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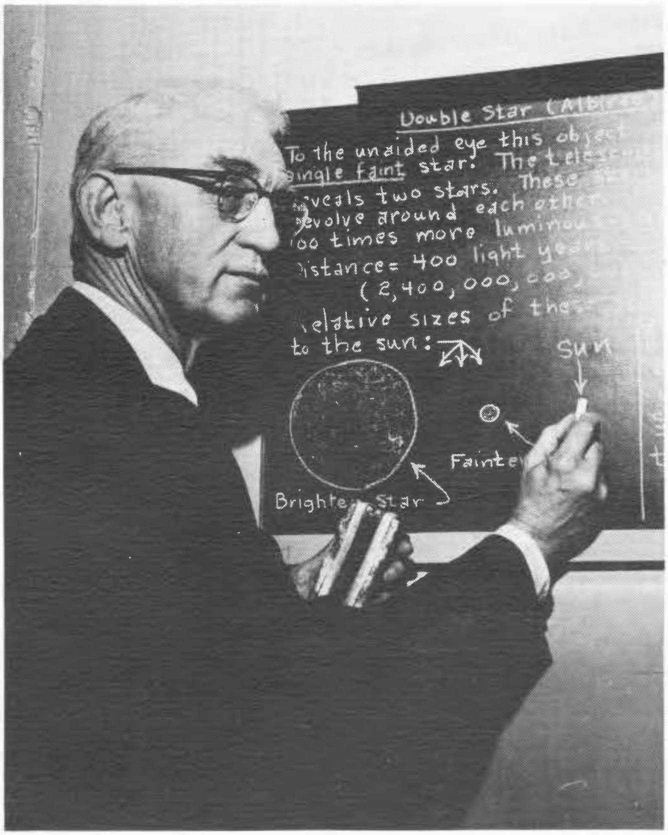

The late Dr. Dinsmore Alter, Director Emeritus of the Griffith Observatory and Planetarium, lecturing at the blackboard. A biographical note appears on pages 101-103.

THE STROLLING ASTRONOMER
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ASSOCIATION OF LUNAR & PLANETARY OBSERVERS
ALPO

Founded In 1947

IN THIS ISSUE

MERCURY IN 1964

By: Richard G. Hodgson, A.L.P.O. Mercury Recorder

1. Introduction

This report of Mercury observations by A.L.P.O. members in 1964 has been delayed for reasons set forth in the recent report for 1963.[1] Essentially this article is a continuation of that report; therefore, it would be redundant to remark again about the recent literature on Mercury, or to repeat advice on observing the planet. Perhaps this account may prod more observers to secure good quality disc drawings so that (1) the suggested 58.6462-day rotation period may be more adequately verified, and (2) a critical map be prepared in time.

2. Mercury's Elongations in 1964

The dates of Mercury's conjunctions, elongations, and elongation angles from the Sun in 1964 were as follows:

Inferior Conj.	Greatest Elongation W.	Superior Conj.	Greatest Elongation E.
Jan. 4	Jan. 27 (25°)	March 13	April 7 (19°)
April 27	May 24 (25°)	June 27	August 5 (27°)
Sept. 2	Sept. 18 (18°)	Oct. 15	Nov. 30 (21°)

The most favorable elongations for observers in the northern hemisphere were those of April and September; in the southern hemisphere late January and early August were most favorable.

3. Observers and Observations in 1964

The planet Mercury was poorly observed in 1964 by A.L.P.O. members. Only one elongation was well observed, and that by only two men. The following persons submitted observational reports for the year:

Observer	Location	Instruments
Klaus R. Brasch	Rosemere, Quebec	8-inch (20-cm.) Newtonian reflector
Walter H. Haas	Las Cruces, New Mexico	6-inch (15-cm.) Newtonian reflector & 12½-inch (32-cm.) Newtonian reflector
Tod Markin	Lakeland, Florida	6-inch (15-cm.) Newtonian reflector

Of the six apparitions during 1964, four passed totally unobserved. Both Brasch and Haas observed the April evening apparition. Brasch submitted five disc drawings and five intensity estimates covering the period March 30-April 12. Haas submitted four drawings and four intensity estimates for the period April 10-April 16. Tod Markin submitted two phase estimates made on June 8 and 9. A total of 11 observations was reported for the year, down sharply from 62 reported in 1963.

These 11 observations were secured through the following apertures:

Aperture	No. of Observations
6-inch reflectors (15 cms.)	4
8-inch reflector (20 cms.)	5
12½-inch reflector (32 cms.)	2

The average observation was made in 1964 with an aperture of 8.1 inches, compared with an average aperture of 6.6 inches the previous year. This step toward larger apertures is a welcome one since their greater resolution is of considerable advantage in Mercury studies.

One cannot but wish for more observers in the Mercury Section, and better use of every opportunity to study the planet, particularly when twilight observation is possible for only a few minutes near sunrise or sunset. A Mercury observing program need not take much time from other observing projects which A.L.P.O. members may wish to pursue.

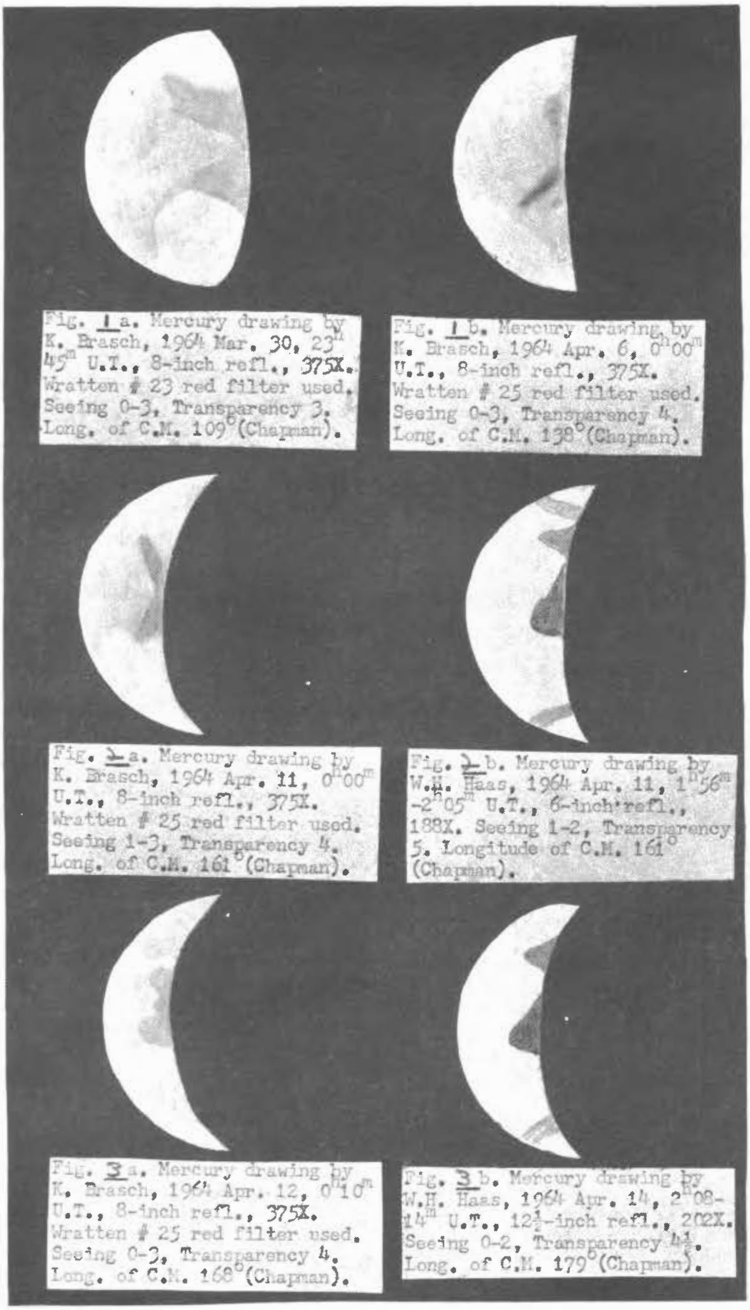

Fig. 1 a. Mercury drawing by K. Brasch, 1964 Mar. 30, $23^h 45^m$ U.T., 8-inch refl., 375X. Wratten # 23 red filter used. Seeing 0-3, Transparency 3. Long. of C.M. 109° (Chapman).

Fig. 1 b. Mercury drawing by K. Brasch, 1964 Apr. 6, $0^h 00^m$ U.T., 8-inch refl., 375X. Wratten # 25 red filter used. Seeing 0-3, Transparency 4. Long. of C.M. 138° (Chapman).

Fig. 2 a. Mercury drawing by K. Brasch, 1964 Apr. 11, $0^h 00^m$ U.T., 8-inch refl., 375X. Wratten # 25 red filter used. Seeing 1-3, Transparency 4. Long. of C.M. 161° (Chapman).

Fig. 2 b. Mercury drawing by W.H. Haas, 1964 Apr. 11, $1^h 56^m$ -$2^h 05^m$ U.T., 6-inch refl., 188X. Seeing 1-2, Transparency 5. Longitude of C.M. 161° (Chapman).

Fig. 3 a. Mercury drawing by K. Brasch, 1964 Apr. 12, $0^h 10^m$ U.T., 8-inch refl., 375X. Wratten # 25 red filter used. Seeing 0-3, Transparency 4. Long. of C.M. 168° (Chapman).

Fig. 3 b. Mercury drawing by W.H. Haas, 1964 Apr. 14, $2^h 08$-14^m U.T., 12½-inch refl., 202X. Seeing 0-2, Transparency 4½. Long. of C.M. 179° (Chapman).

Figures 1,2, 3. Selected A.L.P.O. drawings of Mercury in 1964.

4. Disc Drawings

Six of the nine disc drawings submitted have been selected for publication in Figures 1,2, and 3 as part of this report. Comparison should be made with the appropriate portions of Clark Chapman's Mercury map published in Sky and Telescope, Vol. 34, No. 1 (July, 1967), p. 25.

The Brasch observation of March 30, made when Mercury's central meridian (C.M.) was 109° according the longitude ephemeris of Chapman, is in good agreement with the drawing by Larry Anthenien of 1963, April 16 (C.M. = 107°). The Anthenien drawing was published as part of the 1963 report. Both of these drawings also show fair agreement in major features with the Chapman map.

Two observations were made on 1964, April 11 about two hours apart by Brasch and Haas. The reader can compare them for himself; agreement appears fairly good for major features. These drawings do not, however, compare as well with the Chapman map. (C.M. = 161°.)

There is also some agreement between the Brasch observation of 1964, April 6 (C.M. = 138°) and an unpublished drawing by Anthenien on 1963, April 21 (C.M. = 128°) on gross features.

One could continue these comparisons at considerable length. While there appears to be fairly good agreement about prominent surface features, the science of hermography is still very much in its infancy. Observers, however, have reason for encouragement. A full discussion of these drawings is better postponed until there is a much larger number at hand covering this portion of Mercury's surface.

5. The Observed Phase

Estimates of observed phase were given some attention by Mercury observers in 1964. In April Haas reported the following estimated values of k (the ratio of the area of the illuminated portion of the apparent disc to the area of the entire apparent disc regarded as circular, expressed as a decimal fraction):

Date	Estimated k	Theoretical k
April 10, 2^h, U.T.	.43	.32
April 11, 2^h	.41	.29
April 14, 2^h	.38	.20
April 16, 2^h	.25	.15

Brasch does not give estimates of observed phase as such, but study of his drawings reflects values closer to the theoretical amount. The Recorder cannot judge the extent to which knowledge of the theoretical value may have influenced the making of disc drawings. Irradiation of Mercury's bright surface against a dark sky may help in part to explain Haas' estimated values.

Measurement of Tod Markin's phase drawings of June 8 and 9 yields estimates of k of .60, while the theoretical value was .69 on June 9.

6. Intensity Observations

In 1964 all disc drawings submitted were accompanied by intensity estimates. These estimates are a great help to all who compare and interpret disc drawings, and should be made whenever possible. The recommended scale is 0 (very darkest features) to 5 (very brightest) with the average surface background of Mercury considered to be 3.

7. Conclusion

As emphasized in the report "Mercury in 1963", securing disc drawings of good quality continues to be the most important project of the Mercury Section. Many more observers are needed, especially those with 8-inch and larger aperture telescopes at their disposal. The 1964 observations, although few in number, are a definite contribution to our knowledge of the planet. Let us hope that in the years immediately ahead even more significant contributions will be forthcoming.

Any unreported Mercury observations by A.L.P.O. members for the years 1965, 1966, and 1967 should be sent to the Mercury Recorder without delay. Reports for these years will soon be prepared and published.

Reference

1. Cf. "Mercury in 1963" in The Strolling Astronomer, Vol. 21, Nos. 1-2, (published June, 1968), pp. 5-11.

Postscript by the Mercury Recorder: The hermographic longitudes given in this report, like those given in the report of the 1963 observations, are based on the ephemeris of Clark Chapman. This ephemeris is about to be superseded by an ephemeris published by the New Mexico State University Observatory. The longitudes given by the NMSU ephemeris, when published, will be adopted by the Mercury Section for its interpretation of disc drawings and photographs.

A REVISED CATALOG OF LUNAR DOMES

By: Kenneth J. Delano, A.L.P.O. Lunar Recorder

Despite the hundreds of excellent Orbiter photographs of the Moon's surface, a need still exists for Earth-based observations of lunar domes, especially with apertures of 8-inches and over. Relatively few domes are clearly recognizable in the Orbiter photographs since domes do not stand out well if the Sun lies more than a few degrees above the lunar horizon, as indeed was the case when most Orbiter photographs were taken. However, if we know from Earth-based telescopic observations the precise locations and extents of the numerous lunar domes, we can learn much more about the detailed appearance of the domes and their environs from an examination of the Orbiter photographs, even though the domes themselves are often not recognizable as such on the basis of the Orbiter photographs alone.

The accompanying list of lunar domes is presented with the two-fold purpose of:

1), Providing experienced lunar dome observers with a revised, updated listing of confirmed domes to be used in the continuing work of establishing the precise locations and perimeters of these domes; and
2), Giving anyone interested in finding these elusive swellings on the lunar surface a chance to locate them and to become familiar with their appearance in a telescope, and perhaps be encouraged to take an active part in the A.L.P.O. lunar dome program.

In order to secure as exact as possible a fix of a particular dome's location, participants in the lunar dome program are encouraged to take out to the telescope a good photographic lunar atlas (e.g., Kuiper's PHOTOGRAPHIC LUNAR ATLAS or his ORTHOGRAPHIC ATLAS OF THE MOON, or Kopal's PHOTOGRAPHIC ATLAS OF THE MOON). With a good photographic atlas or with the USAF's LAC charts at the telescope, the observer can, with care, quite accurately trace out the exact position and outline of any dome he sees.

The catalog of domes given here is a revised and supplemented version of the original ALPO-BAA listing, which appeared in THE STROLLING ASTRONOMER, Vol. 18, #9-10, p. 180. Subsequent observations have caused a few deletions as well as additions to that original listing. The first column here identifies the dome by its xi and eta coördinates; the second column (for the convenience of those owning lunar charts or atlases which do not use the xi and eta grid system) gives the dome's corresponding lunar longitude and latitude; the third column aids the observer by informing him of the approximate size of the dome and its general appearance.

Members of the ALPO who have taken part in the lunar dome program are:

Beck, Mrs. I. N.	McIntosh, Patrick S.
Capen, Charles F.	Olivarez, José
Delano, Kenneth J.	Ricker, Charles L.
Herring, Alika K.	Schneller, Kenneth
Jamieson, Harry D.	Suárez, Michael (now Podanoffsky, M. S.)
Kiplinger, Alan	Westfall, John E.
Korintus, John S.	Watts, Donald W.
Lambert, Randy	Wood, Gary

The BAA participants are:

Abineri, K. W.	Heath, Alan W.
Barnes, C. G.	Howie, F. G.
Bestwick, J. D.	Marsh, J. C.
Chalmers, J.	Moore, Patrick
Cooke, S. R. B.	Pither, C. M.
Doherty, B. T.	Rae, W. L.
Ellis, R. E.	Warner, Brian
Ford, A.	Weekes, J. H.

