rut". If an observer loses his open-minded interpretation at the telescope, he may well draw features less as they actually look and more like similar features he has seen in past years. One way an observer can rid himself of an unrealistic style is to experiment with his observing methods and drawing procedures. Try experimenting with different magnifications, different-sized disks, and different pencils. Experiment with your methods of beginning drawings and darkening in the detail. One well-known astronomer made half his drawings of Mars while looking through an inverting eyepiece. (Most Mars observers would probably hesitate to make drawings of the well-known Mars surface features "upside down"; but if the observer is completely objective and open-minded, such an observation should be just as accurate as one made through a regular eyepiece.)

Too sharp boundaries. One common fault of drawings is the tendency of observers to show sharp boundaries to planetary features or sharply linear lines when actually fairly broad bands are seen. The boundaries to Jupiter's belts can never be resolved to perfectly sharp lines--the boundaries must always be somewhat indefinite. Similarly, the Lowellian type of Martian canal is just a misrepresentation of the true features. Mr. James Sitler ran an extensive experiment by having persons draw artificial disks of Mars from various distances. Almost invariably the splotched features on the original disk were interpreted to be straight lines. Many errors of this type could be checked if observers would use blunt pencils for making drawings. A similar misrepresentation occurs when observers draw the cusps of Mercury perfectly sharp even when the seeing is poor. The drawing by Geoff Gaherty during the July 23, 1961, Mercury alert (Figure 3 in the first report) is much more realistic.

Differences in resolution and seeing. Differences in drawings often result from differences in aperture, seeing, and individual visual acuity. Observers with smaller apertures, poorer seeing, or poorer acuity often make drawings which are simplified in comparison with observations made with larger telescopes under better seeing conditions. A double festoon on Jupiter may appear to be one large dark area to a person with less resolving power. During the July 25 Jupiter alert a rectangular hump on the NEB was seen rounded by two observers with smaller telescopes. Linear Martian canals are also over-simplified representations of detail below the resolving power of most instruments.

Contrast sensitivity. Another factor which contributes to differences in drawings and intensity estimates is differing sensitivity to faint shades of contrast. Some observers have very poor contrast sensitivity. Their drawings are characterized by only two or three variations in tone (generally "light", "dark", and "intermediate", with "shadow" a fourth category if a shadow is present). These observers have great difficulty in observing detail within the dark regions on Mars. They also cannot see well the faint shadings visible on the flat lunar regions, in the Martian deserts, and on the planet Venus. Intensity estimates by these observers are likely to be inaccurate, particularly if they have not had experience in estimating intensities. Some other observers have excellent contrast perception. Sometimes such a person will unknowingly exaggerate certain faint differences in tone. In experiments with artificial disks such an observer may draw a large dark spot where none seems to exist on the original. Careful inspection of the original will probably indicate a faint tonal difference. Such an exaggerated representation is as misleading as a three-toned drawing. With practice, such a person can probably estimate intensities accurately nearly down to a tenth of an intensity unit on the A.L.P.O. scale. If you are bothered by being unable to represent successfully with a pencil the great variety of tones you observe when drawing a lunar crater, you probably have excellent contrast sensitivity.

Relative proportions. Another cause for differences in drawings is the factor of estimating proportions. We have already seen great errors in estimations of the shapes of lunar craters. The problem of proportion manifests itself in other ways, too. For instance, some observers systematically draw the dark features on planets too small in relation to the size of the disk. Others tend to draw the dark areas relatively too large. Many examples of these errors were evident in the drawings made by the participants in Mr. Sitler's Mars experiment. Although often these errors are the result of personal differences between the observers, these effects can be caused by other factors. If a low magnification is used on a relatively bright planet such as Mars, irradiation can often cause the dark areas to appear smaller. This tendency has often been given as an explanation for linear representations of the canals. Similarly if a high magnification is used on a fainter planet, or if a planet is observed through very hazy skies, I have found that the dark regions often can appear exaggerated in size.

