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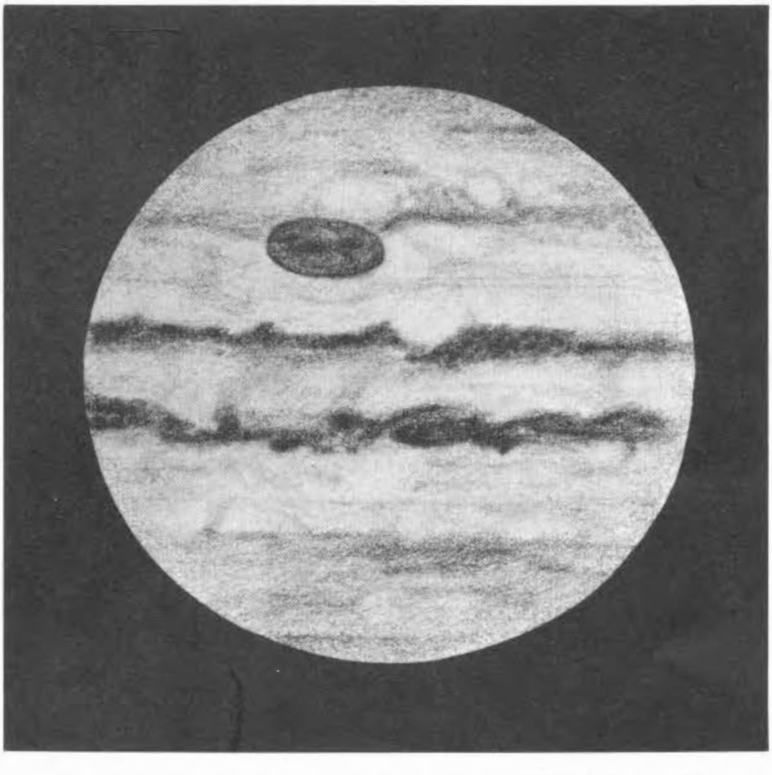

Drawing of Jupiter by Mr. Ron Doel on July 12, 1973 at 5 hrs., 35 mins., Universal Time. 8-inch reflector, 150X. Seeing 5-8 (good), transparency 4.5 (limiting stellar magnitude). Simply inverted view with south at the top. The Red Spot is the large dusky oval in the upper left quadrant of the disk, with white South Temperate Zone Oval DE above it and slightly to its right. These features on the Giant Planet and others are discussed in articles in this issue beginning on pages 213, 228, 236, 239, and 240. C.M. (I) = 65°. C.M. (II) = 18°.

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ASSOCIATION OF LUNAR & PLANETARY OBSERVERS
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JOVIAN COLORS IN 1973

By: Paul K. Mackal, A.L.P.O. Jupiter Recorder

Colors on the planet Jupiter were quite noticeable in 1973 to most of our observers, as the results here provided will attempt to show. Suggestions made by José Olivarez about the wide range of color on Jupiter in 1968, from blue to orange, have been confirmed, using fairly large reflecting instruments.

The Red Spot was usually regarded as being dark pink or orange in color throughout 1973. Such was the case for the duration, according to Reinhard Sopper. The intensity of the Spot varied prior to opposition, with the appearance of rifts, while afterwards a dark bar formed across the face of the Spot, according to Chick Capen. A chronological table is presented below which summarizes the color of the R.S.:

R.S. Color

Date (1973)	Observer	Longitude*	Color
Early '73	David Widman	----------	dark pink
May 5	Toshihiko Osawa	----------	not too red
June 10	Ernst Mayer	----------	bright orange
July 7	Tod Lauer	----------	red-orange
Aug. 3	Lawrence Carlino	----------	salmon pink
Aug. 15	Alan Heath	----------	rosy pink
Aug. 27	Walter Haas	----------	orange
Sept. 9	J. R. Smith	----------	dark pink
Sept. 23	Walter Haas	----------	orange
Sept. 30	Wayne Wooten	----------	dark pink
Oct. 14	Walter Haas	----------	orange-red
Oct. 24	Clay Sherrod	----------	red

Color in the northern half of Jupiter was very cool in 1973, with a reddening of the N.Tr.Z. due to the reddening of the flanking $N.E.B._n$ (according to the Recorder) in late July and early August, first observed by J. Vitous and later confirmed by J. Russell Smith. The following charts are each chronological in nature, beginning with the N.P.R. and moving southward through the EB and EZ.