DOME (xi-eta)	Long. & Lat.		Size & Comments
+777-318	+55°03'	-18°35'	30 kms.; oval, with surface craters.
+745+265	+50 25	+15 23	20 kms. x 8 kms.; dumbell-shaped; low.
+697-075	+45 00	-03 30	45 kms.; has 3 summits.
+618-167	+38 53	-07 25	7 kms.; has 2 craters at its summit.
+615+065	+37 50	+03 43	35 kms.; low, irregular.
+615+126	+38 13	+07 12	10 kms.; a steep, round dome.
+610+042	+37 35	+02 30	30 kms.; low & ill-defined.
+608-376	+41 05	-22 07	10 kms.; hemispherical; low.
+603-380	+40 42	-22 32	5 kms.; a steep, hemispherical dome.
+595+055	+36 30	+03 20	30 kms.; low & ill-defined.
+593+131	+36 44	+07 27	11 kms.; a steep, round dome.
+568+244	+35 55	+14 11	7 kms.; has a summit crater.
+537+204	+33 10	+11 50	11 kms.; summit traversed by cleft.
+536+183	+33 02	+10 36	8 kms.; flat summit; surface crater(s).
+534+288	+33 44	+16 46	61 kms.; a Rümker-type dome; complex.
+524+187	+32 14	+10 40	8 kms.; has a steep summit.
+523+206	+32 23	+11 55	15 kms.; has 2 craters on surface.
+523-334	+33 40	-19 10	21 kms.; has 2 off-center craters.
+519+186	+31 50	+10 40	7 kms.; hemispherical; moderate slope.
+510+200	+31 25	+11 34	7 kms.; round, with a steep summit.
+507+184	+31 04	+10 38	10 kms.; round & hemispherical.
+430+280	+26 42	+16 18	Medium, round dome.
+424-462	+28 38	-27 32	14 kms.; has several peaks on it.
+363+130	+21 35	+07 37	24 kms.; complex; has several peaks.
+358+149	+21 10	+08 34	8 kms.; round & featureless.
+357+554	+25 29	+33 45	12 kms.; low; hemispherical.
+353+155	+20 52	+08 55	10 kms.; round & featureless.
+349+161	+20 42	+09 18	7 kms.; has summit crater or cleft.
+339+107	+20 00	+06 09	20 kms.; has several craters & peaks.
+325+733	+29 05	+46 48	10 kms.; low, much surface detail.
+274+299	+16 37	+17 32	12 kms.; bisected by a cleft.
+259+304	+15 45	+17 49	12 kms.; bisected by a cleft.
+183+348	+11 11	+20 21	12 kms.; has a summit crater.
+152+510	+10 00	+30 44	22 kms.; low and flat; heart-shaped.
+098+260	+05 40	+15 20	12 kms.; low and hemispherical.
+095+582	+06 48	+35 32	15 kms.; steep; associated with ridges.
+091-117	+05 15	-05 50	8 kms.; somewhat triangular.
+090+768	+08 20	+50 12	12 kms.; hemispherical; moderate slope.
+061+068	+03 32	+03 54	5 kms.; located on Triesnecker's wall.
+055+508	+03 30	+30 50	25 kms.; low & ill-defined.
+012+827	+01 10	+55 50	17 kms.; smooth except for 2 craters on W.*
+004+041	+00 12	+02 25	12 kms.; round, with summit crater.
+002+088	+00 06	+05 04	5 kms.; round, fairly high.
-001+080	-00 02	+04 34	5 kms.; round; uneven surface.
-019+730	-01 30	+46 58	4 kms.; round & hemispherical.
-060-060	-04 01	-03 37	8 kms.; no surface detail.
-074+374	-04 10	+21 23	12 kms.; has peak or craterlet on summit.
-075-053	-04 19	-02 53	9 kms.; smooth; slightly oval.
-078-059	-04 24	-03 29	9 kms.; no surface detail.
-089+561	-06 00	+34 02	16 kms. x 24 kms.; lies admidst rills.
-108+317	-06 24	+18 40	45 kms.; bisected by mountains.
-121+670	-09 35	+42 12	34 kms.; triangular; flat.
-138+447	-08 50	+26 34	5 kms.; round, steep, hemispherical.
-156-353	-09 37	-20 42	11 kms.; traversed by a cleft.
-162-347	-09 20	-20 05	4 kms.; traversed by a cleft.

*West in the I.A.U. sense, according to which Grimaldi is near the west limb of the moon.

DOME (xi-eta)	Long. & Lat.		Size & Comments
-193+005	-11°05'	+00°15'	13 kms.; has mountain spur on N. slope.
-205-069	-11 48	-04 00	8 kms. x 11 kms.; has moderate slopes.
-212+049	-12 14	+02 46	15 kms.; has craters and ridges.
-214-507	-14 30	-30 10	10 kms.; very low.
-217-485	-14 25	-29 05	7 kms.; round; has rill at N. base.
-218+042	-12 40	+02 25	5 kms.; round, with rough surface.
-232-467	-15 11	-27 50	13 kms. x 20 kms.; craters and peaks on it.
-247+013	-14 19	+00 42	13 kms.; round; low.
-250+021	-14 29	+01 14	10 kms.; round and low.
-257+030	-15 00	+01 45	20 kms.; low and ill-defined.
-297-475	-19 38	-28 20	15 kms. x 22 kms.; flat and featureless.
-301+019	-17 25	+01 12	Medium-sized; round and low.
-301-233	-18 02	-13 32	50 kms.; has a rough surface.
-343+574	-24 42	+35 12	4 kms.; round and smooth.
-343+580	-24 53	+35 28	4 kms.; round, with no surface detail.
-343+582	-24 56	+35 36	4 kms.; round and featureless.
-362-556	-25 46	-33 52	7 kms.; moderate slopes; featureless.
-365-561	-26 00	-34 00	8 kms.; rather steep slopes.
-366-453	-24 14	-26 57	12 kms.; round, with summit crater.
-370-563	-26 30	-34 07	6 kms.; one of several in Capuanus.
-375-554	-26 50	-33 50	8 kms., approximately; ill-defined.
-378-560	-27 08	-34 04	8 kms., approximately; ill-defined.
-384-442	-26 45	-26 15	20 kms. x 16 kms.; a double dome.
-385-555	-27 37	-33 47	6 kms., approximately; ill-defined.
-429+057	-25 25	+03 30	11 kms.; round, with summit crater.
-431-197	-26 00	-11 17	16 kms.; has several peaks on it.
-435+042	-25 50	+02 20	7 kms. x 12 kms.; rough surface.
-440-100	-26 10	-05 49	23 kms.; has 3 summits.
-449+132	-27 00	+07 25	6 kms.; gentle slopes.
-450+207	-27 23	+11 57	12 kms.; has a prominent central pit.
-455+136	-27 20	+07 49	10 kms.; round and featureless.
-459+131	-27 33	+07 33	5 kms.; has summit crater.
-458+137	-27 32	+07 53	5 kms.; round, with a summit crater.
-462+132	-27 49	+07 36	8 kms.; pear-shaped, with central pit.
-466+124	-28 02	+07 10	6 kms.; flat-topped, with summit pit.
-472+125	-28 25	+07 11	6 kms.; round, with summit crater.
-474+243	-29 10	+13 57	3 kms.; one of three small domes here.
-475+244	-29 50	+14 03	3 kms.; one of trio.
-476+238	-29 25	+13 42	3 kms.; round and smooth.
-478+242	-29 39	+13 55	3 kms.; one of a trio of domes.
-483+157	-29 15	+09 02	15 kms.; rough, with irregular perimeter.
-486+219	-30 00	+12 42	16 kms. x 20 kms.; low and lumpy.
-492+238	-30 31	+13 49	19 kms.; low, round, and pitted.
-496-062	-29 50	-03 30	25 kms.; round, low, and flat.
-497+218	-30 46	+12 36	11 kms.; low and round.
-500-290	-31 30	-16 50	60 kms.; has ridges and peaks on it.
-502-068	-30 13	-03 50	34 kms.; round and flat.
-502+228	-30 58	+13 08	12 kms.; low; round.
-503+245	-31 10	+14 11	16 kms.; low, with peaks on it.
-506+439	-34 16	+26 07	8 kms. x 10 kms.; moderate slopes.
-508+200	-31 13	+11 31	22 kms.; plateau-like, with peaks.
-510+175	-31 12	+10 11	10 kms.; round, with summit crater.
-510+220	-31 26	+12 43	14 kms.; round, with flat summit.
-510+228	-31 36	+13 15	10 kms.; low and ill-defined.
-510+460	-34 50	+27 24	Small and low.

DOME (xi-eta)	Long. & Lat.	Size & Comments
-514+477	-35 46 +28 30	12 kms.; round, rather steep.
-515+228	-31 55 +13 00	15 kms.; low and round.
-523+183	-32 00 +10 37	12 kms.; round, with crater S. of center.
-523+441	-35 36 +26 10	Small, oval-shaped.
-523+484	-36 42 +28 57	19 kms.; round, with moderate slopes.
-528+220	-32 45 +12 40	4 kms.; round and steep.
-528+247	-33 00 +14 15	12 kms.; round, with summit crater.
-532+200	-32 50 +11 24	13 kms.; round, with 2 pits on summit.
-532+166	-32 30 +09 39	7 kms.; round; rather steep.
-538+474	-37 40 +28 19	15 kms. x 25 kms.; has an even surface.
-566-131	-34 54 -07 30	10 kms.; has a cleft or ridge on it.
-600-140	-38 00 -08 10	60 kms.; plateau-like.
-612+451	-43 13 +26 50	20 kms.; has prominent summit pit.
-620+452	-44 03 +26 53	16 kms.; has complex surface detail.
-624+445	-44 03 +26 30	13 kms.; lies on wall of Prinz.
-630+155	-39 26 +09 00	8 kms.; round, with summit crater.
-643+651	-57 45 +40 50	65 kms.; the Rümker formation.
-717+345	-50 00 +20 16	12 kms.; has a summit crater.
-773+155	-51 38 +08 57	20 kms.; has a crater near its center.
-804-365	-59 45 -21 33	14 kms.; has a summit crater.
-884-326	-68 10 -19 00	45 kms.; a complex dome in Darwin.
-897+144	-65 01 +08 17	37 kms.; has much surface detail.
-900-005	-63 50 -00 10	20 kms. x 25 kms.; bisected by valley.
-931-071	-69 36 -04 50	28 kms. and 17 kms.; a double dome.

LUNAR LIBRATION CLOUD OBSERVING POSITIONS

By: Walter J. Krumm, A.L.P.O. Lunar Libration Cloud Recorder

(Paper read at the Southwestern Astronomical Conference '68 at Las Cruces, New Mexico, August 21-24, 1968.)

A method is presented for computing an observing position for the lunar libration clouds L_4 and L_5 at any date, and the determination, before observing, of the probabilities of seeing either L_4 or L_5 at the computed position. The 1967-68 Lunar Libration Cloud Ephemeris, presented at the 1967 ALPO Long Beach Convention, is now out of date. This paper will give a computing method for extending the Ephemeris.

The lunar libration clouds are areas of luminosity by reflection from particle concentrations (clouds) that precede and follow the Moon by approximately 60° and lie near the lunar orbit (see Figure 4). The lunar libration clouds present a challenge to the observer because of their extreme faintness and elusiveness. They also present a problem for the observer to answer because they are known to be "off" a predicted position in both right ascension and declination by irregular amounts of up to 5° or 6°. The "why" of these discrepancies in position has not yet been theoretically or observationally answered.

The computing method for a predicted position assumes pure Lagrangian geometry for the lunar libration clouds, with these objects at ±60° from the Moon and on the lunar orbit. Accuracy in the procedure to within a degree of arc is all that is necessary, for the libration clouds are "off" the predicted positions by more than this amount. The American Ephemeris and Nautical Almanac (AE) will be used in the procedure as being the most readily available source of data published. A full example of the computing method for a predicted position, with notes, follows.

To determine, before observing, the probability that a predicted position will allow L_4 or L_5 to be seen, let us ask of the computations the questions: (a) Does the predicted position put L_4 or L_5 between moonset or moonrise and the beginning or end of twilight? (b) Does the observing window allow sufficient time for an observation to be made? (c) Does the predicted position give sufficient separation to L_4 or L_5 from a distracting bright sky object or obscuring area such as the Milky Way or the Gegenschein? (d) Is the

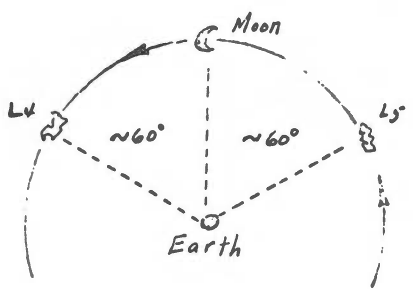

Figure 4. Diagram to show positions of Lunar Libration Clouds L_4 and L_5 relative to Earth, Moon, and lunar orbit.

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local elevation at the time of observing enough to place L_4 or L_5 above the atmospheric extinction that occurs near the horizon? If all these answers are positive, an observation may be made with local sky conditions the only remaining restriction.

When an observation is made and L_4 or L_5 is seen, an observational position is determined in right ascension and declination, including the observing time and place. A careful recalculation of the predicted position is now necessary using the new (observed) time. This allows for a correct "observed minus predicted" value that will be used in the eventual analysis of the positional discrepancy problem.

For computing an observing position for L_4 or L_5 we shall:

Be given: The date;
The observer's latitude and longitude.

Select: L_4 if given date precedes Full Moon, or L_5 if date follows Full Moon.

Want: Position of L_4 or L_5;
Probability of seeing either L_4 or L_5 at the computed position.

Need:
(a) Time of moonset or moonrise, in local time, Universal Time, and standard time;
(b) Time of local beginning or end of astronomical twilight;
(c) Length of observing window;
(d) Local sidereal time or RA at the meridian at moonset or moonrise;
(e) Right ascension (RA) and declination (dec.) of the Moon;
(f) Right ascension for L_4 or L_5;
(g) Declination for L_4 or L_5;
(h) RA and dec. of Gegenschein;
(i) Separation of L_4 or L_5 from Gegenschein;
(j) The RA and dec. position of L_4 or L_5 in the sky for determining the background of stars and constellations, from star maps;
(k) Local elevation of L_4 or L_5.

For the computing example we shall:

Use: September 2, 1968; and
Observer's longitude 106° 41'.8 W. and latitude 32° 17'.3 N. (University Park, New Mexico)

Select: L_4 since this date precedes the Full Moon of September 6th, 1968.

EXAMPLE:

A. Local time of moonset at Greenwich, from AE '68, page 397:

0^h23^m (interpolated between 0^h31^m and 0^h14^m for the observer's 32° latitude)

$\underline{1^h32^m}$ for September 3rd (same interpolation)

$69^m \Delta T$ difference in setting times between the two dates.

$69^m \times \frac{106.7}{360} = 20^m$ (correction for observer's longitude).

R.A. Moon	for L_4 Add	for L_5 Subtract	R.A. Moon	for L_4 Add	for L_5 Subtract
0^h 00'	3^h 45'	3^h 49'	12^h 00'	3^h 45'	3^h 49'
0 20	3 49	3 44	12 20	3 49	3 44
0 40	3 54	3 41	12 40	3 54	3 41
1 00	3 59	3 38	13 00	3 59	3 38
1 20	4 04	3 37	13 20	4 04	3 37
1 40	4 09	3 35	13 40	4 09	3 35
2 00	4 13	3 35	14 00	4 13	3 35
2 20	4 17	3 36	14 20	4 17	3 36
2 40	4 21	3 37	14 40	4 21	3 37
3 00	4 23	3 39	15 00	4 23	3 39
3 20	4 25	3 41	15 20	4 25	3 41
3 40	4 26	3 44	15 40	4 26	3 44
4 00	4 26	3 48	16 00	4 26	3 48
4 20	4 26	3 51	16 20	4 26	3 51
4 40	4 25	3 55	16 40	4 25	3 55
5 00	4 23	3 59	17 00	4 23	3 59
5 20	4 20	4 03	17 20	4 20	4 03
5 40	4 17	4 07	14 40	4 17	4 07
6 00	4 14	4 11	18 00	4 14	4 11
6 20	4 10	4 14	18 20	4 10	4 14
6 40	4 06	4 18	18 40	4 06	4 18
7 00	4 02	4 21	19 00	4 02	4 21
7 20	3 58	4 23	19 20	3 58	4 23
7 40	3 54	4 25	19 40	3 54	4 25
8 00	3 51	4 26	20 00	3 51	4 26
8 20	3 47	4 26	20 20	3 47	4 26
8 40	3 44	4 26	20 40	3 44	4 26
9 00	3 41	4 25	21 00	3 41	4 25
9 20	3 39	4 23	21 20	3 39	4 23
9 40	3 37	4 20	21 40	3 37	4 20
10 00	3 36	4 17	22 00	3 36	4 17
10 20	3 35	4 13	22 20	3 35	4 13
10 40	3 36	4 08	22 40	3 36	4 08
11 00	3 37	4 03	23 00	3 37	4 03
11 20	3 39	3 58	23 20	3 39	3 58
11 40	3 42	3 53	23 40	3 42	3 53

Table I. Values for easy determination of approximate difference in right ascension between Moon and Libration Cloud L_4 or L_5. The tabulated values change with time and are prepared here for the interval July through December, 1968. Table contributed by Walter J. Krumm. See also example of its use in article by Mr. Krumm in this issue.