Systematic positional errors. Another significant cause of variations in observations was revealed by the analysis of the simultaneous drawings: systematic positional errors. Most observers seem to have small systematic errors in position, which, if corrected for, would greatly increase the accuracy of the observations. These errors are brought out well in latitude and longitude placements and in central meridian transits. Positional placements on a drawing tend to be more consistent with other positions on the same drawing than with positions on other drawings by the same observer; however, there is considerable evidence to indicate that there are general "personal equations" which remain true for an observer for a fairly lengthy period of time. Observers should test their own systematic errors and correct for them, if possible, when they reduce their data.

Color sensitivity. Still another cause for error is different sensitivity to color. This circumstance greatly affects intensity estimates and drawings. Leif Robinson considers it to be one of the most important factors. It is well known that different people react to differences in wavelength in very different manners. Some eyes are especially sensitive to certain wavelengths and insensitive to others (this is probably true for most eyes and is not limited to the greatly extreme cases of color blindness). Color can cause important effects even when the color itself is not readily visible. A person with blue sensitivity would probably call the STrZ on Jupiter the brightest zone on the planet right now (June, 1962), while a person with yellow sensitivity would probably consider the NTrZ to be the brighter. This difference in color sensitivity has been considered by some to be an explanation of why some observers see the "spokewheel" pattern on Venus while others see an entirely different pattern. The hypothesis is that both patterns actually exist but that the patterns are of different color. This factor of color is so important that special studies of the effects of color sensitivity would be invaluable to planetary observers.

Pure imagination. Another important problem is the problem of "seeing what isn't there". Many observers attempt (probably unwisely) to draw everything down to the limit of visibility. Some observers invariably fall into the trap of drawing small spots and other features that obviously could not be resolved. The suggestion has been made that the markings seen on Jupiter's satellites with small telescopes are actually features on the diffraction disk rather than on the true disk. Other people will record features which are actually transitory motes in the observer's own eye. There are many other cases where the markings are probably just imagined. This problem is particularly troublesome in Venus drawings. The markings on Venus are especially faint, and it is very difficult to be entirely objective when observing the planet. James Sitler and Joseph Eyer made a series of simultaneous Venus observations between August 28 and 31, 1961, to analyse this problem. These careful observers seem to show real agreement on many of the drawings, but there are still numerous cases of presumably imaginary markings which show up as differences in the two sets of drawings. An observer can usually discover whether he suffers from the error of drawing features which do not exist by comparing his drawings with other drawings made by himself as well as by other observers.

Other factors. Some of the largest and most glaring errors in drawings cannot be explained by any of the factors mentioned above or by other less important factors such as twilight, altitude in the sky, transparency, etc. (which usually cause negligible differences except in extreme cases). The remaining possibilities are that the observer was inexperienced, careless, or sleepy. An observer should always be careful to make accurate and thorough observations. We cannot compete with professionals in the amount of work we do, nor in the extensiveness of our equipment; but there is no reason why our smaller tasks cannot be done carefully and thoroughly.

IV. Recommendations and Suggestions

The best way for the typical lunar and planetary observer to correct for the factors which lead to errors and differences is for the observer to acquaint himself with these factors, analyse his own errors, and correct for his errors. Doing so will require a considerable amount of conscious effort on the part of some members of the Association. More programs similar to the Simultaneous Observation Program should be run in the future with more controls and more participation. One type of Simultaneous Observation Program which should be carried out would be one conducted by members of a local astronomy club so that precise physiological and psychological tests could be made on each observer to serve as controls. Another Simultaneous Observation Program throughout the whole A.L.P.O. would serve to educate the observers to the problems of observing and would be very useful. Individual observers who insist on drawing exceedingly fine canals on Mars or numerous ring divisions on Saturn's rings should conduct their own tests with artificial disks to prove to themselves the impossibility of such observations. Few observers maintain that Dawes Limit can be bested by a factor of two on double stars, but there are many observers who incorrectly seem to feel that there is practically no limit to the resolution of linear features.