N.P.R. Color

Date (1973)	Observer	Longitude	Color
Early '73	David Widman	----------	brown
May 5	Toshihiko Osawa	358°II	grayish brown
June 27	Laszlo Szabo	152°II	yellow brown
July 14	Attila Hajdu	122°II	dark brown
Aug. 4	Walter Haas	222°II	gray
Aug. 26	Walter Haas	218°II	light gray
Aug. 27	Walter Haas	14°II	light gray

N.N.N.Te.Z. Color

Date (1973)	Observer	Longitude	Color
July 6	Ron Doel	222°II	bluish

The N.N.T.B. was brown all apparition, according to R. Sopper.

N. Zones Color

Date (1973)	Observer	Longitude	Color
July 10	Attila Hajdu	4°II	yellow-white
Aug. 4	Walter Haas	222°II	white
Sept. 13	J. Russell Smith	64°-75°II	pink
Sept. 19	J. Russell Smith	173°-222°II	pink

*As is customary, longitude on Jupiter is expressed either in System I for the equatorial portions of the planet or in System II for the rest of the globe.

N. Zones Color (cont.)

Date (1973)	Observer	Longitude	Color
Sept. 20	J. Russell Smith	360°.1 II	white

The N.Te.Z. was white all apparition, according to R. Sopper.

N.Te.Z. Color

Date (1973)	Observer	Longitude	Color
July 6	Ron Doel	222°II	orange
Aug. 26	Walter Haas	218°II	dull white
Aug. 27	Walter Haas	14°II	light gray

The N.T.B. was reddish all apparition, according to R. Sopper.

N.T.B. Color

Date (1973)	Observer	Longitude	Color
July 10	Attila Hajdu	4°II	brown
Aug. 4	Walter Haas	222°II	brownish gray
Sept. 12	Chick Capen	282°II	warm

The N.Tr.Z. was mostly white, but sometimes yellow, according to R. Sopper.

N.Tr.Z. Color

Date (1973)	Observer	Longitude	Color
June 27	Gyula Mohacsi	183°II	ochre
July 29	Joseph Vitous	350°II	red
Aug. 3	Joseph Vitous	344°II	red
Aug. 12	J. Russell Smith	106°II	pinkish
Aug. 26	Walter Haas	218°II	dull white
Aug. 27	Joseph Vitous	338°II	red
Aug. 27	Walter Haas	14°II	white
Sept. 4	Joseph Vitous	114°II	red
Sept. 5	Joseph Vitous	240°II	red
Sept. 11	Joseph Vitous	37°II	red
Sept. 13	J. Russell Smith	348°-9°.7 II	pink
Sept. 15	Joseph Vitous	8°II	red
Sept. 18	Joseph Vitous	41°II	red
Sept. 19	Joseph Vitous	187°II	red
Sept. 26	Joseph Vitous	123°II	red
Oct. 15	Joseph Vitous	98°II	red

The N.E.B.$_n$ was red to R. Sopper; and the Recorder confirms this color after August 1, 1973 for the duration of the apparition. The N.E.B.$_s$ was most often blue, and sometimes brown, according to R. Sopper. To the Recorder the N.E.B. was mostly brown prior to the 1st of August, 1973.

N.E.B. Color

Date (1973)	Observer	Longitude	Color
May 5	Toshihiko Osawa	358° II	grayish brown
May 23	Toshihiko Osawa	190° II	dark gray
June 11	Zoltan Hevesi	326° II	brownish
June 15	Toshihiko Osawa	59° II	dark brownish gray
June 27	Laszlo Szabo	152° II	rusty brown
June 27	Gyula Mohacsi	183° II	light brown
July 4	Gyula Mohacsi	54° II	brown gray
July 10	Toshihiko Osawa	309° II	brownish dark gray
July 14	Attila Hajdu	122° II	grayish brown
Aug. 4	Walter Haas	222° II	red-brown

N.E.B. Color (cont.)

Date (1973)	Observer	Longitude	Color
Aug. 11	Toshihiko Osawa	172°II	gray
Aug. 26	Walter Haas	218°II	reddish brown
Aug. 27	Walter Haas	14°II	reddish brown
Sept. 1	Toshihiko Osawa	286°II	brownish gray
Sept. 7	Toshihiko Osawa	61°II	brownish gray
Sept. 12	Chick Capen	282°II	brownish gray NEB_n-warm NEB_s-cool

According to R. Sopper the E.Z. was white, blue, and brown, in order of significance. The E.B. was not observed by him.