*****

Then 0^h23^m Local time at Greenwich
$+ 0\ 20$ ΔT for longitude
0^h43^m Local mean time (LMT) of moonset.

or 0^h43^m LMT
$+ 7^h07^m$ observer's longitude in "time"
7^h50^m Universal Time (UT) of moonset.

and 7^h50^m UT
$- 7\ 00$ Zone correction
0^h50^m Local Standard Time (LST or clock time) and 1^h50^m of September 2nd if Daylight Saving Time is used.

Note: These three times will be used later on in the computations.

B. Beginning of twilight, from AE '68, page 382:

4^h09^m LMT (interpolated between 4^h14^m and 4^h04^m for the observer's latitude)

No interpolation is necessary from Greenwich local times for longitude, but often an interpolation should be done in the AE tables on date as well as on latitude.

C. Length of Observing Window

$$\begin{array}{rl} 4^h\ 9^m & \text{LMT beginning of twilight} \\ -\ 0^h43^m & \text{LMT moonset} \\ \hline 3^h26^m & \end{array}$$

The practical observing window is much less, and extends from moonset until L_4 is lost by atmospheric extinction as it approaches the horizon.

D. Local Sidereal Time or RA at meridian at moonset

0^h43^m	LMT moonset.
+ 7 00	Zone correction.
+ 0 00	Solar to sidereal time correction if necessary, from AE '68, Table IX.
+22 46	Greenwich sidereal time interpolated for 7^h50^m UT of Sept. 2nd, from AE '68, pages 10-17.
30^h29^m	
- 7 07	observer's longitude
23^h22^m	RA at meridian at moonset (needed for computing local elevation of L_4 later on).

E. RA and dec. of Moon for Sept. 2nd, 7^h50^m UT, from AE '68, page 129:

RA = 18^h49^m and dec. = +28°11'.

F. RA of L_4:

18^h49^m	RA Moon
+ 4 04	RA correction for L_4. See included Table I on page 81. This is the <u>time</u> along the lunar orbit for the 60° separation of L_4 from the Moon with lunar orbit eccentricity included. The table can be updated as required.
22^h53^m	RA for L_4.

G. Dec. for L_4, from AE '68, page 130:

At a RA of 22^h53^m (for L_4) the lunar orbit has a declination of -9°51', and by definition this is the dec. for L_4 since it lies on the lunar orbit.

-9°51' dec. for L_4.

H. RA and dec. of Gegenschein, from AE '68, page 29:

Sun:	RA	dec.
	10^h46^m	+7° 52'
	+ 12 00	change sign for 12^h
Gegenschein:	22^h46^m	-7° 52'

I. Separation of L_4 from Gegenschein:

RA		dec.
22^h46^m	Gegenschein	-7°52'
22 53	L_4	-9°51'
$0^h\ 7^m$ or 1°45'		1°59'

This amount is hardly enough to permit observation.

J. Sky Position:

L_4 = 22^h53^m RA and -9°51' dec.

From a star map we find this position to be in AQUARIUS and about 2½° south of λ Aqr. No nearby brilliant stars or Milky Way. This position should be OK for observing.

K. If local elevation of L_4 above horizon is to be considered:

Use: local elev. = E = $\sin^{-1}$ (sin D sin L + cos D cos L cos H),

where D = dec. of L_4,
L = latitude of observer,
H = hour angle from meridian
= local sidereal time - RA of L_4.

For this example:

23^h22^m L sid. T at moonset.
$- 22\ 53$ RA of L_4 at moonset.
0^h29^m or 7° 15' = H

We get about 47° local elevation of L_4 at moonset, sufficient to be well above the horizon's atmospheric extinction.

Additional suggested examples:

Given: September 22, 1968.

Same observer.

An inspection of the DIARY of the AE '68, page 7 shows this to be the date of New Moon. The probability of seeing either L_4 or L_5 at this time is extremely poor. It has not yet been proven that the lunar libration clouds can be seen by the front scattering of light.

For computing an observing position for L_5:

Computed with the same procedure as for L_4 except that moonrise and the end of twilight are used.

Try: September 16, 1968!

Summary of example:

	date	RA	dec.	observing window
L_4	September 2, 1968	22^h53^m	-9° 51'	3^h26^m
	start of observing		position	probability
	0^h50^m LST		in AQUARIUS	OK except for Gegenschein

Gegenschein

RA 22^h46^m, dec. -7° 52'

VENUS SECTION REPORT: THE WESTERN APPARITIONS OF 1962-3, 1964-5, and 1966

By: Dale P. Cruikshank, A.L.P.O. Venus Recorder

Introduction

This single report combines the results of observers who contributed to the Venus Section their drawings and written reports for the western (morning) apparitions of 1962-3, 1964-5, and 1966. Insufficient quantities of observations were received for each individual apparition to justify separate reports of the Section. When discussing those items, such as dichotomy, requiring individual treatment, the apparitions will be discussed separately; but certain other items lend themselves to discussions wherein the total collection of drawings are considered.

Observations Received

For the apparition of 1962-3, 38 drawings and two written reports were received from eight observers. For the 1964-5 apparition, 36 drawings, 6 written reports, and 16 photographs were contributed by 6 observers. In 1966, 30 drawings and 14 reports were received from 7 observers. Rev. Kenneth J. Delano contributed a large number of observations to all three apparition collections, and his continued substantial aid to the work of the Venus Section is gratefully acknowledged. It is also a pleasure to acknowledge the contributions of our colleagues abroad, who for the periods covered include Mr. Alan W. Heath (Great Britian), M. Jean Dragesco (France), and Mr. Masao Okada (Japan). These gentlemen invariably prepare their drawings and reports with great care and attention to detail.

The following table summarizes the observations received from each observer for the three apparitions considered in this report.

Table I

Contributed Drawings or Reports for Apparitions of

	1962-3	1964-5	1966
Anderson, Carl A.	X	X	X
Cordell, B. M.			X
Delano, K. J.	X	X	X
Dragesco, Jean		X	
Haas, W. H.			X
Heath, A. W.		X	
Hughes, Kurt			X
Lazor, Fred		X	X
Lund, Jeffrey	X		
Okada, Masao	X		
Rea, Raymond			X
Saccone, Donald		X	
Snyder, William	X		
Solberg, Gordon	X		
Whitby, Sammy	X		
Williams, David B.	X		

To all these observers the Recorder gratefully expresses his appreciation for their contributions and for their patience in seeing their work published.

Cusp-Caps and Cusp-Bands

When the phase of Venus is approximately between 0.7 and 0.1, as measured by the value of K, white areas frequently appear at the apparent poles, or cusps of the planet. These "cusp-caps" are commonly segregated from the remainder of the disk of the planet by "collars" or cusp-bands of slightly darker tone. The pole of rotation of Venus is not inclined steeply to the ecliptic plane, as is that of the earth, so the cusps are near the true polar regions of the planet. The snow-white appearance of the caps must not be taken to indicate terrestrial-type polar snow caps, however; the cusp-caps are certainly atmospheric in nature, but the details of the composition of the atmospheric particles are not yet known. Considerable headway in understanding the Venus atmosphere is being made through continued and detailed analysis of the results of the United States and Soviet spaceprobes, Mariner 5 and Venera 4.

Several years ago, W. K. Hartmann made a detailed tabulation of the appearance of the cusp regions from ALPO observational reports in the hope that a statistical approach to the problem might lend some clues to the nature of the phenomena. James Bartlett had initiated this approach some years before. The present Venus Recorder has attempted to continue this tabulation in the present report. In Table 2 is given the statistical information on the three western apparitions considered in this report. All figures are given in percentages of the total number of drawings considered for each apparition. In the column taken from 1746 observations are the data for apparitions from 1944-56, 1960-61, 1962, and 1963-64 taken from various Section Reports in years past, all averaged together. While some trends are obvious in the table, a detailed interpretation appears inappropriate. In general, the caps appear to be visible more than half the time, while the collars or cusp-bands are most often invisible, at least as shown on observers' drawings.

Dark Side Phenomena

When Venus is near inferior conjunction, a large fraction of the planet's hemisphere

Table 2. Cusp-Cap and Cusp-Band Statistics.

	1746 Observations (see text)	1962-1963 37 drawings	1964-1965 28 drawings	1966 44 drawings or reports
South Cap Alone Visible	11%	16%	11%	6%
Both Caps Visible	38	27	64	62
North Cap Alone Visible	9	3	0	5
Neither Cap Visible	41	54	25	27
South Cap Larger	42	13	14	19
Caps Equal in Size	23	84	80	60
North Cap Larger	35	3	7	21
South Cap Brighter	30	30	25	52
Caps Equal in Brightness	36	67	71	17
North Cap Brighter	34	3	4	31
South Band Alone Visible	17	3	0	2
Both Bands Visible	20	3	30	35
North Band Alone Visible	8	0	0	2
Neither Band Visible	55%	94%	70%	61%

directed toward the Earth is unilluminated by direct sunlight. Nonetheless, it frequently happens that the night side of Venus is visible from Earth in one of three ways: 1) Faint illumination of part or all of the night side by a diffuse, ashen glow, usually called the ashen light; 2) Delineation of the dark hemisphere against the background sky by the appearance of a white halo marking the planet's limb; or 3) The appearance of the dark hemisphere of the planet as being darker than the background sky when Venus is observed in daylight or early twilight. The ashen light (item 1 above) and the halo have been seen for many decades by many observers (including the Recorder) and are almost certainly true physical phenomena. Item 3, the appearance of the night hemisphere as being darker than the sky background, is a contrast phenomenon which any observer can demonstrate for himself if he uses a very low magnification in his telescope so that the image of the planet is very bright against the backgrond sky. The sharp contrast in intensity and the geometry of the crescent image of Venus combine to produce the illusion that the dark hemisphere of the planet is seen actually darker that the sky.

The various appearances of the ashen light and of the halo are highly dependent on individual observers, and a detailed study of the phenomena is difficult. In this report we shall itemize each report of the appearance of the dark side for possible study by those interested in correlations with solar activity and other phenomena.

A. Apparition of 1962-63

Delano reported the appearance of the ashen light on November 29, Dec. 3, Dec. 4, & possibly on December 12, 1962. He found it most prominent at 40X and 80X with a 3.5-inch Questar, often detecting it by averted vision. On December 20, 1962, he reported a faint glow along the dark limb, visible only from time to time, probably representing the halo instead of the true ashen light. He suspected the halo when the phase value of K was nearly 0.5 on January 11, 1963. Although other observers looked for the dark side phenomena during this apparition, all other reports were negative.

B. Apparition of 1964-65

Heath alone reported dark side phenomena in this period, though others, especially Anderson, made frequent special searches for faint glow. Heath saw the unilluminated disk, especially near the south cusp with a red filter on August 31, 1964. It was invisible in other filters, as seen through his 12-inch reflector at 190X and 318X, in good seeing conditions.

C. Apparition of 1966

No reports of dark side phenomena were received, though Haas made frequent notes indicating that he looked closely for the halo and ashen light.

Dichotomy

Delano, Williams, and Lund made special notes on the appearance of the terminator near dichotomy, or the exact half-phase time. Predicted half-phase was January 23, 1963, but the observed dichotomy characteristically is a few days late at western apparitions of the planet. Williams observed several times in the critical period near half-phase and regards January 24, 1963, as the best estimate. Delano found the terminator straight as early as January 17, but noted it concave at certain magnifications as late as January 22. Lund used a straight edge in the eyepiece to compare with the terminator and found dichotomy on January 25. As an average date from these three estimates, we shall adopt January 23, which is the predicted date.

In 1964 Heath, Clark Chapman, and Anderson made estimates of the half-phase date, finding September 3, September 6, and September 7, respectively. The predicted date was August 29.2, making a difference of about 7 days.

At the 1966 apparition Haas observed regularly through dichotomy and estimated the date as April 13. Cordell's drawing of April 13 shows a straight terminator with very slightly rounded cusp tips. The predicted date was April 7.6, so the difference between observed and predicted times is about 4 days.

As has been pointed out in previous reports of the Section and in other discussions, the exact physical meaning of the difference between observed and predicted dichotomy (Schroeter's Effect) is not obvious. In particular, it is uncertain that there is any understanding about Venus as a planet which is derived from accurate estimtes of dichotomy dates. The terminator is usually the darkest part of the image of Venus in the telescope, and its appearance is subject to all those atmospheric and instrumental parameters that affect image contrast. In addition, those conditions in the Venus atmosphere that govern the intensity and distribution of the so-called ultraviolet clouds (the dark markings showing in ultraviolet photographs) will also affect the appearance of the terminator of the planet. To separate the observers' contrast problems from the physical changes in the Venus atmosphere is, and probably will remain, impossible by visual techniques. It remains an unfortunate fact that the nature of the ultraviolet clouds is unknown. Whether they consist of carbon dioxide, carbon suboxide (formed by ultraviolet sunlight on carbon monoxide and carbon dioxide, both of which occur in the Venus atmosphere), dust, or water vapor is undetermined, though astronomers have used powerful physical techniques on the planet for half a century.

There are long periods of time, covering several months or even an entire apparition, when the ultraviolet clouds on Venus are sparse or faint. Insofar as the clouds frequently occur near the terminator and thus affect the darkness of the terminator and consequently the observed date of dichotomy, one might use the dichotomy differentials as a rough index of cloud activity. A search for periodicities in the magnitude of the phase differ-

Figure 5. Venus drawing by M. Okada on Oct. 24, 1962, 6^h35^m, U.T. 8-inch refr., 240X. Venus an evening object before inferior conjunction. Cusps extended beyond geometric limits.

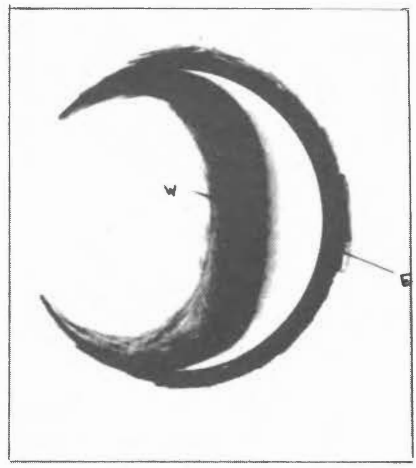

Figure 6. Venus drawing by M. Okada on Dec. 6, 1962, 2^h7^m, U.T. 8-inch refr., 240X. Cusps again extended beyond geometric limits.

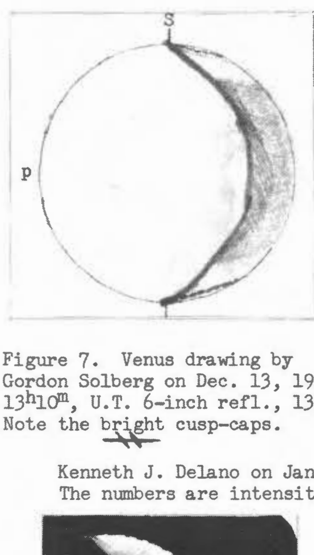

Figure 7. Venus drawing by Gordon Solberg on Dec. 13, 1962, 13^h10^m, U.T. 6-inch refl., 130X. Note the bright cusp-caps.