Some experts in the field of lunar and planetary astronomy have noted the errors in disk drawings with great alarm and have advocated that drawings not be used for scientific analysis (except to provide a pretty picture of the general appearance of the object under observation.) There is a particularly large amount of feeling against using drawings for positional work. I believe that this is a very unfortunate attitude, for with correct reduction drawings can provide a wealth of information. For instance, using just eleven 1961 simultaneous drawings of Jupiter (July 18 alert), I found latitudes of the Jovian belts that are nearly as precise as some of the photographic and micrometric measurements reported in past Final Jupiter Reports. If quantitative measurements were made from the large number of drawings which are turned in to many of the Recorders, much more information could be obtained. I have found accurate positions on Mars (Str. A., Vol. 15, Nos. 7-8, page 118), accurate rotation rates for dozens of Jovian features, and other information from quantitative analyses of a relatively small number of my personal drawings. While individual drawings often have serious errors, the errors are considerably reduced when large numbers of observations are averaged together.

I strongly suggest that the Recorders apply this type of analysis to the drawings they receive. Despite the doubts expressed by some experts, I feel confident that very accurate positional measurements, rotation rates, small atmospheric motions, phases, etc. can be determined from an effective analysis of the data. Despite the poor quality of individual intensity estimates, averages of the carefully reduced estimates of the large number of observers who make intensity estimates could be very precise. Greatly increased accuracy could be achieved if corrections were made for the systematic errors of the observers. For some of the Sections, this type of effective analysis would be impossible to do with only two Recorders.

A problem of great importance concerns the training of new observers to make reliable observations. A number of correspondents have suggested to me that a method of "apprenticeship" such as is used by the Solar Division of the A.A.V.S.O. be adopted. One objection to this is discussed by Dr. James Bartlett, Jr.: "Because of the inherent discriminatory nature of the method its application has to be carefully weighed. The goats naturally do not relish public separation from the sheep, and a membership drop may be the result. On the other hand, if skillfully handled, it may also promote membership in that it confers the distinction of belonging to an organization of first class reputation." There are other objections, however, which should be considered. There can hardly be a fixed time interval set for a training period. I have witnessed one observer make a very satisfactory drawing of Jupiter the first time she had ever seen the planet through a telescope. There are a number of observers, however, who have been observing for decades and still make unacceptable drawings. Perhaps a more fundamental objection is this: the A.L.P.O. really needs as many observations as possible. We would be doing far more harm to ourselves than good if we decided to use the observations of only the top 25 observers in the A ssociation.

I have a suggestion of a similar type of training method that I think would greatly alleviate the problem. In the past the Recorders have to some extent weeded out and not used the work reported by inferior observers. Too many times, however, mistakes and poor drawings have slipped through. I suggest that a definite plan be set up whereby each Recorder assigns, on the basis of his own judgment, a rating to each observer who communicates with his Section on the following scale:

A: means that the observer is judged to be very reliable (a rating to be given with considerable discretion).

B: means that the observer submits observations of some value to the Section but still needs to make more improvement (to be given to most observers).

C: means that the observer's observations are not reliable and therefore should not ever be seriously considered (to be given to beginning observers and to the poorest of the long-time observers).

A beginning observer would start with a "C" rating and would work up the ladder as he improves. Work by "C" observers would never be used in the final reductions or Final Reports. As the quality of the work improves (rapidly for most observers), the observer is given a "B" rating. The reports of a "B" observer would be used, but his observations should always be marked on the working papers of the Recorder and in published reports as by a "B" observer. After a period of some time (a matter of years in most cases) the best observers would be given an "A" rating. Considerable faith would be placed in the work of "A" observers.

It should be pointed out that the rating would be done individually by each Recorder for his own Section. Some observers can make excellent observations of Jupiter but do very poorly on the moon, for example. An "A" rating would be a goal for the observers to strive toward; yet most of them could still have their observations used and published if marked as coming from a "B" observer. Only the poorest observers would remain for any length of time in the "C" category. The Editor could effectively serve as a final check on material to be published. I suggest that readers consider this plan and write to the Editor and myself about your ideas; probably you can think of useful improvements.

The Simultaneous Observation Program has been a very interesting and educational enterprise. I urge all serious observers in the A.L.P.O. to consider the results in the first report and the ideas in this report to help make themselves aware of some of the problems of lunar and planetary observing. Those who are interested could do a great service by conducting tests of greater precision on some of the factors mentioned in this article. Again I thank all those who contributed to the Simultaneous Observation Program, and I hope that the results have been as interesting and informative to the readers as they have been to me.