E.B. Color

Date (1973)	Observer	Longitude	Color
May 5	Toshihiko Osawa	230°I	grayish brown
June 11	Zoltan Hevesi	142°I	brownish
June 15	Toshihiko Osawa	265°I	dark brownish gray
July 10	Toshihiko Osawa	176°I	brownish dark gray
Aug. 4	Walter Haas	85°I	reddish brown
Aug. 27	Walter Haas	51°I	brown
Sept. 1	Toshihiko Osawa	357°I	reddish brown, orange
Sept. 7	Toshihiko Osawa	178°I	brownish gray

E.Z. Color

Date (1973)	Observer	Longitude	Color
Early '73	David Widman	----------	yellow-orange
June 11	Zoltan Hevesi	142°I	cream yellow
June 27	Laszlo Szabo	84°I	cream
June 27	Gyula Mohacsi	107°I	whitish-yellow
July 4	Gyula Mohacsi	34°I	yellow
Aug. 12	J. Russell Smith	31°I	pinkish
Aug. 26	Walter Haas	247°I	light brownish gray
Aug. 27	Walter Haas	51°I	light brownish white

Color in the southern half of Jupiter was also very cool throughout the 1973 period. No startling red eruptions were discovered by the Recorder at any time in July or August of 1973. Such was not the case with many of our observers, however. Starting with the S.P.R., we shall wind up with the $S.E.B._n$.

S.P.R. Color

Date (1973)	Observer	Longitude	Color
May 23	Toshihiko Osawa	190°II	bluish
June 27	Laszlo Szabo	152°II	light brown
June 27	Gyula Mohacsi	183°II	grayish
July 4	Sandor Keszthelyi	54°II	brown
July 14	Attila Hajdu	122°II	dark brown
Aug. 4	Walter Haas	222°II	gray
Aug. 26	Walter Haas	218°II	light gray
Aug. 27	Walter Haas	14°II	light gray

S.S.S.Te.Z. Color

Date (1973)	Observer	Longitude	Color
July 6	Ron Doel	222°II	slight green

The S.S.S.T.B. was gray all apparition, according to R. Sopper.

S.S.Te.Z. Color

Date (1973)	Observer	Longitude	Color
July 6	Ron Doel	222°II	orange

The S.S.T.B. was brown, according to R. Sopper.

S.S.T.B. Color

Date (1973)	Observer	Longitude	Color
Aug. 4	Walter Haas	222°II	reddish brown
Aug. 27	Walter Haas	14°II	brown

S. Zones Color

Date (1973)	Observer	Longitude	Color
July 10	Attila Hajdu	4°II	yellowish-white
Aug. 4	Walter Haas	222°II	white
Sept. 13	J. Russell Smith	64°-75°II	pink
Sept. 19	J. R. Smith	173°-222°II	pink
Sept. 20	J. R. Smith	360°1 II	white

The S.Te.Z. was white all apparition, according to R. Sopper.

S.Te.Z. Color

Date (1973)	Observer	Longitude	Color
June 27	Gyula Mohacsi	183°II	yellow, faint
July 6	Ron Doel	222°II	gray
Aug. 26	Walter Haas	218°II	dull white
Aug. 27	Walter Haas	14°II	white

The S.T.B. was blue all apparition, according to R. Sopper.

S.T.B. Color

Date (1973)	Observer	Longitude	Color
June 27	Laszlo Szabo	152°II	orangeish-brown
July 4	Gyula Mohacsi	54°II	red-brown
July 10	Attila Hajdu	4°II	yellowish-brown
July 20	Sandor Keszthelyi	5°II	grayish-brown
Aug. 4	Walter Haas	222°II	reddish brown
Aug. 26	Walter Haas	218°II	reddish brown
Aug. 27	Walter Haas	14°II	reddish brown
Sept. 1	Toshihiko Osawa	286°II	chocolate gray
Oct. 14	Walter Haas	---------	red-brown
Oct. 24	Clay Sherrod	---------	red

The S.Tr.Z. was white all apparition, according to R. Sopper.

S.Tr.Z. Color

Date (1973)	Observer	Longitude	Color
July 4	Gyula Mohacsi	54°II	yellow white
July 6	Ron Doel	222°II	gray
Aug. 4	Walter Haas	222°II	violet white
Aug. 12	J. R. Smith	106°II	pinkish
Aug. 26	Walter Haas	218°II	white
Aug. 27	Walter Haas	14°II	white

S.Tr.Z. Color (cont.)