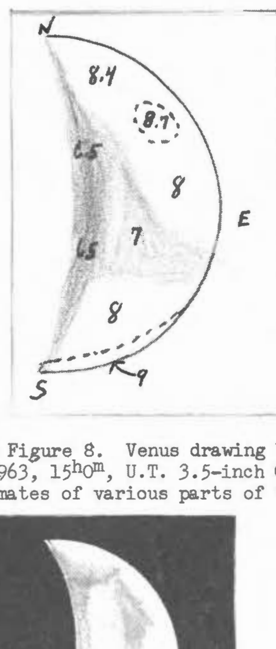

Figure 8. Venus drawing by Kenneth J. Delano on Jan. 9, 1963, 15^h0^m, U.T. 3.5-inch Questar, 80X and 160X. The numbers are intensity-estimates of various parts of the disc.

Figure 9. Venus drawing by J. Dragesco on Aug. 5, 1964, 4^h10^m, U.T. 10-inch refl., 320X. No filter.

Figure 10. Venus drawing by J. Dragesco on Aug. 6, 1964, 4^h0^m, U.T. 10-inch refl., 265X. Yellow filter.

Figure 11. Venus drawing by J. Dragesco on Aug. 11, 1964, 4^h15^m, U.T. 10-inch refl., 260X. Yellow filter.

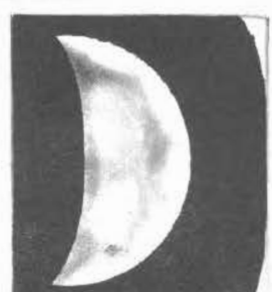

Figure 12. Venus drawing by J. Dragesco on Aug. 13, 1964, 4^h20^m, U.T. 10-inch refl., 260X.

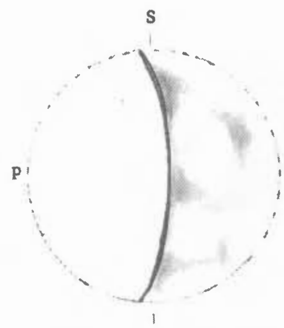

Figure 13. Venus drawing by J. Dragesco on Aug. 14, 1964, $4^h 25^m$, U.T. 10-inch refl., 320X. Wratten 15 Filter.

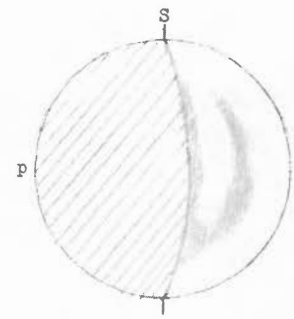

Figure 14. Venus drawing by Carl Anderson on Aug. 15, 1964, 14^h45^m, U.T. 6-inch refl., 125X.

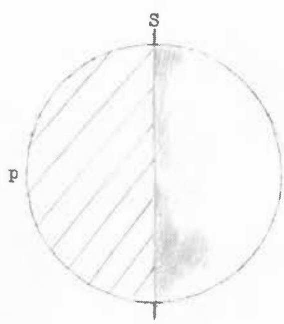

Figure 15. Venus drawing by Carl Anderson on Sept. 6, 1964, 16^h40^m, U.T. 6-inch refl., 125X. Various filters.

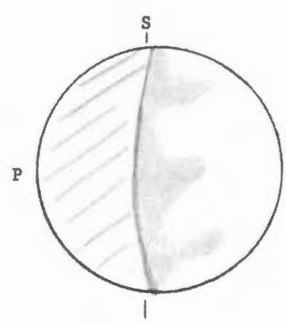

Figure 16. Venus drawing by Carl Anderson on April 23, 1966, 13^h15^m, U.T. 10-inch refl., 150X-200 X. Yellow and green filters.

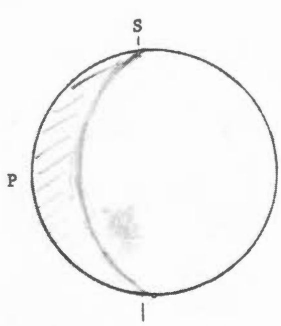

Figure 17. Venus drawing by Carl Anderson on June 12, 1966, 14^h0^m, U.T. 10-inch refl., 200X. Green filter.

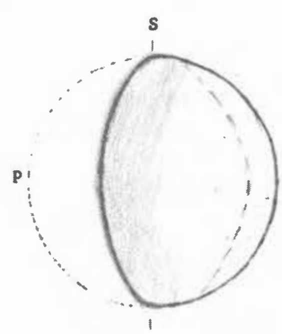

Figure 18. Venus drawing by Bruce Cordell on June 22, 1966, 9^h42^m, U.T. 6-inch refl., 180X. Note bright limb-band.

ential might prove interesting, and for such a study amateur observations of the type published here would be quite suitable.

Drawings of Venus

In Figures 5-20 there are presented representative A.L.P.O. drawings from those submitted for the three morning apparitions considered in this report. The drawings were selected partly for their pictorial interest; and this concept eliminated many useful drawings that were made in a more schematic style, such as many of those of Delano. The schematic drawings are no less useful, however, because they delineate and give intensity estimates for the cusp features, limb bands, and terminator regions.

Several of Dragesco's drawings are included among the figures because his series covers a period of about nine days in August, 1964. Readers will recall that there is mounting evidence that pattern of cloud bands on Venus tends to repeat after intervals of about 4.5 to 5.5 days. Readers can judge for themselves whether they see recurrent patterns in Dragesco's drawings.

It appears significant that in 1964 the prominent markings were bands and streaks, while in 1966 larger and more amorphous features were commonly recorded. This variation of marking type from one apparition to the next is not uncommon on Venus, and shows in the ultraviolet photographs of the planet made in years past. Further study of this general phenomenon may shed some light on cyclic changes in the Venus atmosphere. While observers may often think that their individual observations for a given day are of little practical use, they should remember that the long-term appearance of Venus and the more general character of the markings during a given period may be just as important as the fine details of cloud pattern on a particular day. Visual observations of Venus have not yet come to full importance, but the same can be said of many types of astronomical observations. Observers should continue their efforts, working toward the day when the full value of their drawings and reports is realized.

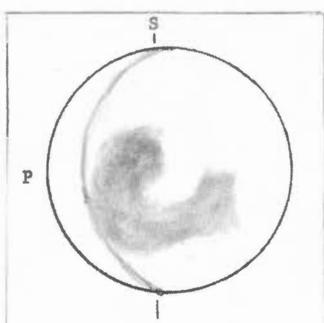

Figure 19 (left). Venus drawing by Carl Anderson on July 4, 1966, 8^h45^m, U.T. 10-inch refl., 200X.

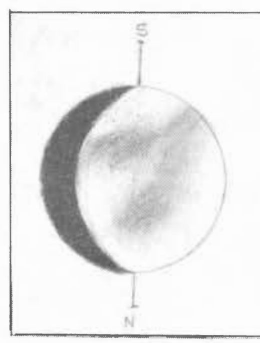

Figure 20 (left). Venus drawing by Kurt Hughes on July 5, 1966, 12^h 0^m, U.T. 4¼-inch refl., 123X and 160X.

GENERAL REPORT - 1966-67 APPARITION OF JUPITER

By: Richard E. Wend, A.L.P.O. Jupiter Recorder

The report on the rotation periods of this apparition, by Assistant Jupiter Recorder Phillip W. Budine, has already appeared in The Strolling Astronomer (see Vol. 21, #1-2, pp. 13-23). This excellent reduction of the central meridian transits contributed by A.L.-P.O. Jupiter observers tabulated the various drift rates of the Jovian currents and features.

This report describes the general appearance of the Giant Planet, based on the drawings, sketches, and descriptive comments of 38 contributing observers. Below is a list of observers, their observing stations, telescopes employed, and the number of contributions excluding central meridian transits.

Abbott, Ron	Overland Park, Kans.	6" refl.	1
Borde, Jack	Concord, Calif.	10" refl.	7
Bossie, J. Bruce	Daytona Beach, Fla.	12" refl.	1
Budine, Phillip W.	Binghamton, N. Y.	10" refl.	33
Carlino, L. M.	Buffalo, N. Y.	6" refr.	8

Delano, Kenneth J.	New Bedford, Mass.	12½" refl.	16
Edsall, Christopher	Warren, Mich.	4½" refl.	3
Farrell, Joanne	Binghamton, N. Y.	4 " refr.	13
Feiereisen, William	Madison, Wisc.	6 " refr. and 4½" refr.	10
Gordon, Rodger W.	Ackermanville, Pa.	3½" refr.	6
Heath, Alan W.	Long Eaton, Nottingham, England	12 " refl.	29
Hicks, Bob	Quito, Equador	10 " refr.	8
Hughes, Kurt	Royal City, Washington	4¼" refl.	9
Kaiser, M. L.	College Pk., Md.	6 " refl.	5
Kohl, Michael	Lebanon, Pa.	6 " refl.	2
Kolman, Roger	Chicago, Ill.	10 " refl.	2
Krisciunas, Kevin	Naperville, Ill.	6 " refl.	11
Larkin, Kip	Binghamton, N. Y.	3 " refr.	1
Lonak, E. M.	Chicago, Ill.	10 " refl.	1
Mackal, Paul	Mequon, Wisc.	6 " refl.	32
Melville, E. C.	Jamaica, West Indies	9.6 " refl.	29
Mitchell, Jimmy	Cairo, Ga.	6 " refl.	6
Moore, Patrick	Armagh, Northern Ireland	8½" refl., 10 " refr., 12½" refl.	102
Moser, Bill	Connellsville, Pa.	6 " refl.	42
Osawa, Toshihiko	Hyogo, Japan	6 " refl.	7
Pollak, Charles	Binghamton, N. Y.	8 " refl.	4
Quesinberry, Tom	Chagrin Falls, Ohio	8 " refl.	4
Ricker, Charles	Marquette, Mich.	8 " refl.	6
Rost, Carlos	Santurce, Puerto Rico	6 " refl.	29
Shartle, Stanley	Indianapolis, Ind.	12½" refl.	17
Smith, Douglas	Vinton, Va.	6 " refl.	16
Stewart, Robert N.	Indianpolis, Ind.	10 " refl.	14
Thiede, Eric	Madison, Wisc.	6 " refl., 6 " refr., 10 " refl., 15.6 " refr.	16
Viscardy, M.	Monte Carlo, France	12 " refl.	10
Vitous, Joseph	Riverside, Ill.	8 " refl.	10
Wacker, Wynn	Madison, Wisc.	6 " refl.	8
Winkler, William	Suitland, Md.	8 " refl.	19
Wooten, Wayne	Gainesville, Fla.	8 " refr.	34
			561

Observations ranged from August, 1966 to June, 1967, with the distribution in time following that listed in the Rotation Periods report, thus giving the greatest number of observations shortly after opposition on January 20, 1967. The seldom-made twilight and dawn observations are important to maintain continuity from one apparition to the next; thus a special effort should be made to observe Jupiter both early and late in the apparition.

Drawings and sketches illustrating this report are presented in chronological order, with a few exceptions for purposes of comparison. Members wishing to contribute drawings of Jupiter are invited to request official drawing blanks from the Recorder.

The North and South Polar Regions. Both regions were reported to be a neutral grey, usually of equal intensity. Occasionally the southern hemisphere south of the STB appeared to be thinly veiled; when this was reported, the SPR was slightly darker than the NPR. Usually the polar regions were featureless, but under unusually good conditions detail could be seen in the form of condensations and white spots. Fig. 21 is an example, also Fig. 32.

The South South South Temperate Belt was seldom commented upon, being seen only in sections rather than all the way across the planet. When conspicuous,

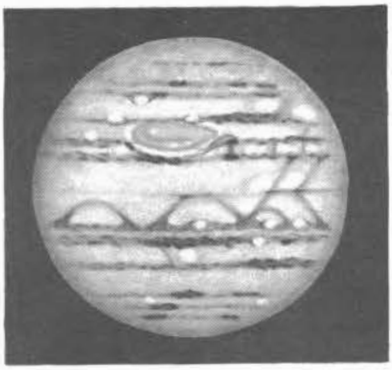

Figure 21. Drawing of Jupiter by Charles J. Pollak on November 13, 1966 at 6^h45^m, U.T. 8-inch refl., 260X. Seeing 9, transparency 5. $C.M._1 = 239°$. $C.M._2 = 35°$. Note Red Spot and vicinity.

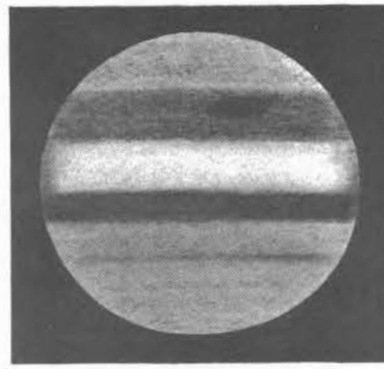

Figure 24. Drawing of Jupiter by Alan W. Heath on January 3, 1967 at 22^h50^m, U.T. 12-inch refl., 190X. Seeing 4, transparency 4. $C.M._1 = 245°$. $C.M._2 = 7°$. Dufay blue filter used.

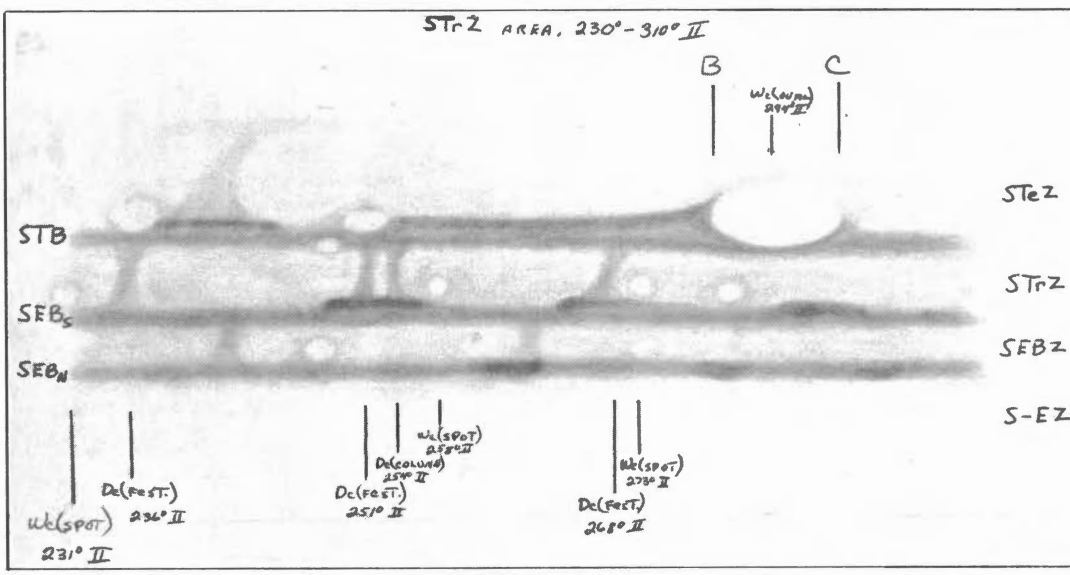

Figure 22. Sectional drawing of Jupiter from south part EZ to STeZ by Charles J. Pollak on December 4, 1966 at 5^h20^m, U.T. 8-inch refl., 275X. Seeing 8, transparency 3. Longitudes given on sketch are from C.M. transits on same night.

Figure 23. Sectional drawing of Jupiter from SEB_n to STeZ by Joanne Farrell on February 7, 1967 at 3^h16^m, U.T. 4-inch Unitron refr., 167X and 214X. $C.M._1 = 20°$. $C.M._2 = 241°$. Note STeZ oval BC. Seeing 7, transparency 4.

it was separated from the SPR by a narrow dusky zone. At other times it formed a border to the polar region, with occasional darker condensations. See Fig. 21.

The South South Temperate Zone, when it was not lost in the polar shading, appeared very similar to the STeZ in intensity and shading. It was reported as featureless by those who observed it.

The South South Temperate Belt varied in intensity during the apparition, occasionally lost in the polar shading, at other times appearing as a narrow belt with short darker sections. It is interesting to note that all three of the long enduring white ovals in the STeZ were reported with "caps" - dark markings in the SSTB that were centered more or less over the ovals. Sometimes the cap appeared as a grey spot, round and slightly larger than the shadow of Io when that shadow was on the disc. More often, the cap appeared as a short, dark section of the SSTB. Fig. 28 shows the cap over DE, and Fig. 31 shows the cap over FA plus an additional marking just south of, and preceding, it. Concerning this southern-most mark Eric Thiede comments: "distinctly reddish in contrast to grayish polar shading."