ANNOUNCEMENTS

Tenth Convention of the Association of Lunar and Planetary Observers. This meeting will be held at Montreal, Quebec, Canada, on August 31-September 3, 1962. Our hosts are the Montreal Centre; and the General Convention Chairman is Mr. W. A. Warren, 30 52nd Ave., Lachine, Quebec, Canada. Readers may write for information either to Mr. Warren or to the Editor. Mr. Geoffrey Gaherty has pointed out that this meeting will not be the first one outside of the United States by an American amateur group since our friends in the A.A.V.S.O. have already met several times in Canada--the Editor's oversight.

We shall not repeat information upon our Convention already given on pp. 85-86 of the March-April, 1962, Strolling Astronomer. There are a few new developments. It has now been arranged that the papers sessions will be in a large lecture room of Sir George Williams University, located in downtown Montreal and only a few blocks from the Hotel Laurentien. This room has blackboards, movie screen, fluorescent lighting, microphone jack with speakers, etc. The Exhibit will be either in this room or in an adjacent room in the same building. A registration fee of only one to two dollars per person will be levied upon arrival to cover costs, but there is no advance registration charge. The Sunday evening banquet will be in the Windsor Station Restaurant of the Canadian Pacific Railway Company. The 1962 A.L.P.O. Award, a sterling silver necktie clasp, will be given after the banquet; and we are working on finding an after-dinner speaker. About 20 papers have been selected so far for the program, and it is very gratifying that a large majority of these will be by authors present at the meeting. Topics to be discussed include the moon, Jupiter, Saturn, observational techniques, astronomical optics, and even scientific philosophy.

IT IS IMPORTANT THAT ALL THOSE ATTENDING THIS CONVENTION SHOULD RETURN TO THE EDITOR THE REGISTRATION BLANK MAILED OUT WITH OUR MARCH-APRIL, 1962, ISSUE. WE NEED THIS BLANK BACK BY JULY 14, 1962. AS OF JUNE 7, ONLY A SMALL NUMBER OF BLANKS HAVE BEEN RETURNED, EVEN BY PERSONS WHO WRITE THAT THEY WILL BE AT MONTREAL. IT IS IMPORTANT TO CONVENTION PLANNING TO ESTIMATE ACCURATELY THE ATTENDANCE IN ADVANCE. WE HAVE A FEW EXTRA BLANKS FOR THOSE WHO MAY HAVE LOST THE FIRST ONE. PLEASE--THE REGISTRATION BLANK NOW! AND SEE YOU IN MONTREAL SOON!

Address for Submitting Montreal Convention Exhibit Material. Mr. Clark Chapman is collecting and arranging our A.L.P.O. Exhibit. From June 25 to August 25, 1962, his temporary address for receiving Exhibit material will be c/o Mr. Alika K. Herring, 5010 East Montecito Street, Tucson, Arizona. It will help Mr. Chapman to send photographs, charts, drawings, etc. for this display as soon as possible and certainly in no case later than August 18. Your help with this aspect of the Convention will be appreciated.

New Address for Mercury Recorder. Soon after his return from England, Mr. Geoffrey Gaherty will move to:

2800 Hill Park Road
Montreal 25, Quebec, Canada.

All future correspondence should go to this new address. (P.S.--A better sky should here allow him to do much more Mercury observing as well as recording.)

Back Issues Requested. The Library of New Mexico State University at University Park, New Mexico, wishes to complete its second set of The Strolling Astronomer. This library and the Library of Congress are the only ones, to the Editor's knowledge, having complete files of our journal. The issues which The N.M.S.U. Library lacks from its second set are:

> Volumes 3-5; Volume 6, Nos. 2, 3, 9, 10, and 12; Volume 7, Nos. 1, 4-6, and 8-11; Volume 8, Nos. 1-6; Volumes 11-13; and Volume 14, Nos. 11-12.

Persons wishing to assist the Library by supplying part or all of these issues should write to the Editor, stating just what issues they have, in what condition these are, and what price they are asking.

New Subscription Prices. Readers are reminded that the price of The Strolling Astronomer is now four dollars per year or seven dollars for two years. Single issues are one dollar. The new rates went into effect on June 15, 1962, and represent our first price increase since 1949.