Date (1973)	Observer	Longitude	Color
Aug. 27	Walter Haas	14°II	RSH-white
Sept. 7	Toshihiko Osawa	61°II	white

S.E.B. Color

Date (1973)	Observer	Longitude	Color
June 11	Zoltan Hevesi	326°II	brownish
June 27	Laszlo Szabo	152°II	rusty brown
June 27	Gyula Mohacsi	183°II	coffee brown gray
July 4	Gyula Mohacsi	54°II	brown gray
July 10	Attila Hajdu	4°II	grayish brown
July 14	Attila Hajdu	122°II	grayish brown
July 30	Lawrence Carlino	136°II	red-purple
Aug. 11	Toshihiko Osawa	172°II	brownish
Sept. 4	Richard Wessling	55°II	reddish

S.E.B.$_s$ Color

Date (1973)	Observer	Longitude	Color
Z-mas photo*	Chick Capen	---------	red-brown

This condition of the S.E.B.$_s$ may have existed all apparition, if R. Sopper's claim is correct. He regarded it as a fawn color, or fawny. The S.E.B.$_n$, however, was observed to be most often red-brown, and sometimes orange-brown. The S.E.B. Z. was considered to be white by R. Sopper throughout the period.

S.E.B. Z. Color

Date (1973)	Observer	Longitude	Color
July 6	Ron Doel	222°II	gray
Aug. 4	Walter Haas	222°II	violet white
Aug. 26	Walter Haas	218°II	white
Aug. 27	Walter Haas	14°II	white

S.E.B.$_n$ Color

Date (1973)	Observer	Longitude	Color
May 23	Toshihiko Osawa	190°II	brownish orange
July 10	Toshihiko Osawa	309°II	orange, red
Aug. 4	Walter Haas	222°II	red-brown
Aug. 26	Walter Haas	218°II	reddish brown
Aug. 27	Walter Haas	14°II	reddish brown

In conclusion, it should be noted that at Z-mas time our Pioneer 10 space-probe passed by Jupiter and recorded a host of colors not unlike those observed by our observers in Japan, America, Britain, Germany, and Hungary.

Blue and violet colors were observed for certain in 1973, confirming the Olivarez thesis. Red color formed in the N.Tr.Z. after having spread horizontally from the north edge of the N.E.B. in two weeks time. This phenomenon tends to be in keeping with Rossby's conception[1] of "lateral mixing" staying in preferred latitudes, as originally suggested by M. Margules (1903).**

An observation by J. Russell Smith that pink zones appear lavender in a blue filter suggests to the author that blue-colored matter lies at a lower level in the Jovian atmosphere than red-colored matter. This effect was first noted by the author in 1973 while observing the R.S. in red and blue filters.

[1]Carl-Gustav Rossby, "On the Nature of the General Circulation of the Lower Atmosphere". (Of the Earth.) In Gerard P. Kuiper's edition of The Atmospheres of the Earth and Planets. Univ. of Chicago, 1957. Press copy. p. 33.

*A Christmas card photograph of Jupiter by Mr. Capen taken not in 1973 but in 1969 or earlier.

**However, Mr. Elmer J. Reese of the New Mexico State University Observatory tells us that Jupiter photographs at that institution and at the Lunar and Planetary Laboratory make the N.Tr.Z. white in 1973.

COMET KOHOUTEK OBSERVATIONS WITH AN IMAGE INTENSIFIER*

By David A. Sutherland, ALPO Comets Section

My observations of Comet Kohoutek 1973f began on October 20th, 1973, using a 16-inch f/4 Newtonian reflector equipped with an RCA #4549 image intensifier, as shown in Figures 1 and 2. The intensifier is valuable in both visual and photographic uses, and on October 25th the comet was photographed in only a one-second exposure with a Polaroid camera. At this time I estimated the visual magnitude of the comet at 9.0 by placing the intensifier out of focus and making comparisons with stars listed in the Smithsonian Astrophysical Observatory Star Catalog. During October and early November the aperture effect[1] (where a comet is estimated fainter in a larger aperture) was noted consistently in the 16-inch reflector and a 2-inch refractor, the difference between them being 0.5 magnitudes. Another intersting effect was the much larger coma size measured with the 2-inch against the 16-inch; for example, on Oct. 31st, 1973, the diameters by the drift method were 2' and 5' respectively; on November 2nd they were $2\frac{1}{4}$' and $6\frac{1}{4}$'.