The cap over BC was the most unusual of the three. It moved a bit faster than BC (see the graph on pg. 17 in Mr. Budine's Rotation Periods Report), and was in conjunction with BC on February 5, 1967. Patrick Moore named it "Feature X", describing it as a reddish spot extending north from the SSTB. Fig. 30 shows this feature about a month past conjunction with BC. The SSTB was most conspicuous in December-January and again in March-April, 1967.

The South Temperate Zone was frequently the brightest zone, and quite white. It contained a number of festoons, columns, and bright spots, but was not so active as the STrZ. Moore reported an "extra belt" in the STeZ on February 5, 1967, associated with "Feature X". The three long-enduring white ovals in this zone were quite bright, and appeared to nestle lower into the STB than in previous apparitions.

Stanley Shartle reported that on February 26, 1967 he observed the most singular and sharply outlined object of the apparition. Its location was outside of, and adjoining, the south preceding margin of the oval BC. This position was very close to the position of "Feature X", and was probably associated with it. He described the object as "a very small circle having a perimeter so distinct, black, and perfect as to compare with ink scribed with a compass on white paper. The interior was white except for a possible black dot in the center." He was unable to observe this spot again.

The South Temperate Belt, commented Alan Heath, had different intensities in different longitudes. In February and March it was the darkest belt on Jupiter, but only barely so. Fig. 38 shows the STB very dark following the oval FA. Fig. 26 shows the STB, along with the SEB_s and the SEB_n, forming what several observers called "a triple belt system." The STB was also noticed darker following oval DE in March, 1967.

The South Tropical Zone began the apparition a dull white, not so bright as the EZ or the NTrZ, but still the brightest zone in the southern hemisphere. In March, 1967, Budine reported it dusky preceding the Red Spot, and dull yellow following the Red Spot. A month later he found it bright yellow. Following that time, Vitous noted a faint bluish tinge. The zone is always watched for a revival of the STrZ Disturbance; and this 1966-67 apparition produced more festoons, columns, bright spots, and dusky sections than there were in the previous several apparitions. On October 6, 1966 Paul Mackal observed a streak in the STrZ at 221° by System II, which was subsequently lost. At various times from September 22, 1966 through April 21, 1967 Moore reported what he called the STrZ Disturbance, a mass of darker material in the STrZ preceding the Red Spot. This feature was not connected with the more active Sectional South Tropical Zone Disturbance described in the Rotation Period Report, the preceding end of which advanced from 235° to 205° in System II. Mackal suggests the term "Complex" to describe zonal activity somewhere between a small number of isolated spots and a major disturbance. Thus a STrZ Complex is definitely not a Classical STrZ Disturbance.

Fig. 22 is an early view of the STrZ in the vicinity of the dark marking shown in Fig. 23, which defined the preceding end of the Sectional STrZ Disturbance. Fig. 33 shows the dusky nature of the STrZ following the well-defined preceding end. There were bright spots throughout the entire length of the zone.

The Great Red Spot was a little darker than during the previous apparition, but its outline became ill-defined, particularly on the northern

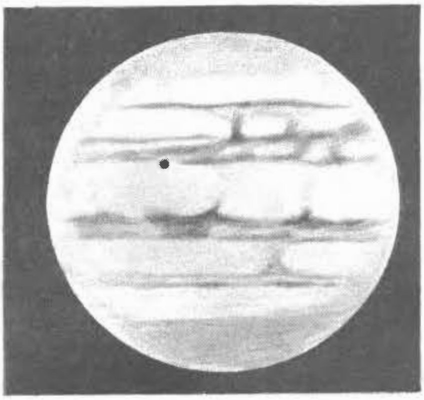

Figure 25. Drawing of Jupiter by Toshihiko Osawa on February 5, 1967 at 12^h3^m, U.T. 6-inch refl., 230X. Seeing 3-5, transparency 4. C.M.$_1$ = 26°. C.M.$_2$ = 259°. Shadow of III on disc.

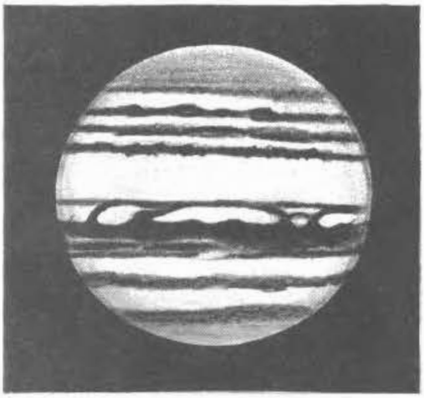

Figure 26. Drawing of Jupiter by Paul K. Mackal on February 5, 1967 at 3^h7^m, U.T. 6-inch refl., 212X. Seeing 9, transparency 4. C.M.$_1$ = 59°. C.M.$_2$ = 295°.

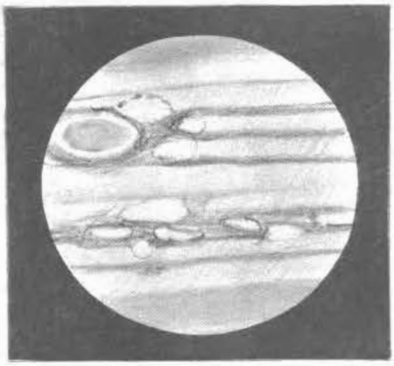

Figure 27. Drawing of Jupiter by Wayne Wooten on February 18, 1967 at 2^h10^m, U.T. 8-inch refr., 300X. Seeing 8-9, transparency 4. C.M.$_1$ = 278°. C.M.$_2$ = 55°. Red Spot and Hollow near left limb.

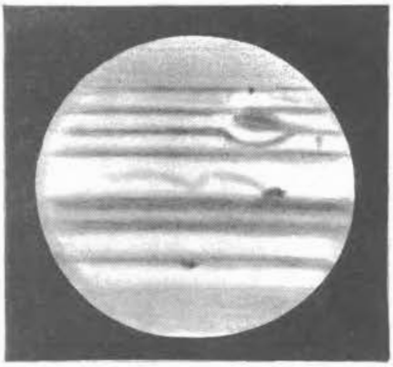

Figure 28. Drawing of Jupiter by Alan W. Heath on February 28, 1967 at 19^h0^m, U.T. 12-inch refl., 190X. Conditions fair. C.M.$_1$ = 312°. C.M.$_2$ = 8°.

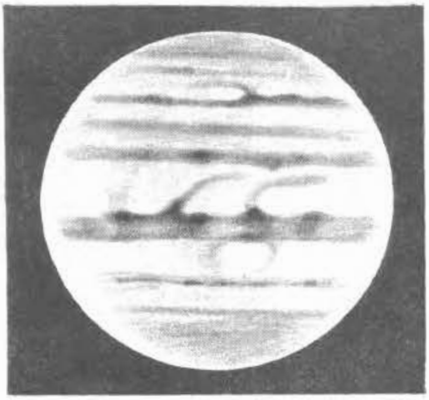

Figure 29. Drawing of Jupiter by Toshihiko Osawa on March 1, 1967 at 11^h17^m, U.T. 6-inch refl., 230X. Seeing 3-4, transparency 4.5. C.M.$_1$ = 188°. C.M.$_2$ = 238°. Note oval BC.

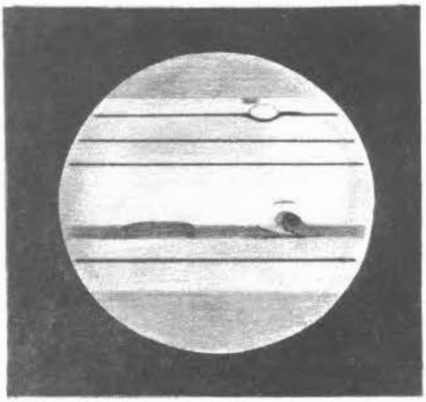

Figure 30. Drawing of Jupiter by Eric Thiede on March 3, 1967 at 2^h15^m, U.T. 6-inch refl., 250X. Seeing 4, transparency 4.5. C.M.$_1$ = 174°. C.M.$_2$ = 212°. Note STeZ oval BC and "Feature X".

side. Mackal recorded its color as orange prior to April 2, 1967, then red, and red orange, and during the last part of the apparition orange again. Shartle described the color sequence as yellow orange, reddish tan, and rusty tan. The Red Spot's southern edge merged with the STB; and before the veil appeared over its northern portion the Spot was of large size, with pointed ends. Budine noted that by mid-December, 1966 the ends were much less pointed and a light center had developed.

The Red Spot Hollow began the apparition brighter than the nearby STrZ. By April 2, 1967, it had become brownish in color; Mackal reported on that date that the RS and RSH were of similar intensity, differentiated only by the red color of the RS and the brown color of the RSH. Moser found on the same date that the RSH was so dark it seemed to merge the STB, SEB_s, and SEB_n. Fig. 32 shows this aspect of the RSH. Later on, the RSH brightened to equal the STrZ brightness, which was not so bright as it had been early in the apparition.

Figs. 34, 35, and 36 are from Phillip Budine's accurately detailed series of strip sketches of the RS area. The three drawings cover a two week period in which a "wormlike streak", with bright ovals preceding and following, appeared in the RSH. In addition to tilting the preceding end of the RS southward (Fig. 34), the RSH appeared to be displaced about 10° in the preceding direction with respect to the RS. In Fig. 35 the RS is no longer tilted, the streak is not connected to the RS at the following end, and the preceding end appears to be darkening the STrZ. In Fig. 36 the streak is gone, but the dark STrZ preceding the RSH remains. The white spot in the SEB Z preceding the RSH, prominent in all three strip sketches, was longer-lived; Fig. 39 shows it clearly on May 25, 1967.

The RS also influenced the STrZ immediately following the RSH. In Fig. 27 there is a mass of dark material immediately following the RSH, which was still bright on February 18, 1967.

Observers with smaller telescopes were often puzzled by the appearance of the RS when the veil of whitish cloud material obscured much of the north preceding portion of the RS. Drawings were submitted in which this veiled portion (clearly delineated in Fig. 35) was assumed to be part of the RSH, resulting in an odd-shaped RS.

<u>The South Equatorial Belt - south component</u> - was quite dark, particularly early in the apparition. Mackal comments: "The SEB_s preceding the RS for about 40° was darker than I have ever seen any belt in my four years of observing experience" (December 12, 1966). Following the RS the SEB_s was broader, and not so dark. After opposition the SEB_s was not quite so dark as the STB and the NEB. The SEB_s was more active than the SEB_n, serving as a base for the columns and festoons in the STrZ. (See Figs. 22 and 23).

<u>The South Equatorial Belt Zone</u> was almost as wide as the STrZ (except north of the RS, of course) and often as bright as the STrZ. However, its color was pinkish instead of white. The pink color is clearly shown in Joseph Vitous' color drawing on April 29, 1967. Fig. 37 is a black and white reproduction of that drawing. Shartle noted that beginning with March, 1967 the SEB Z following the RS gradually became interrupted by several dark areas, sometimes linking up the SEB_s and SEB_n. Fig. 38 shows two such columns; see also Fig. 25.

<u>The South Equatorial Belt - north component</u> - was reported double by Moore on November 23, 1966, and reddish in color prior to opposition, according to Delano. It was not so dark as the other major belts, but was nevertheless conspicuous in all longitudes.

<u>The Equatorial Zone</u> was the brightest zone on the planet. Numerous white spots were present, often brilliant. In comparison with these white spots, the EZ was cream colored. Moore distinguished between loop-bounded areas of the EZ that displayed the same color as the EZ, and similar-shaped white spots. Both types were ranged along the NEB_s, which appears to dominate events in the EZ. Many wisps and festoons sprang from the NEB_s projections into the EZ. In his color drawings, Vitous shows the bluish nature of these delicate wisps and festoons. Again, see Fig. 37.

<u>The Equatorial Band</u> was thin, sometimes prominent, and apparently always associated with the tops of the wisps and festoons from the NEB_s. Fig. 21 illustrates this aspect. The darkest parts of the EB were bluish grey in color. In some longitudes the EB disappeared. A. W. Heath contributed Fig. 24, in which he shows how the planet appeared through a blue filter. A featureless EZ was the only bright zone vis-

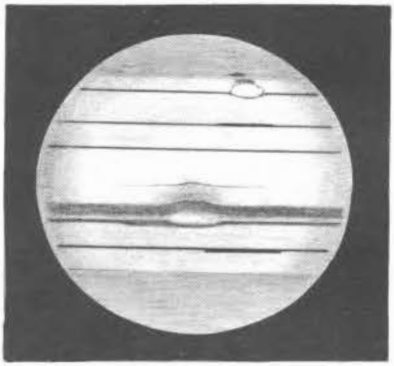

Figure 31. Drawing of Jupiter by Eric Thiede on March 7, 1967 at 3^h10^m, U.T. 6-inch refl., 250X. Seeing 8, transparency 2-3. C.M.$_1$ = 119°. C.M.$_2$ = 126°. Note oval FA and its double "cap".

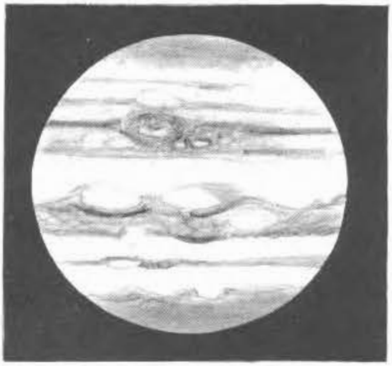

Figure 32. Drawing of Jupiter by Wayne Wooten on March 12, 1967 at 0^h0^m, U.T. 8-inch refr., 250X. Seeing 6, transparency 4. C.M.$_1$ = 72°. C.M.$_2$ = 42°. Considerable activity around Red Spot and Hollow.

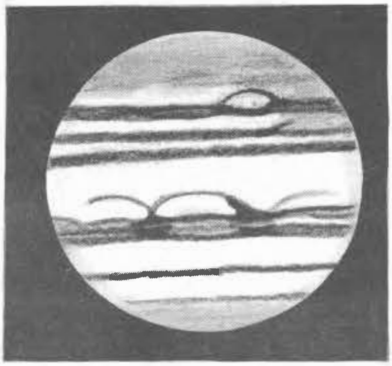

Figure 33. Drawing of Jupiter by Paul K. Mackal on April 8, 1967 at 1^h40^m, U.T. 6-inch refl., 212X. Seeing 6, transparency 4. C.M.$_1$ = 74°. C.M.$_2$ = 198°.

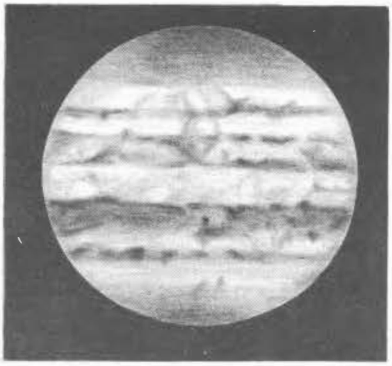

Figure 37. Drawing of Jupiter by Joseph P. Vitous on April 29, 1967 at 1^h25^m, U.T. 8-inch refl., 360X. Seeing 6-7, transparency 4-5. C.M.$_1$ = 137°. C.M.$_2$ = 101°. Original drawing is in natural colors.

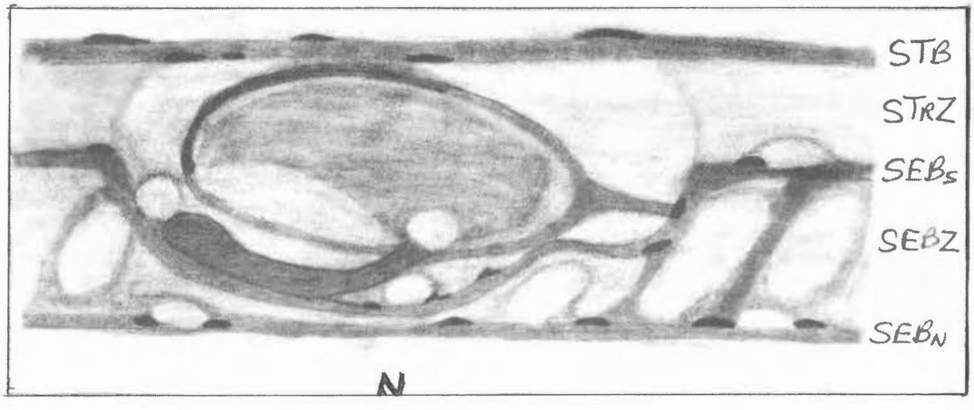

Figure 34. Sketch of Red Spot and vicinity by Phillip W. Budine on April 17, 1967 at 0^h 15^m, U.T. 10-inch Cave refl., 250X and 300 X. Seeing 6-7, transparency 5. C.M.$_2$ = 58°. See also discussion in text of Mr. Wend's Jupiter Report.

ible; the STB, SEB_n, SEB_s, STrZ, and SEB Z appeared as one broad belt, with the RS inconspicuous.