New Lunar Meteor Search Recorder and Request. Mr. Robert M. Adams is being replaced in this position by Mr. Kenneth Chalk, 3489 Grey Avenue, Montreal 28, Quebec, Canada. Mr. Adams has filled this post for many years with devotion, scientific thoroughness, and careful and detailed planning. He has been a model correspondent in his Section. We are all grateful to him. Indeed, many of our members may not know that lunar meteor searches began more than 15 years before Mr. Adams took charge of A.L.P.O. activities in this direction.

Mr. Chalk already supervises the Montreal Centre's considerable and excellent work on the Lunar Meteor Search program. He directs to A.L.P.O. members this announcement: "Mr. Robert Adams has asked me to take over the Lunar Meteor Search Section, and I should like to see this project receive a little more of the attention it merits. A large percentage of the participants in recent years has come from Montreal; and while they have done their part well, they are limited by the comparatively small area they cover, and by weather. This difficulty would be overcome by a loose net of observers spread over the United States and Canada. Observers added in the other time zones would add other hours to the total observing time. That total might easily be increased by 300-400%. Spreading out of stations within time zones would help overcome the weather difficulties which a single group of participants encounters. Observers are asked to contribute only three hours monthly to the project, weather permitting. Addition of larger instruments to the search will increase the probability of sighting one of these trails, which would be in any case very faint.

"The program should also be extended to include a patrol for other lunar events, such as dust clouds and vulcanism. These will involve a new observation schedule, but such a new program can be carried out at Full Moon.

"I would greatly appreciate your co-operation in reviving this project. Increased participation will make results already obtained more valuable."

Error in March-April, 1962, Issue. On page 90 of this issue the telescopes used on Jupiter in 1961 by Mr. Charles Giffen were incorrectly given as 19½" and 15.6" reflectors. They were actually 9½" and 15.6" Clark refractors.

Astronomical League 1962 National Convention and Award. This year's National Convention of the Astronomical League will be held in the Western Skies Motor Hotel at Albuquerque, New Mexico, on September 1-3. For information, write to Mr. Dan Fenstermacher, 9700 Claremont Avenue, N.E., Albuquerque, N. Mex. The theme of this League Convention is "The Moon and Its Exploration." A featured speaker will be Dr. Lincoln La Paz, the Director of the Institute of Meteoritics of the University of New Mexico and the Counsellor of the A.L.P.O. The Astronomical League Award will be given to Mr. Robert E. Cox, O'Fallon, Missouri, Optical Division, McDonnel Aircraft Corporation, St. Louis. Mr. Cox and his work have long been very well known to American amateurs. Mr. Cox will be at Albuquerque to receive the Award.

W. A. A. Hawaii Convention. The Western Amateur Astronomers are meeting under the tropical skies of Hawaii, August 20-25, 1962. Most of August 20 to 23 will be given to sightseeing. Tours include shopping centers on the island of Oahu, the island of Hawaii and the volcanic area, and the Satellite Tracking Station on Maui. The hosts are the Hawaiian Astronomical Society and the Bernice P. Bishop Museum at Honolulu. The Convention Chairman is Dr. Earle G. Linsley, Bishop Museum, Honolulu 17, Hawaii. The final event will be a reception and luau at the Bishop Museum on Saturday, August 25. The Convention will include the usual papers, exhibits, and star party. Chartered tours from California are being arranged.

Dr. Linsley very graciously invited the A.L.P.O. to hold a Convention at Hawaii with the W.A.A.; and it was with great regret that we declined, primarily because of our meeting at Montreal.

A.L.P.O. Library. A number of books have been added to our Library since the last listing appeared; we plan to carry these titles in our next issue. A.L.P.O. members in the United States and Canada are again invited to borrow books. The price of borrowing a book is only 25 cents and the return mailing costs.