Comet searching with the intensifier, a strictly nocturnal device, commenced on May 4, 1973. It has been in use for 55.5 hours on 37 nights as of Oct. 31, 1973, with a total of 178 meteors recorded. Direct screen viewing is achieved by a 32-mm. focal length Erfle eyepiece giving 50 power and a one-degree field in the 16-inch, and six power and an 11-degree field in the 2-inch f/3.5 refractor. Changing the intensifier from one telescope to the other can be accomplished in less than a minute. The usual extra-focal comparison technique for comet magnitudes[1] is used except that the whole intensifier is racked out as well as the eyepiece. Images of maximum sensitivity materialize while scanning as quickly as the eye can detect the new field, but the image trails of bright stars require a few seconds for complete image decay as they pass out of the field of view. The intensifier image is erect and does not suffer inversion as in the usual astronomical telescope. Stellar magnitude threshold limits are increased by about two magnitudes with the intensifier. The spiral structure of galaxies such as the Whirlpool (M51) displays a wealth of detail not seen in the 16" without the intensifier. Auroral streamers and upper atmospheric phenomena are noted with increasing frequency since using the intensifier, and telescopic meteor counts per hour are up substantially. Not one iota of intensifier malfunction has been experienced while operating in the damp air under open skies.

Intensifier Operation

The intensifier employs an internal solid oscillator and voltage multiplier supplying 45,000 volts to the third stage and lesser voltages to the two first stages. Total power requirements vary between 20 and 50 milliamperes at 6.75 volts depending on the light intensity emitted upon the photocathode. The maximum luminance gain is 70,000 for the intensifier. The gain is varied manually by rotating the input voltage rheostat from 4 volts to 6.75 volts. The input voltage is reduced when viewing near bright stars and planets in order to prevent damage to the viewscreen phosphor. The photocathode is an RCA ERMA type with a sensitivity of 300 UA/lumen. Fiber optic bundles are used to couple the stages together and to form flat surfaces for the convex photocathode input and viewscreen output. The intensifier employs for tube protection an automatic brightness control, which has been in service only once when I was spotlighted by deer poachers. The useful photocathode diameter is 37.5 mms., and the viewscreen is 42 mms. The #4549 length is 12.028 inches, and the diameter is 3.748 inches. Color filters and a polarizer are fitted in front of the photocathode fiber optics and can be changed in seconds by simply lifting the thick black cloth cover and changing them. The polaroid camera (with a plus ten diopter closeup lens attached just in front of the regular camera lens) was held by hand in front of the intensifier screen for shots of Kohoutek.

For additional information, write to the author at Pen Hook, Virginia 24137.

Reference

1. Charles S. Morris, "The Reduction of Comet Magnitude Estimates and Comet Observing", Journal ALPO, Vol. 24, Nos. 7-8, pp. 150-156, 1973.

*Communicated by Mr. Dennis Milon, ALPO Comets Recorder.

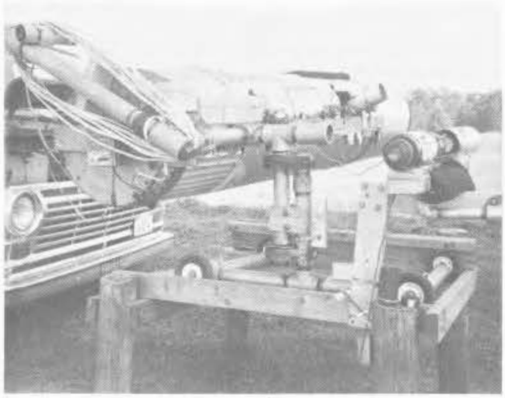

Figure 1. 16-inch Newtonian Reflector used by David A. Sutherland at Pen Hook, Virginia to observe Comet Kohoutek. Shown here on its altazimuth pipe mounting, sitting in a wooden platform. At right is a 2-inch refractor with the image intensifier installed. Power for the intensifier, 110-volt inverter, lens heaters, and heating pad is supplied by a 12-volt battery under the car hood at left. The inverter is at the rear of the 16-inch mirror. Three voltmeters to insure the accuracy of the 6.75-volt supply are mounted under the 16" intensifier housing, which has black cover cloth pulled back from over it. Between the 16" mount bearings are adjustable wing-nut friction brakes to hold position during windy nights.