The North Equatorial Belt was the broadest belt on Jupiter, and throughout most of the apparition was also the darkest belt. Delano found the dusky central portion of the belt a reddish color that was more obvious than in the Red Spot itself. He also found the northern edge of the belt distinctly red after November 24, 1966. The southern edge was the darkest part of the belt, and the condensations and projections here that formed the bases for the EZ festoons and wisps were bluish in color. Some of these projections were so prominent and long-lived that Moore gave them names. "The Smokestack", particularly prominent throughout the apparition, appears in Fig. 29 to the left of the central meridian. "The Hook" appears in Fig. 26 left of the C.M. and in Fig. 25 on the C.M. Another hook is seen toward the following edge. At times large white spots in the EZ and NEB gave the belt the appearance of undulating across the planet. Fig. 32 illustrates this. While the interior of NEB was often lighter than the edges (Fig. 28), it was still dark enough to be considered part of the belt, and not a NEB Z separating a NEB_s and NEB_n. However, Shartle and Thiede did detect at times a narrow rift in the middle of the belt. Both observers said high power and superb seeing were required to detect such a rift.

The North Tropical Zone was brighter than during the 1965-66 apparition, and second only to the EZ. It was occasionally bridged by festoons, bluish in tint according to Vitous.

The North Temperate Belt was reported double by Moore and Osawa (Fig. 25), with the north component thin and faint. Stewart noted on May 4, 1967 that the NTB was a dark gray, while all the other major belts were definitely orange brown. The NTB was darker than during the previous apparition, but this was overshadowed by all the activity in the NEB. During April, Heath considered the NTB the darkest belt, but only barely. During the rest of the apparition the NEB, SEB, and STB were darker. Delano considered the dark NTB to be the greatest change that he observed on Jupiter compared to the previous apparition. Occasionally dark spots (Fig. 38) and small ovals (Fig. 32) appeared along the NTB.

The North Temperate Zone was not quite so bright as the NTrZ, exhibiting a grayish tone. It was recorded as featureless by those who commented on it.

The North North Temperate Belt had several dark condensations and one long rod-like feature that made this belt conspicuous. Between these features it was thin and faint. The preceding and following ends of the long rod were quite abrupt. Mackal found this belt double on April 4, 1967.

The North North Temperate Zone bordered the polar region duskiness, and the bright spots that it displayed were enhanced by the darker surroundings. Fig. 21 shows two of these spots.

The North North North Temperate Belt was usually seen as a darker edge to the NPR. Under unusually good conditions a NNNNTB could be seen just north of the NNNTB, but this was only seldom. Darker sections of the belt made it easier to see, as illustrated by Fig. 21.

Latitudes of Belts. In Stanley M. Shartle's excellent personal report of his observations for this apparition of Jupiter, he listed the results of eight observing sessions in which he determined the zenographic latitudes of the major belts. The filar micrometer was used during four sessions, and during the other four he used a method of direct visual estimates described by Walter H. Haas at the 1966 convention of the A.L.P.O. in Tucson, Arizona. The weighted means of his results are reproduced below from his report.

center NTB	+28.6°	N edge SEB_n	- 7.6°
N edge NEB_n	+21.4°	S edge SEB_s	-21.7°
S edge NEB_s	+ 7.4°	center STB	-29.6°

Satellites of Jupiter. Delano and Heath observed the satellites repeatedly with color filters. Both got more than average indications of a bluish color for IV. Heath found the results inconclusive for the other three Galilean satellites. Delano got indications of red for I.

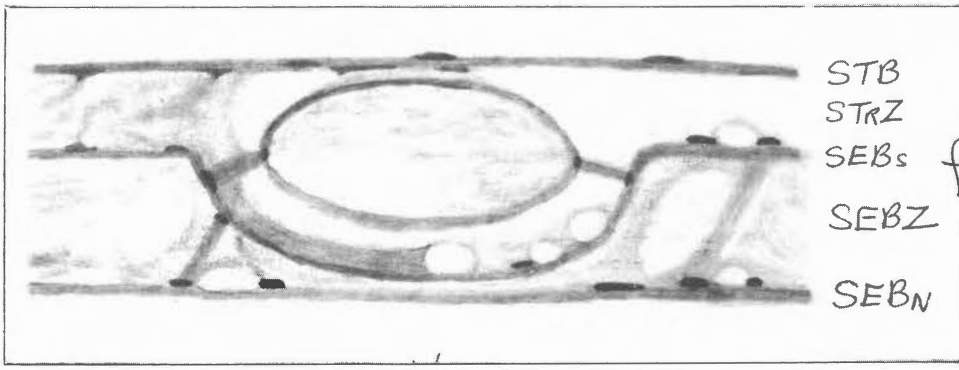

Figure 35. Sketch of Red Spot and vicinity by Phillip W. Budine on April 24, 1967 at $0^h 45^m$, U.T. 10-inch Cave refl., 225X. Seeing 6, transparency 5. C.M.$_2$ = 46°. See also discussion in text of Mr. Wend's Jupiter Report.

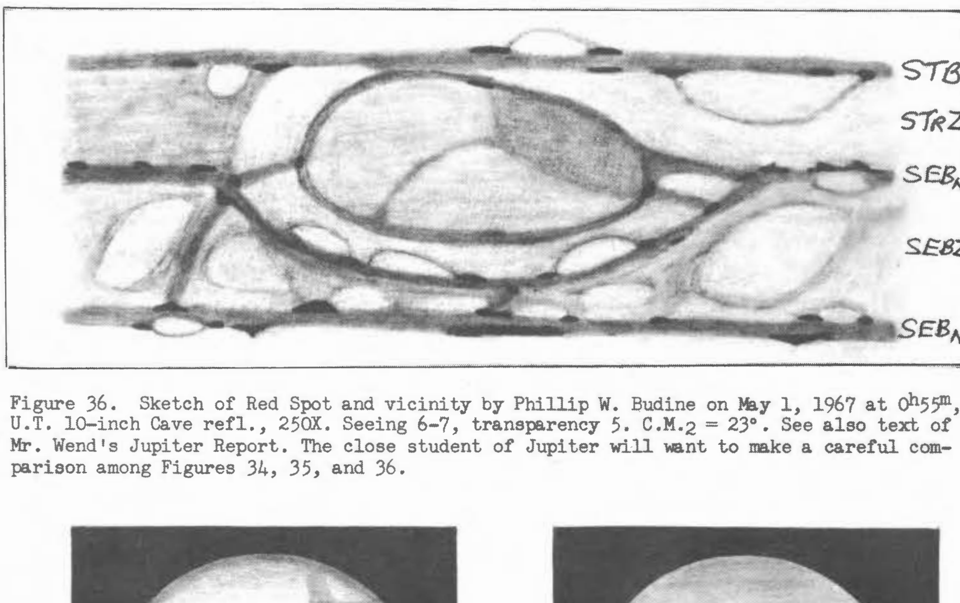

Figure 36. Sketch of Red Spot and vicinity by Phillip W. Budine on May 1, 1967 at $0^h 55^m$, U.T. 10-inch Cave refl., 250X. Seeing 6-7, transparency 5. C.M.$_2$ = 23°. See also text of Mr. Wend's Jupiter Report. The close student of Jupiter will want to make a careful comparison among Figures 34, 35, and 36.

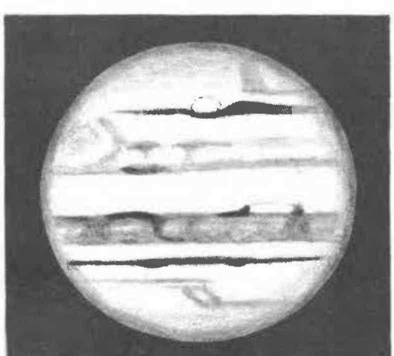

Figure 38. Drawing of Jupiter by L. M. Carlino on May 23, 1967 at $0^h 55^m$, U.T. 6-inch refr., 125X-200X. Seeing 2-5. Transparency 4.5. C.M.$_1$ = 303°. C.M.$_2$ = 84°. Red Spot and Hollow close to left limb.

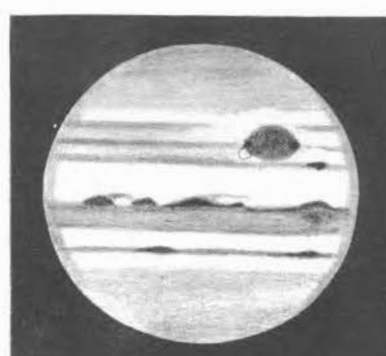

Figure 39. Drawing of Jupiter by Robert Neil Stewart on May 25, 1967 at $0^h 41^m$, U.T. 10-inch refl., 305 X. Seeing 6, transparency 3. C.M.$_1$ = 250°. C.M.$_2$ = 16°. Note Red Spot and bright spot at north preceding side of Red Spot.

Shartle made an interesting satellite observation that has implications for observing planetary detail. On April 12, 1967 satellite II was crossing the EZ_s. However, the dark silhouette "was not a gray disk as expected, but a long thin meridional projection from the SEB_n." Several good glimpses were obtained of this aspect. Seeing was 3 on a 1 to 10 scale.

In the following list of observed satellite phenomena, the observed time is for mid-phenomenon, unless otherwise indicated. It should be emphasized that the predicted time in the Ephemeris is also for mid-phenomenon. Moore's observation of March 23, eclipse of III, shows that the fading took 20 minutes, the satellite finally disappearing almost 5 minutes after the predicted time. However, the mid-time of Moore's sequence of observations is about 5 minutes ahead of the predicted time of eclipse. Eclipses of satellite IV can last even longer.

OBSERVER	DATE	PREDICTED (U.T.)	OBSERVED
Moore	1966, August 6	I. Ec.D. 4:15	4:14
Moore	August 15	I. Oc.R. 3:32	3:31
Moore	September 18	II. Tr.I. 1:40	1:39
Moore	September 22	I. Tr.I. 3:01	2:59½
Rost	October 2	II. Tr.I. 7:04	7:05
Rost	October 2	II. Sh.E. 7:31	7:29½
Budine	October 22	I. Tr.E. 7:28	7:26
Moore	October 24	IV. Tr.E. 3:03	3:03
Budine	October 29	I. Tr.I. 7:06	7:02
Budine	October 29	I. Sh.E. 8:06	8:04
Moore	November 6	I. Ec.D. 4:50	4:49 started to fade 4:50½ vanished
Moore	November 9	I. Tr.E. 0:10	0:07
Budine	November 13	I. Oc.R. 10:16	10:16.01
Moore	November 23	I. Tr.I. 1:34	1:34
Moore	November 23	I. Sh.E. 2:42	2:42
Budine	December 10	III. Sh.E. 5:38	5:33.1
Budine	December 10	III. Tr.I. 5:49	5:43.1
Budine	December 13	IV. Tr.E. 5:13	5:13.2
Rost	December 13	IV. Tr.E. 5:13	5:11
Moore	December 16	I. Sh.E. 2:51	2:51
Moore	December 20	III. Ec.D. 20:06	20:05 fading began 20:08 still visible 20:10½ vanished
Moore	December 21	IV. Ec.D. 0:49	0:47 fading began
Moore			0:51 two magnitudes below II 0:52½ four magnitudes below II 0:54 lost
Moore	1967, January 1	I. Ec.D. 1:32	1:33
Heath	January 8	I. Ec.D. 21:55	21:54½
Shartle	January 16	I. Oc.R. 2:14	2:12
Moore	January 22	III. Tr.I. 1:46	1:45
Rost	January 22	III. Tr.I. 1:46	1:46
Rost	January 22	III. Sh.I. 1:59	2:00 inside limb
Moore	January 22	I. Tr.I. 4:28	4:26½
Rost	January 29	III. Tr.I. 5:02	5:02
Rost	January 29	II. Oc.D. 5:45	5:44

OBSERVER	DATE	PREDICTED (U.T.)	OBSERVED
Rost	1967, January 31	II. Tr.I. 0:16	0:15
Budine	January 31	II. Tr.I. 0:16	0:16.1
Rost	January 31	I. Tr.I. 0:38	0:38
Rost	January 31	II. Sh.I. 0:49	0:50
Budine	January 31	I. Tr.E. 2:54	2:52.9
Budine	January 31	I. Sh.E. 3:10	3:10.1
Budine	January 31	II. Tr.E. 3:10	3:11.2
Budine	January 31	II. Sh.E. 3:44	3:44.1
Budine	February 7	I. Tr.I. 2:22	2:22.9
Budine	February 7	II. Tr.I. 2:33	2:32.8
Budine	February 7	I. Sh.I. 2:48	2:47.3
Budine	February 7	II. Sh.I. 3:27	3:28.8
Moore	February 7	I. Oc.D. 23:35	23:34
Shartle	February 8	I. Ec.R. 2:21	2:18
Shartle	February 9	IV. Oc.D. 2:12	2:09
Budine	February 14	I. Tr.I. 4:07	4:05.5
Shartle	February 15	I. Oc.D. 1:20	1:20
Simmons	February 16	III. Oc.D. 1:22	1:23.5
Heath	February 26	II. Ec.R. 19:22	19:19
Heath	March 5	II. Ec.R. 21:57	21:54 started to re-appear 21:56 full brilliance
Heath	March 5	III. Tr.I. 21:59	21:55 first contact
Budine	March 10	I. Oc.D. 1:10	1:08½
Heath	March 11	I. Ec.R. 22:58	22:56½
Moore	March 12	II. Oc.D. 19:33	19:31
Moore	March 12	I. Sh.E. 20:08	20:04
Moore	March 18	I. Sh.I. 1:18	1:17½
Moore	March 18	I. Tr.E. 2:27	2:30
Budine	March 18	I. Tr.E. 2:27	2:25.4
Moore	March 23	III. Ec.D. 23:58	23:40 equal, compared to II 23:43 0.2 magnitudes fainter than II 23:52 0.3 magnitudes fainter than II 23:57 0.3 magnitudes fainter than II 23:58 0.5 magnitudes fainter than II 23:59 0.8 magnitudes fainter than II
	March 24		00:00 1.5 magnitudes fainter than II 00:02 2.5 magnitudes fainter than II 00:02.75 vanished
Moore	March 26	I. Ec.R. 2:49	2:47¼ first appeared 2:50 equal to III
Moore	March 27	I. Ec.R. 21:19	21:16 first seen 21:20 full brilliance
Moore	April 3	III. Sh.E. 21.27	21:22½
Moore	April 6	II. Ec.R. 21:36	21:35
Rost	April 10	I. Tr.E. 2:32	2:31
Moore	April 11	I. Ec.R. 1:09	1:07
Moore	April 12	II. Tr.I. 0:30	0:30
Budine	April 17	I. Tr.I. 2:11	2:09.8
Budine	April 26	I. Tr.E. 0:51	0:49.5
Moore	May 5	III. Ec.D. 23:58	0:00½ vanished (May 6)
Moore	May 6	II. Tr.I. 21:47	21:48½

OBSERVER	DATE	PREDICTED (U.T.)	OBSERVED
Moore	1967, May 19	I. Ec.R. 23:43	23:42.75
Moore	May 23	III. Tr.E. 21:00	21:00
Moore	June 4	I. Ec.R. 22:02	21:58½ first seen 22:01 equal to IV
Moore	June 7	II. Tr.I. 22:06	22:03

I. denotes ingress; E. is egress; D. is disappearance; R. is reappearance; Ec. is eclipse; Oc. is occultation; Tr. is transit of the satellite; Sh. is transit of the shadow of the satellite.