Co-op Program at Pan American College. Pan American College at Edinburg, Texas, has begun to participate with the National Aeronautics and Space Administration in a co-op program allowing science students to do technical work while still undergraduates, with evident economic advantages to the student plus the valuable opportunity to learn early about his intended profession. The work phases in the program will be at the Manned Spacecraft Center in Houston, while the study phases will be at Pan American College. Students may join the program at the end of either the freshman or the sophomore college year. Selection will be based on such criteria as grades, native abilities, character, professional potential for a career in science, etc. A security clearance is also necessary. Candidates chosen must major in either physics or mathematics; at Pan American College they can also take courses in the astro-sciences, perhaps even a minor or a major. The director of the program at Pan American College is Professor L. A. Youngman, Dept. of Physics, Pan American College, Edinburg, Texas. At this date (June 12) one candidate for September, 1962, is still not chosen; and vacancies at later times will need to be filled.

OBSERVATIONS AND COMMENTS

Dome-Like Ridges near Marius. On March 10, 1962, Mr. Takeshi Sato of Hiroshima, Japan, wrote in part as follows: "On Plate 71, and less distinctly on Plate 70, of the Photographic Atlas of the Moon by Dr. S. Miyamoto and Mr. M. Matsui of the Kwasan Observatory of the University of Kyoto, I have found that the ridges around the lunar crater Marius are resolved into a great number of dome-like hills. I first noticed this fact probably more than a year ago but supposed that such prominent features would be shown in the great map of the moon by Dr. H. P. Wilkins. However, when I recently examined the Wilkins map, I found that they are mostly shown as simple ridges and that only a small number of these dome-like hills are shown in the Wilkins map. As far as I could tell from the photographs mentioned, it is uncertain whether these dome-like hills are really true domes, terminology also here posing difficulties; but it appears to me that these features are of great importance in theories of the origin of the lunar surface formations, including craters. I would hence like to ask A.L.P.O. lunar observers to examine the details of these features. It is hoped that details of other ridges will also be carefully observed and that possibly such observations will reveal the evolution of ridges. If pure speculation is permissible from my poor knowledge, it appears that such ridges as those of Marius may have evolved into crater-chains like those near Stadius."

Depression North of Aristarchus. Mr. Takeshi Sato called attention to this feature in our January-February, 1962, issue, text on p. 44 and location sketch (Figure 51) on p. 43. Mr. Sato writes that this object was observed by Mr. Isamu Hirabayashi on February 17, 1962, probably with a 4-inch reflector.

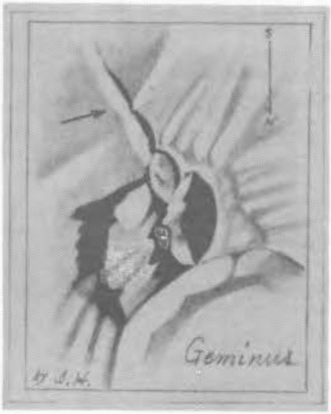

FIGURE 50. Lunar Valley Near Crater Geminus. Isamu Hirabayashi. 4-inch refl. 220X. Sept. 19, 1959. $13^h\ 20^m$, U.T. S=8-6. T=3. Colongitude=115.°6.

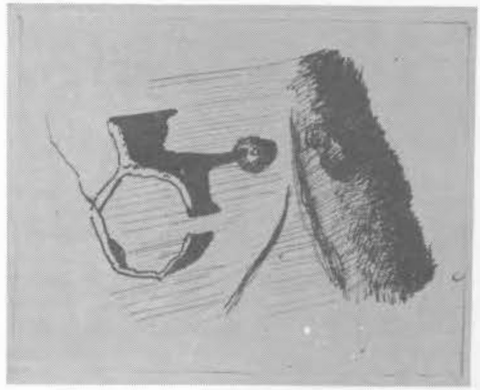

FIGURE 51. Lunar Crater Kies and Vicinity. A. C. Larrieu. 10-inch refl. Oct. 6, 1954. 19^h, U.T. Colongitude=25.°7.