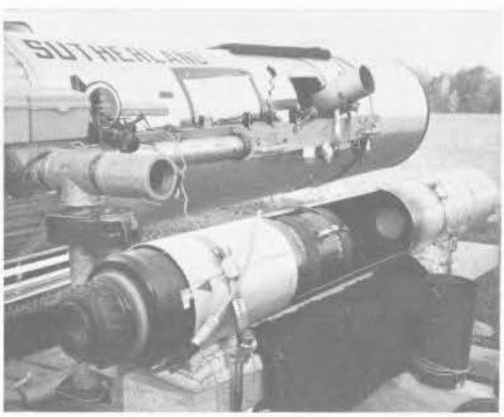

Figure 2. This closeup of the 2-inch refractor shows how Author Sutherland's image intensifier unit is mounted in front of the eyepiece. Note 2"-f3.5 Achromatic Objective with aluminum tube extending far beyond it. (Tube extensions to reduce stray light were found very necessary for both telescopes in order to see the faintest possible objects.) The intensifier positive terminal shows just beyond the RCA trademark. The negative terminal is at the far end near the photocathode. The polarizer and color filter mount that fit over photocathode may be seen at the lower right. Surface friction of tape buildup holds the eyepiece into the intensifier and also the intensifier into the aluminum tube.

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COMET MAGNITUDE ANALYSIS: IKEYA-SEKI 1968 I (1967n)

By: Charles S. Morris, ALPO Comets Section

As a result of good sky position and the fact that the comet was relatively bright during most of its apparition, Comet Ikeya-Seki 1968 I (1967n) offered a rare opportunity to study the light curve of a comet with a large perihelion distance.

A total of 106 observations made by members of the ALPO Comets Section were selected for reduction. A list* of observers and observations can be found in The Strolling Astronomer, Vol. 21, Nos. 7-8. From this list a fair number of observations had to be eliminated for the following reasons:

1. The method used to obtain the magnitude estimate made the accuracy of the observation suspect.
2. The observer did not state what type of instrument was used to make the estimate. Thus, it was impossible to determine which aperture correction to use.
3. The observation was made under very bad observing conditions and was in total

*The following observations were not included in the list of observations cited above: 1968, Sept. 29.30, 12.5; Oct. 22.30, 12.6; Oct. 28.21, 12.8; Oct. 28.21, 13.3. All were made with a 22" Maksutov. First three observations by Bortle and the last one by Scovil.

disagreement with other observations.

The first step in the reduction was to correct the observations for the aperture effect. The refractor observations were corrected using the aperture correction determined by N. T. Bobrovnikoff (Popular Astronomy, Vol. 49, No. 467, 1941 and Vol. 50, No. 473, 1942); the reflector observations were corrected using the aperture correction determined by the author (Publications of the Astronomical Society of the Pacific, Vol. 85, No. 506, 1973 and The Strolling Astronomer, Vol. 24, Nos. 7-8, 1973). The observations made by Bortle and Scovil using a 22-inch Maksutov were corrected using the aperture correction for reflectors. The actual aperture correction for this kind of instrument is not known. As it turns out, the aperture correction which is assumed for these four observations controls the resulting magnitude formula. Thus, one can see that the assumption made here is an important one.

The values of r (the comet's distance from the Sun in astronomical units) and Δ (the comet's distance from the Earth in AU) were calculated by the author using the following orbital elements computed by Marsden (IAU Circular No. 2376):

T = 1968, February 25.7055	ω = 70°872
e = .99915	Ω = 254°628
q = 1.69658 A.U.	i = 129°316

The observations were corrected for the changing Earth-comet distance. These heliocentric magnitudes were then fitted to the well known ("power-law") formula:

$$H_\Delta = H_0 + 2.5n \log r,$$

where H_Δ is the heliocentric magnitude, H_0 is the absolute magnitude, and n is a number which indicates how the comet's brightness varies with heliocentric distance. The results of the least squares reduction were as follows:

$$H_\Delta = 4.83 + 8.32 \log r, \text{ where}$$

$H_0 = 4.83 \pm 0.11$ (pe) and $n = 3.33 \pm 0.17$ (pe), where pe is probable error.
(Variation in r: 1.827 - 1.697 - 3.421)

This result is quite different from the result obtained by Morris and Bortle (Publications of the Astronomical Society of the Pacific, Vol. 85, No. 504, 1973) in their study of 243 observations of this same comet. The following results were obtained in that study:

$H_0 = 3.87 \pm 0.09$ (pe), $n = 4.85 \pm 0.15$ (pe)

The reason for this great difference is that no aperture corrections were applied to the observations in the Morris and Bortle study. (This reduction was performed before the Morris aperture correction study.)