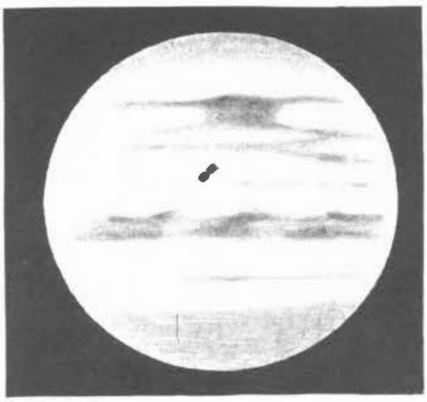

Figure 40. Drawing of Jupiter by Toshihiko Osawa on January 27, 1967 at 13^h5^m, U.T. 6-inch refl., 270X. Seeing 3-5, transparency 4. $C.M._1 = 81°$. $C.M._2 = 23°$. Red Spot dark and prominent. Shadow of J. I apparently doubled; see text.

*****

Another Doubling of the Shadow of J. I? Figure 40 shows what the observer, Mr. Toshihiko Osawa, regards as a "doubling of the shadow of Io." Several examples of this curious, and fairly unusual, anomaly have been described in the pages of this journal during the last few years. A doubling of the shadow of J. I on a really good photograph of Jupiter by Mr. Philip R. Glaser was discussed by the writer in "The Doubling of Jovian Satellite Shadows", Str. A., Vol. 19, Nos. 5-6, pp. 79-80, 1965.

Note by Editor. At the time of Mr. Osawa's drawing, J. I, J. II, and their shadows were all four on the disc of their primary. The C.M. times of transit can be computed to be: J. II, 12^h36^m, U.T.; J. I, $12^h 54^m$; shadow of II, 12^h56^m; shadow of I, $13^h 3^m$. The darker shadow depicted close to the center of the disc at 13^h5^m is hence presumably that of I. The invisibility of II in a 6-inch telescope is only to be expected. J. I must have been present just preceding its shadow, but perhaps the images were merged only 7 days past opposition. The shadow of II must have lain in a south-preceding direction from the shadow of I, preceding because of the earlier C.M. transit. The fainter shadow on Figure 40 is instead in a south-following direction from the darker one. The Editor would hence tentatively conclude that the shadow of I was in fact doubled on this occasion and that the shadow of II was not detected. An option might be to regard the darker "shadow" as actually J. I and the fainter one to its south as the shadow of II, which transited only two minutes later; but then we are obliged to suppose that the shadow of I went unobserved.

Final Remarks. Many thanks are due to the contributing observers for both sketches and descriptive comments. The selection of drawings for reproduction here was guided by the need to illustrate certain features. Many excellent drawings remain in the files for future studies. The descriptive comments of Patrick Moore and Alan Heath were very thorough and most helpful. Paul Mackal provided comment and advice throughout the apparition and particularly during the preparation of this Report.

COMET 1968a

By: Dennis Milon, A.L.P.O. Comets Recorder

The first ALPO observations of Comet 1968a were reported in Str. A., Vol. 21, Nos. 1-2, pp. 28-29. A number of letters from Takeshi Sato have informed us of the circumstances of its discovery, notably the fact that K. Itagaki of Yamagata saw it on April 25th, 1968, five days before the other five Japanese discoverers. ALPO members watched it until June 1st, when it became too difficult near the northwest evening horizon. Finding 1968a in May was aided by an ephemeris computed by Brian Marsden. This ephemeris was distributed to the Comets Section on May 14th, and on May 20th Michael McCants sent a similar one.

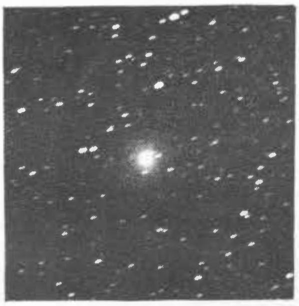

Figure 41. Photograph of Comet 1968a by John Bortle and Charles Scovil on May 8, 1968 at 8^h15^m, U.T. Taken with 22-inch Maksutov at Stamford Observatory in Connecticut. North at top. 103aF plate. Coma less than 2' across.

Comet Tago-Honda-Yamamoto 1968a was an unspectacular object, never brighter than 7th magnitude, and lacking a tail. The diameter was about 3' of arc or 70,000 miles, which is average for comets at great distances from the sun. Comet 1968a's perihelion was 63 million miles from the sun on May 16th. All observers called the degree of coma condensation 4 or less (0 is diffuse, 9 stellar), and Simmons rated it completely diffuse in all observations.

Photographic results. John Bortle and Charles Scovil photographed 1968a on four nights in May, using a 13½-inch focal length f/3.5 astrograph and also the 22" aperture f/3.7 Maksutov of Stamford Observatory in Connecticut (Figure 41). By standardizing the exposures Bortle was able to make rough magnitude estimates from the plates, which were yellow sensitive. The comet was compared to SAO Star Catalog visual magnitudes, furnishing: May 7, 8.9; May 8, 8.7; May 21, 9.5; and May 25, 9.7. Its appearance was diffuse with little condensation and a diameter of from 1' to 3'. A nucleus was present on May 25th and possibly on the 8th. There was no tail.

***** Comet 1968a ALPO Visual Magnitudes

1968 UT Date	Observer	Aperture (inches)	Observed Magnitude
May 1.44	McCants	2	7.0 a
2.43	McCants	2	7.0 a
2.43	Minton	4.2	7.6 a
7.47	Miller	6	8.0 a
8.36	Bortle	2	7.6 b
12.47	Simmons	2	7.7 b
13.48	Simmons	2	7.8 b
16.09	Delano	12.5	7.5 c
16.12	McCants	10	9.4 a
19.12	McCants	10	9.5 a
22.14	Simmons	4.2	9.0 a
23.17	Simmons	4.2	9.5 a
24.12	Simmons	4.2	9.0 a
26.14	Simmons	4.2	9.4 a
27.14	Simmons	4.2	9.0 a
28.14	Simmons	4.2	9.2 a
29.14	Simmons	4.2	9.4 a
30.14	Simmons	4.2	9.1 a
31.15	Simmons	4.2	9.4 a
June 1.15	Simmons	4.2	9.5 a

a. SAO Catalog. b. AAVSO charts. c. Skalnate Pleso Atlas.

DR. DINSMORE ALTER (1888-1968)

By: Walter H. Haas, A.L.P.O. Director

It was sad news to learn of the death, on September 20, 1968, of Dr. Dinsmore Alter, lunar research astronomer, retired planetarium director, and outstanding popularizer of science.

He was born on March 28, 1888 in Colfax, Washington, the eldest of four children. Both parents were college graduates. His father, the Reverend Joseph Alter, was a Union veteran of the Civil War and a home missionary of the United Presbyterian Church who, upon graduation in 1873, told his church: "Send me any place in the United States that no other minister will go." He was sent to the "dugouts" of Kansas. When the state had become more developed by 1883, Joseph Alter asked for another assignment and was given the eastern half of Washington Territory and the panhandle of Idaho. Dinsmore spent five years of his boyhood on the Warm Springs Indian Reservation in Oregon, 80 miles from the railroad.

Dr. Alter received a B.A. from Westminster College, New Wilmington, Penna. in 1909, an M.S. from the University of Pittsburgh in 1910, and his Ph.D. from the University of California in 1916 in astronomy, mathematics, and physics. His major was in Celestial Mechanics, under Dr. Leuschner. Monmouth College conferred an honorary Sc.D. upon him in 1941.

He married Ada McClelland of Crafton, Penna. on December 26, 1910. They had one daughter, now Mrs. Helen Alter Asling. Two grandchildren, Joseph Henry Asling, M.D. and Mrs. William H. (Carol) Clewell, and two great grandchildren, Jeanette Renee and Kirsten Ann Asling, also survive him.

Dr. Alter taught physics and astronomy at the University of Alabama from 1911 to 1914 and astronomy at the University of California at Berkeley from 1914 to 1917. He served in the Coast Artillery during World War I in 1917 and 1918, with ranks from Second Lieutenant through Major. He organized and commanded a group of Coast Artillery schools, South Pacific Coast Artillery District. He was at the University of Kansas from 1919 to 1935 and became a full professor in 1924. Among his famous students there is Dr. Clyde Tombaugh, the discoverer of Pluto. In 1929-30 Dr. Alter was on leave as a Guggenheim Fellow, and he spent several summers in study at the University of Chicago.

He was Director of the Griffith Observatory in Los Angeles from 1935 until he retired as Director Emeritus in 1958, except while on leave for active service as Colonel in the Army of the United States from 1942 to 1947. As Transport Commander, commanding officer of troops, he made 24 voyages carrying approximately 275,000 troops for perhaps 275,000 miles.

His retirement was a very active one as long as health permitted; he was engaged as a consultant about the moon by several nationally known companies, and he was in great demand as a lecturer. His pioneering interest in Man's proper development of the moon had become extremely timely by 1958 and later.

His technical papers chiefly deal with orbits and Celestial Mechanics, astronomical-meteorological periodicities, and lunar morphology. His popular writings include about 200 papers. He established the monthly, The Griffith Observer, in 1936 and edited it, except during war leave, until his retirement. His published books are Introduction to Practical Astronomy, 1933; Pictorial Astronomy, originally with C. H. Cleminshaw in 1948; Pictorial Guide to the Moon, First Edition 1963; and Lunar Atlas, first published in 1964. The last-named contains about 50 of his photographs of the moon with the Mount Wilson 60-inch reflector and earned Dr. Alter the G. Edward Pendray Award for "the outstanding contribution to astronautical literature during the year 1964."

His professional society memberships were numerous, and he served at times as an officer or national council member of several such societies.

Yet all these facts and more, kindly made available by his widow, Mrs. Ada Alter, do little enough to explain the great regard in which this man was held by a host of devotees of astronomy and the sense of loss which his passing causes. They certainly do not explain the genuine eagerness with which his lectures were awaited at W.A.A. Conventions in the 1950's and the enthusiasm with which the word "Dr. Alter is here" was speedily passed around. I do not think that any other speaker at those meetings was half so warmly welcomed by the audience. He was a singularly good friend of the A.L.P.O., and it is typical that he insisted on taking out a Sponsor Membership during what turned out to be the last year of his life. He had great respect for the work of earnest amateurs and often praised the lunar studies of our A.L.P.O. Secretary, Mr. David P. Barcroft of Madera, California. He kindly contributed the lead article, "The Moon as a Laboratory for Basic Scientific Research", for the Fifteenth Anniversary Issue of this journal (Str. A., Vol. 16, Nos. 3-4, pp. 45-50, 1962). The thoughts he developed there are very much worth reading today.

My clearest early personal recollection of Dinsmore Alter is a lecture which he gave at the Second W.A.A. Convention in San Diego in 1950. He presented an inspiring picture of space travel in our time and of Man's opportunities for the scientific development of the moon, including a lunar astronomical observatory. A few months later I heard staff members at a major planetarium express dismay that a responsible scientist should so mislead, in their opinion, the general public. Space travel was rather a matter for speculation about future centuries, in their opinion -- and this opinion was surely then the majority opinion of astronomers. Time has shown, of course, who was the better prophet.

Later meetings with Dr. Alter were always enjoyable to me, and a few hours in his company at the Griffith Planetarium in the spring of 1958 is a delightful memory. He was then keenly interested in his famous photographs of the Alphonsus-Arzachel region of the moon on October 26, 1956. Comparison of simultaneous infrared and blue-violet photographs had appeared to show variations in the visibility of detail over part of the floor of Alphonsus. He also gave me some of his Mount Wilson 60-inch photographs showing marginal evidence of apparent variations in Linné. These too are now part of the literature of lunar transient phenomena -- I never published the Linné photographs in this journal because of serious doubts that the apparent variations could be reproduced well enough to constitute a worthwhile case for lunar changes. The Kozyrev emission spectrograms of Alphonsus and the Greenacre-Barr red glows near Aristarchus were to create in some years a different scientific atmosphere toward the general problem of lunar surface activity, a change in which Dr. Alter's influence played a major role.

The Space Age has brought new opportunities and new responsibilities to the research astronomer. He will do well to imitate the skill, enthusiasm, and devotion which Dinsmore Alter displayed. We shall be fortunate if the astronomers of a new era show the same historical and philosophical appreciation of their research and the same basic wisdom as our departed colleague did in his popular writings.

We extend our deep sympathies to Dr. Alter's family and many friends in their loss.

BOOK REVIEWS

A Concise Encyclopedia of Astronomy, by A. Weigert and H. Zimmermann; translated by J. Home Dickson; American Elsevier Publishing Company, New York, c. 1968, 360 pages. Price $9.00.

Reviewed by Kenneth J. Delano

With the advent of the Space Age there have appeared a number of one-volume dictionaries and encyclopediae devoted to the sciences of astronomy and astronautics, each compiled with the intention of offering to the public a quick and easy means of obtaining answers to questions concerning astronomical facts and recent space research. Some volumes, because they are too elementary and provide too little information, are of no use to the fairly well informed amateur astronomer. That charge cannot be laid against Weigert and Zimmermann's A Concise Encyclopedia of Astronomy.

The 368 pages of fairly small print plus 20 plates of astronomical photographs are bound in a very convenient-size book measuring 8 by 5½ inches and only 1" thick. Despite its deceptively small size, A Concise Encyclopedia of Astronomy has articles on about 1500 astronomy-related terms which are comparable in length and quality to those contained in the major 30-volume general encyclopediae. For example, A Concise Encyclopedia of Astronomy has a 3300-word article on comets as compared with the Encyclopedia Americana's 6700 words, and it has a 5700-word article on galaxies as opposed to the Americana's 7000 words. The owner of a late, 30-volume, general encyclopedia will not be inclined to purchase Weigert and Zimmermann's book, except perhaps for the convenience of using one small book instead of often having to cross-reference through 30 large volumes to acquire the desired information.

A major drawback to A Concise Encyclopedia of Astronomy is the way in which it has been updated. The work is a translation of the 2nd (1967) edition of ABC der Astronomie. However, it is quite evident that the first edition (1960) was updated by simply adding a sentence or two concerning developments since 1960, but without changing the text of the first edition to any great extent in order to make the articles consistent. Thus in the article on Mars, the two paragraphs concerning the Martian surface and canals each contain a sentence about the Mariner IV photographs taken in 1965. Yet in the paragraph on the Martian atmosphere there is no mention whatsoever of Mariner IV's valuable atmospheric density findings. Elsewhere, under the term "space travel" the Mariner II fly-by of Venus in 1962 and the Venus 3 landing in 1966 are merely mentioned as having taken place. In the article entitled "Venus" there is no mention at all of those two space probes and their findings. Furthermore, the article on Venus cites a possible 125-day retrograde rotation for Venus -- a value which was superseded by a 247-day retrograde rotation which was discovered by radio telescopes in 1965 and has been since revised to a 243-day period.

The result of the inconsistent updating is that the reader is often not sure whether he is reading a 1960 or a 1967 part of the book. Nevertheless, A Concise Encyclopedia of Astronomy is unquestionably a handy reference book, filled with a great amount of astronomical information, much of which has remained, and is likely to remain, unchanged for years.

Weigert and Zimmermann's work is well bound and is printed on good quality paper; and were it not for the rather high price, the book could be recommended with much less hesitancy as a very handy quick-reference encyclopedia.

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Unveiling The Universe, by Harley Wood, DSc. Published by American Elsevier Publishing Company, Inc., New York, 1968. 240 pages. Price $10.75.

Reviewed by H. W. Kelsey

Dr. Wood has been Government Astronomer for New South Wales since 1943 and is Director of Sydney Observatory, which has published extensive catalogs of southern stars. He has always been active in encouraging amateur astronomy and has held various positions, including that of President, in the New South Wales Branch of the British Astronomical Association. He is also the author of The Southern Sky. The author states that the aim of this book is ".... to provide a minimum serious account of astronomy in a book which strikes a balance between the brief account, whose danger lies in giving inadequate information, and the full statement, more formidable to read and to buy, of which there are several good examples." This intention is admirably effected; and in so doing "the Aims and Achievements of Astronomy", the book's subtitle, are clearly revealed.

Even though this book is not a large volume, the reader will appreciate its comprehensive examination of modern methods of astronomical research and the resulting data presentation that is directed to answering the question, "How do you know this?" The discussion adequately investigates and describes the solar, galactic, and extragalactic systems, as well as stellar astronomy, with emphasis given to photographic, spectroscopic, photoelectric photometry, and radio astronomy techniques.