<u>Lunar Valley Near Geminus</u>. Mr. I. Hirabayashi of Tokyo, Japan, calls attention to a curious lunar valley near the crater Geminus and thus close to the moon's northwest limb north of Mare Crisium. One of his drawings here appears as Figure 50, showing a low evening lighting aspect. On February 6 and May 17, 1962, Mr. Hirabayashi wrote in part as follows: "I am the leader of the Club of Lunar and Planetary Research, composed of about 30 Japanese amateur astronomers, most of them senior high school and university students. We have observed a large valley near Geminus on the moon. It is not present at all on the Goodacre map of the moon; and while on the Wilkins map something is drawn with a dotted line, I think that his object is smaller and less prominent than my observed valley. It is a very curious thing that, so far as I know, this prominent object is not recorded in any lunar maps at all. The object can be called either a 'valley' or a 'groove' but for convenience I shall here call it a valley. I first observed this valley on January 7, 1958, at $12^h\ 12^m$, U.T., colongitude=114.°8. The overall appearance as observed by members of the club is as follows:

"The Valley runs southwest from near the west edge of Geminus to a large plain, as shown on Figure 50. The east end of the valley contacts a craterlet near Geminus, and the west end reaches to the small hill (or mountain) west of Burckhardt. Under poor seeing the valley looks like a chain of craterlets, but we can observe complex objects with good conditions and proper solar illuminations. The valley is about 50-100 kms. long and about 15 kms. wide in its widest part. It is deeper and wider in its east part than in its west part, which is hard to detect under high lighting since it is very shallow and narrow. No mountain nor cleft has been found on the interior. One observer says that this large valley is formed from two parallel grooves. If so, there is a convexity in this valley as in the Ariadaeus Rille.

"I have searched for this object in the Kwasan Observatory <u>Photographic Atlas of the Moon</u> and have found it on Plates 2 and 29; but these do not show much detail, and I think that we need many observations under different solar illuminations for a close study. During a recent visit to the Kwasan Observatory to meet Dr. Miyamoto, I looked for the Geminus valley in Dr. Kuiper's <u>Photographic Lunar Atlas</u>, but I found no plate taken under favorable solar lighting.

"I think it unlikely that the valley can be observed usefully on the narrow crescent moon."

Kies and Nearby Dome. Mr. A. C. Larrieu of Marseille, France, expresses interest in Mr. Carlos E. Rost's drawing of Kies and the dome to its east, Figure 48 on p. 42 of the Jan.-Feb., 1962, Strolling Astronomer. Mr. Larrieu invites attention to one of his own drawings of this lunar area, Figure 51 in this issue. He saw on this occasion the curious aspect that the shadow of a high peak on the east rim of Kies was falling upon the dome, an appearance never reobserved since the 1954 date of this drawing. This aspect is obviously of brief duration and may also vary appreciably with the small changes in the sun's selenographic latitude.

Triesnecker Drawing and Lunar Drawing Techniques. Mr. Charles M. Cyrus, 1216 Leeds Terrace, Baltimore,27, Maryland, has contributed the drawing of Triesnecker and its clefts which appears on the front cover of this issue. He also discusses certain general questions about lunar drawing procedures. This drawing of Triesnecker was compared to a tracing of a photograph (he does not say what one); the Editor found agreement of drawing and tracing of photograph to be excellent indeed. Readers may want to make their own comparisons, certainly including photographs of Triesnecker from Dr. Kuiper's Photographic Lunar Atlas. The drawing, to be sure, thus here added very little to what we already knew from the photograph; but Mr. Cyrus points out that he has never seen really outstanding photographs of such popular craters as Aristarchus, Gassendi, or Petavius. One difficulty with using photographs as base outlines for drawing in the finer lunar detail in our visual studies (such a base assuring much more accurate positions and proportions) is scale. Most lunar photographs would need to be enlarged considerably before they can be so used. Mr. Cyrus wonders whether to submit to A.L.P.O. Lunar Recorders the composites of a number of drawings rather than the individual drawings. Certainly the composite is preferable for topographical studies and is more reliable for detail. The Editor would suggest that individual drawings would be useful in certain studies of errors on drawings, in determining at what solar lighting various features or aspects are visible, and perhaps in studies of possible curious variations in aspect at the same solar lighting in different lunations.

Peculiar Dome near Herigonius. Leif J. Robinson invites attention to a horseshoe-shaped dome northwest of Herigonius, xi=-.51 and eta=-.21. It looks like three large domes fused together. Just to its west is a "classical" dome with a small mountain mass on its summit instead of the usual crater pit. Meaning in lunar surface formation theories? Careful observation, especially with larger apertures, may prove rewarding.

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