The regression equation determined for the ALPO data explains only 63% of the scatter of the observations. This result indicates that there was a lot of variation in the brightness of this comet which was not due to the changing heliocentric distance. In the Morris and Bortle study it was found that there were variations in brightness of almost a magnitude before and after perihelion. However, near perihelion the comet's brightness was almost constant.

Thus, from the present study it can be concluded that Comet Ikeya-Seki 1968 I was an intrinsically bright comet (an average comet has an absolute magnitude of about six) which experienced large variations in brightness (which do not appear to have been caused by solar activity). A final result obtained from the ALPO data is that the maximum heliocentric brightness probably occurred before perihelion. This conclusion in itself indicates that Comet Ikeya-Seki was a very unusual comet.

MARS 1971 APPARITION - ALPO REPORT I

By: C. F. Capen and T. R. Cave, A.L.P.O. Mars Recorders

Introduction

The 1971 apparition of Mars was the second of the most favorable perihelic apparitions of this century. The opposition occurred on August 10, 1971 with an apparent disk diameter of 24.89 arc-seconds at an areocentric orbital longitude of 232°L_s, or just 18° from perihelion at 250°L_s. The closest approach occurred on August 12 with an apparent disk diameter of 24"9 at a distance of only 34.9 million miles. This was the closest that Mars had been to the Earth since August, 1924 when it subtended 25"1 at 34.6 million miles (Ref. 1). The aspects of the Martian globe and seasonal conditions were similar to those of the 1956 apparition. The 1971 apparition was characterized by the beautiful changing appearance of the retreating spring-summer south polar cap and by the dynamic activity exhibited by the Martian atmosphere. The 1971 apparition will be long remembered as the epoch of the predicted yellow dust storm (Refs. 2,3,4,5, and 6).

1971 Mars Observing Program

The A.L.P.O. Mars 1971 observing program was a successful international patrol. Member observers of the world societies of the Oriental Astronomical Association, Société Astronomique de France, British Astronomical Association, Mars Section Berlin, Mars observing sections of five US astronomical societies, and individual observers located in 16 countries actively participated and contributed data at regular intervals, which allowed an approximate 24-hour surveillance of all Martian longitudes. Observations were obtained from 63 individual locales distributed around the world. Fifty-four locales were in the northern hemisphere, and nine were in the southern hemisphere. Those located near to, or south of, the Equator had the advantage that Mars was high in the sky. The world map (Fig. 3) shows the terrestrial location of each observing locale and the longitudes covered. The dots represent visual stations only, and the stars represent photographic observatories. Figure 4 shows the high concentration of locales in the hemisphere of the Americas. The value of a set of continuous observational data is manyfold. It allows the daily study of any one of several Martian phenomena on a global basis, and it made possible an advanced alert system for observers of events located at any one longitude via the "Martian Chronicle '71" newsletter. The use of standard report forms, similar color filters, a standard intensity estimation scale, and similar observing techniques produced homogeneous observing data which has high analytic value.

The ALPO Mars Section received a total of 1,951 observations of Mars from 112 observers. There were 1,612 visual observations (98% useable), 339 photographs (95% useable), and several hundred intensity and color estimates. This mass of data has been evaluated and chronologically filed in two large loose-leaf binders for study and reference. Never before have so many quality black-and-white and color photographs been received covering one Mars apparition. W. Haas began the apparition with the first visual observation on 29 Nov., 1970 at 97°L_s; and T. Osawa brought it to an end with an observation on 12 Mar., 1972 at 358°L_s. The total seasonal coverage was thus 261°L_s, or 73% of a Martian year, which included the winter, spring, and summer in the southern hemisphere. Refer to Fig. 5. Six Mercator 1971 Mars charts were constructed by Mars Section members (Ref. 7). Some of these charts will appear in future 1971 Mars Reports. There were 40 subscribers to the "Martian Chronicle '71". The mean telescopic aperture employed by the top ranking 100 ALPO observers was 12.1 inches. This value is 2.8 inches larger than the average aperture used in 1969.

Acknowledgement

The ALPO Mars Recorders wish to thank all Martian observers for their systematic observing data, friendly correspondence, and so many hours persevering at the telescope. We fully appreciate the care and time spent in reproducing copies of your original observations in a standard format for ease of future study. Without the dedication and integrity of these ALPO Mars Observers, the current synoptic study of Mars in 1971 would not have been possible. Those who have shared this common interest have experienced a unique epoch in the history of science, for we have seen the intriguing nature of a fascinating and dynamic world - that is Mars.