The author also states, "It is not easy to decide how much mathematics should be allowed to enter into an account of this kind." He then utilizes only the mathematics required to display the relationship existing between physical quantities, when necessary. The too often rigorous derivations of equations are avoided. In fact, a familiarity with the mathematics and physical science of high school level will be sufficient for a complete understanding of the text.

One chapter is provided for those who will want to see some of the objects that are mentioned in the text, and tables of the most interesting ones are presented. Additionally, six star maps covering the entire sky are provided. These are limited at the 4th magnitude for comfortable naked eye use. Dr. Wood has enhanced his text by including a comprehensive index, which will increase the usefulness of the book as a very convenient reference volume.

The major points of discussion in the text are illustrated by fifty-six line drawings, twenty-one tables, and forty-five photographic plates, of which four are in color.

Unveiling The Universe is recommended to those who have not recently added a modern general astronomy text to their library. Also, it can be most profitably studied by the person who is considering a future career in astronomy. Unveiling The Universe is available for circulation in the A.L.P.O. Library.

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Electron Density Profiles in Ionosphere and Exosphere, edited by Jon Frihagen. John Wiley and Sons, Inc., New York, N. Y., 1966. Price $18.75.

Reviewed by J. Russell Smith

This book is a 629 page report of the proceedings of the third NATO Advanced Study Institute that was held at Finse, Norway in 1965. The text is composed of technical papers which deal with the many phases of the physics of our ionosphere and exosphere.

The papers cover the following basic topics: 1. The constitution of the upper atmosphere, 2. The disturbed D region, 3. Observations of the quiet D region, 4. Very low frequency observations of the D region, 5. The E region, 6. The bottomside F region, 7.

The topside F region, 8. Incoherent scatter, 9. Total electron content measurements, 10. The F region, 11. Irregularities in the F region, 12. The exosphere, and 13. Summary of the conclusions of the meeting.

An interesting feature of the book is that a summary of the discussions is found at the end of each section.

There are two or three papers in French; but these occupy only a few pages out of the total number of pages, which will give the reader up to date information on the present status and future trends of research in ionospheric physics.

This book is now in the ALPO Library. If you have done work in this field, you will want to see the book.

ANNOUNCEMENTS

Error in Volume 21, Nos. 3-4 of This Journal. On page 50, lines 2 and 3, a sentence should be corrected to read: "Nor is the apparent contrast dependent on (gray) absorption if the scattered light is zero."

Changes in Mars Section. Mr. Klaus R. Brasch has been replaced as A.L.P.O. Mars Recorder by Mr. Charles F. Capen, Table Mountain Observatory, P. O. Box 367, Wrightwood, California 92397. We wish to express our thanks to Mr. Brasch at this time for his considerable efforts to further our studies of Mars while he was Recorder. It has been very difficult for him to find enough time for such work in addition to the great demands of his graduate studies. He has agreed to complete work on a report upon the 1966-67 apparition of Mars. Hence, any observers who have not yet done so should immediately submit their work on Mars in 1966-67 to Klaus R. Brasch, Dept. of Biology, Carleton University, Ottawa 1, Ontario, Canada. This assistance will be greatly appreciated. We also thank Mr. Kenneth Chalk for his help as Assistant Mars Recorder.

The new Mars Recorder will scarcely need an introduction to A.L.P.O. members or to amateur observers of Mars. He has authored a number of articles in this journal, and he has been a major contributor to the Mars Section for many years. During the last several apparitions of Mars he has carried on exhaustive professional observational research with the telescopes at Table Mountain Observatory, where he is Director, and elsewhere. Mr. Capen will outline his Mars program for the A.L.P.O. in 1969 in the next issue of this journal. Those who have already begun systematic observations of Mars should write to the new Mars Recorder at the address given above.

A.L.P.O. Remote Planets Section. In accord with a resolution passed during the A.L.P.O. business meeting at the 1968 Convention, we have created a new Remote Planets Section; and the Director has appointed as the first Recorder Mr. James W. Young, Table Mountain Observatory, P. O. Box 367, Wrightwood, California 92397. The remote planets are here defined to be Uranus, Neptune, and Pluto. The new Section thus replaces the old Uranus-Neptune Section. It is hoped that Section observers of these distant planets will in part use advanced techniques and large apertures, under Mr. Young's guidance. At the Table Mountain Observatory the new Recorder will certainly have access to both.

We want to thank Mr. Leonard Abbey at this time for his past supervision of A.L.P.O. efforts on Uranus and Neptune. We regret his leaving our staff. Those who have not been Recorders often too little appreciate what is needed to do a good job of directing the efforts of amateur observers and sometimes are too quick to criticize.

Comet Report Forms. These are now available at a price of $2.00 for 50 forms. They may be ordered from the A.L.P.O. Comets Recorder, Mr. Dennis Milon, 378 Broadway, Cambridge, Mass. 02139. Observers will find the forms very helpful in reporting their studies of comets and even as a guide while observing in regard to what to record, and in what manner. The use of the forms also makes the Recorder's job much easier.

A.L.P.O. Business Meeting in August, 1968. (Concluded from pg. 72 of preceding issue.) There was considerable discussion of our possible relations to proposed international amateur groups, or to a suggested amateur commission in the I.A.U. The following resolution was eventually passed by a very large majority: "Resolved, that the A.L.P.O. considers at present inappropriate its entry into an amateur international association." It was moved and seconded that the Uranus-Neptune Section be replaced by a Remote Planets Section, with the Remote Planets Recorder to be appointed by the Director. (Now done, see above). Lunar Recorders Delano and Ricker announced plans to issue a Lunar Section Bulletin at appropriate intervals. Mr. Phillip Budine plans a similar service for observers of

Jupiter. Reverend Richard Hodgson was appointed head of a committee of three to study the general nature and the methods of operating of the A.L.P.O. The other two members were appointed by the Director after the Convention; they are Richard Wend of Chicago and Ken Thomson of Pasadena, Texas. The committee is to report during the San Diego Convention next August.

The A.L.P.O. officially expressed its thanks to the Astronomical Society of Las Cruces, New Mexico State University, Corralitos Observatory, and all others who helped to make the S.A.C.'68 enjoyable and successful.

Joint 1969 W.A.A.-A.L.P.O. Convention. This meeting will be held on August 21, 22, and 23, 1969, at San Diego, California. The site will be the Stardust Motor Hotel, which

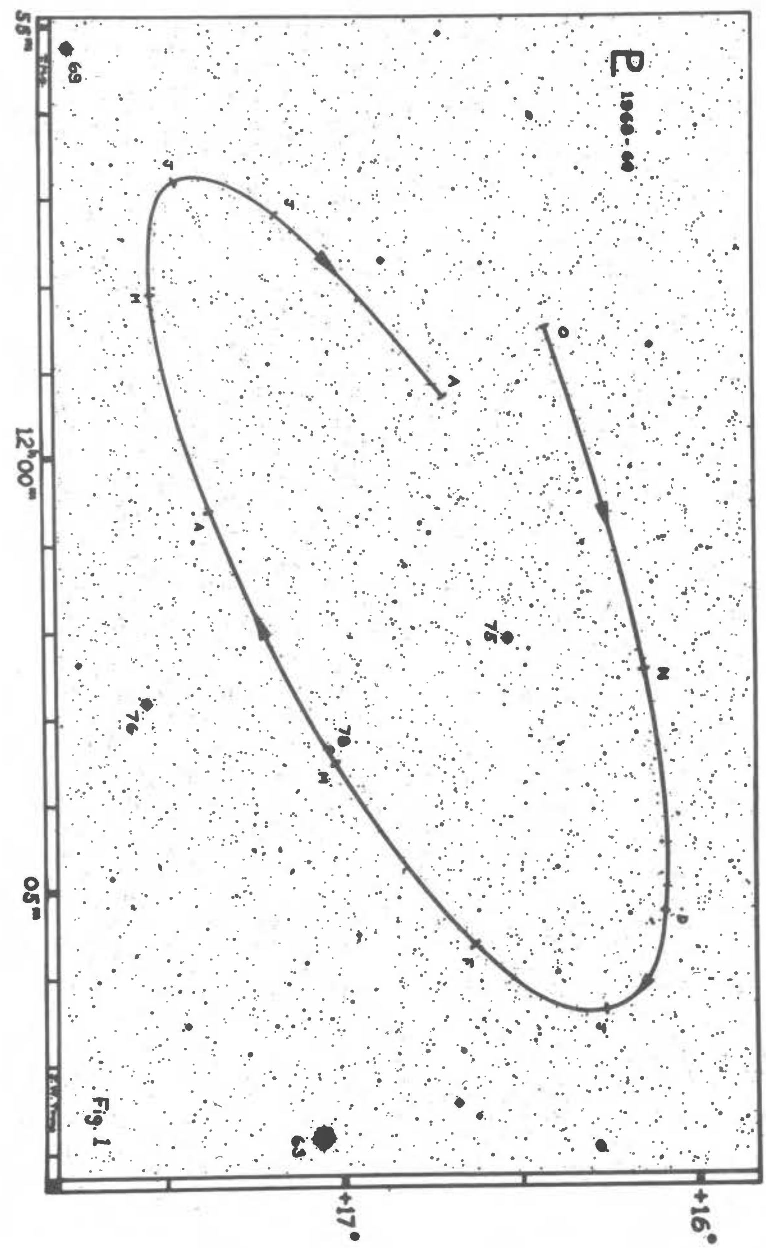

Figure 42. Chart showing the position of Pluto among the stars from October, 1968 to August, 1969. The tick marks show the position at the beginning of a month. Chart prepared and contributed by Mr. James W. Young. See also text of his paper.

has excellent facilities for such gatherings. There will be a field trip to Palomar and several Morrison Lectures by professional astronomers. A strong showing of amateur papers is also greatly desired, and the readers of this journal are heartily invited now to begin considering possible subjects. The host society is the San Diego Astronomy Association, and the General Chairman is Mr. Howard L. McCalla.

Sustaining Members and Sponsors. As of January 16, 1969, we have the following people in these special classes of membership. Sponsors pay $25 per year; Sustaining Members, $10 per year. The surplus above the regular rates supports the work and activities of the A.L.P.O.

Sponsors. William O. Roberts, David P. Barcroft, Grace A. Fox, Philip and Virginia Glaser, John E. Westfall, Joel W. Goodman, Dr. James Q. Gant, Jr., Ken Thomson, Reverend Kenneth J. Delano, Richard E. Wend, Reverend Richard G. Hodgson, William Kunkel, A. B. Clyde Marshall, and Walter Scott Houston.

Sustaining Members. Sky Publishing Corporation, Charles F. Capen, Geoffrey Gaherty, Jr., Charles L. Ricker, Alan McClure, Elmer J. Reese, Carl A. Anderson, Gordon D. Hall, Michael McCants, Dr. William K. Hartmann, Ralph Scott, A. W. Mount, Charles B. Owens, Joseph P. Vitous, John E. Wilder, Clark R. Chapman, A. K. Parizek, B. Traucki, Frederick W. Jaeger, P. K. Sartory, Nicholas Waitkus, Patrick S. McIntosh, Lyle T. Johnson, the Chicago Astronomical Society, H. W. Kelsey, Phillip Wyman, Harry Grimsley, Daniel H. Harris, Fred

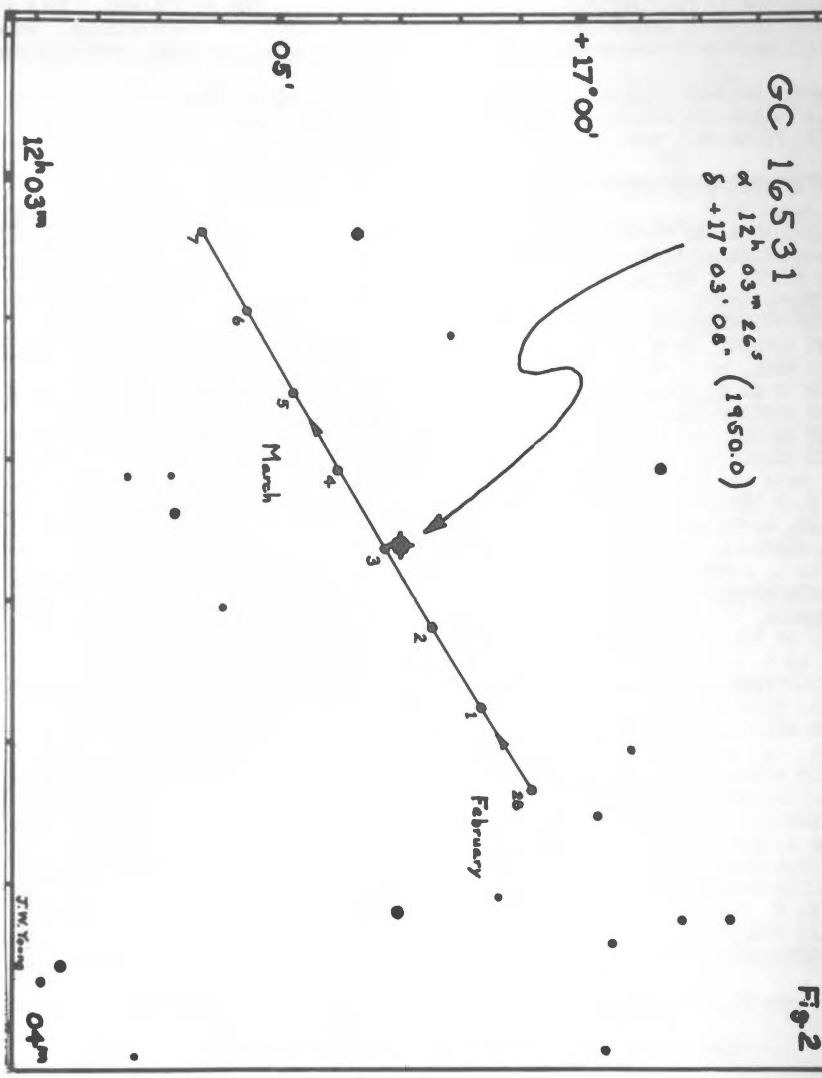

Figure 43. The motion of the planet Pluto past the star GC 16531 from February 28 to March 7, 1969. Chart prepared and contributed by James W. Young. This period will be a very favorable one to try to find and identify Pluto.

M. Garland, the Junior Texas Astronomical Society, Dr. David Meisel, Steve Hall, Jack K. Fondren, Daniel Vukobratovich, John Bally-Urban, W. King Monroe, Warner T. Crocker, James W. Young, Phillip W. Budine, Klaus R. Brasch, and Victor Nikolashin.

THE 1968-69 APPARITION OF PLUTO

By: James W. Young, A.L.P.O. Remote Planets Recorder

The one principal planet in our Solar System which never shows visual markings or even a discernible disk is also by far the most difficult to locate. For experienced amateurs and professional planetary astronomers, Pluto can be seen in a 6-inch telescope under ideal "mountain-top" conditions. For those who possess even larger instruments, locating the planet will be relatively easy, using the finder chart in Figure 42 on page 106. The chart was made by superimposing a grid of Pluto's 1968-69 positions over the correct star-field on a National Geographic Society Palomar Observatory Sky Survey chart. The grid of the planet's positions was made in a rectangular projection sense, whereas the Sky Survey chart is of an inside spherical projection. Slight positional corrections were made by applying the cosine for Pluto's +17 degree declination, and checked relative to a nearby star, GC 16494, by differential coördinates.

Figure 43 on page 107 shows an enlarged area of Pluto's path near GC 16531, a KO 7.8 m_v star. This passage will give inexperienced amateurs a better opportunity to locate the 14 m_v planet and to familiarize themselves with its motion and brightness. This event will occur about two weeks before opposition, allowing all night for observations. However, the near-by full moon will hamper observers with instruments of less than 10-inches aperture.

I would be very interested in hearing from those serious observers who locate the planet and follow its motion during the coming year. In October, 1970, and August and October, 1971, Pluto will pass extremely close to several extragalactic nebulae in the Virgo cluster, again presenting a more rewarding telescopic view. Interested readers should write to James W. Young, Table Mountain Observatory, P. O. Box 367, Wrightwood, California 92397.

The Strolling Astronomer

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