A list of the contributing observers, their observing locations, visual and photographic data contributed, and instruments employed is given in Table I. Exceptional colorimetry and color observations were received from B. Salmon, Z. Dvorak, C. Capen, C. Ricker, T. Osawa, K. Delano, M. Fornarucci, M. Mattei, J. Lankford, L. Carlino, C. Haase, and J. Mitchell. Experiments with Ektachrome IR and Kodachrome-X were made during the Great Yellow Cloud event by Capen. Photographs of several ALPO Mars observers and their telescopes used in 1971 are shown in Fig. 6. A new photo file of ALPO observers at their favorite telescopes has been initiated. Those interested should kindly send a 3" X 5" or 4" X 5" picture to Mars Recorder Capen.

TABLE I

NAME	LOCATION	VISUAL	PHOTOGRAPHY B&W	PHOTOGRAPHY COLOR	TELESCOPE(S)
Fred Alpers	Riverside, Calif.	1			12.5" Newt.
T. C. Akiyoshi	Monterey Park, Calif.	1			8" Newt.
J. Andrew	Hampshire, England	5			8.5" refl., 6" refl.
J. C. Bartlett, Jr.	Baltimore, Md.	22			4" refr.
R. M. Baum	Chester, Ch., England	1			4.5" refr.
S. W. Bieda, Jr.	Wiesbaden, Germany	12			8" Newt.
Bruce Blundell	Jamaica, New York	2			6" Newt.
Charles F. Capen and	Flagstaff, Ariz.,	79	4	103	31" Cass.,
Rigel W. Capen	Lowell Observatory,	1		2	24" refr.,
	USGS Gilbert Observatory				12" refr.
Lawrence Carlino	Buffalo, New York	35			8" Schmidt Cass.
B. G. Casseres	Curaçao, Neth. Antilles	8			8" Newt.
Tom Cave	Long Beach, Calif.	30			12.5" Newt., 24" refr.
Tom Colligan	Pt. Wash., New York	7			8" Newt.
Tom Cragg	Mt. Wilson Observatory, Calif.	1			6" refr.
Raleigh Crausby	Salt Lake City, Utah	24			3" refr.
Kenneth J. Delano	Taunton, Mass.	46			12.5" refl.
Brad Dischner	Riverside, Calif., Idyllwild Observatory	17			12.5" Newt.
Jean Dragesco	Yaounde, Cameroun, Eq. Africa	63	9		10" refl.
Mark Dvorak and	S. Lake Tahoe, Calif.				
Zdenek Dvorak		23			6" Newt.
Shirō Ebisawa	Tokyo, Japan, Kwasan Observatory, Pic du Midi	32			40" refl., 24" refl., 24" refl., 18" refl.
Michael Fornarucci	Garfield, N. J.	46			6" refl.
Tom Fox	Chester, Va.	3			4" refr.
Paul Getz	Riverside, Calif.	3			8" Newt.
Steven Gilsdorf	Albuquerque, N. M.	14			6" Newt.
Joel W. Goodman	Mill Valley, Calif., Lick Observatory	7			12" refr.
Rodger W. Gordon	Nazareth, Penna.	30			3.5" catadioptric refl., 7" cat. refl.
Walter H. Haas	Las Cruces, N. M.	13			12.5" refl.
Curtis Haase	Moulton, Texas	43			6" Newt.
Anatole Haidai	Brooklyn, N. Y.	1			6" refl.
Robert C. Hartman	West Palm Beach, Fla.	5			16" Newt., 8" Newt.
Wm. K. Hartmann	Tucson, Ariz.	7			8" refl.
Alan Heath	Nottingham, England	18			12" refl.
Otis Henderson	Madison, Alabama	13			8" refl.
James M. Henry	North Little Rock, Arkansas	7			12.5" Newt.
J. A. Herchak	Charleston, South Carolina			2	8" Newt.
Alika Herring	Catalina Observatory, Arizona	21			61" refl., 12.5" refl.
Kevin Hester	Albuquerque, N. M.	1			6" Newt.
John T. Hopf	Newport, R. I.		2		6" Newt.
Reiichi Horiguchi	Tokyo, Japan	24	10	1	10" Newt.
Jeff Hurst	Riverside, Calif.	2			12.5" Newt.
J. H. Hernández Illescas	Mexico, Laplace Observatory	8			10" Newt.
Jay Inge	Flagstaff, Ariz., Lowell Observatory	4			24" refr., 12" refr.

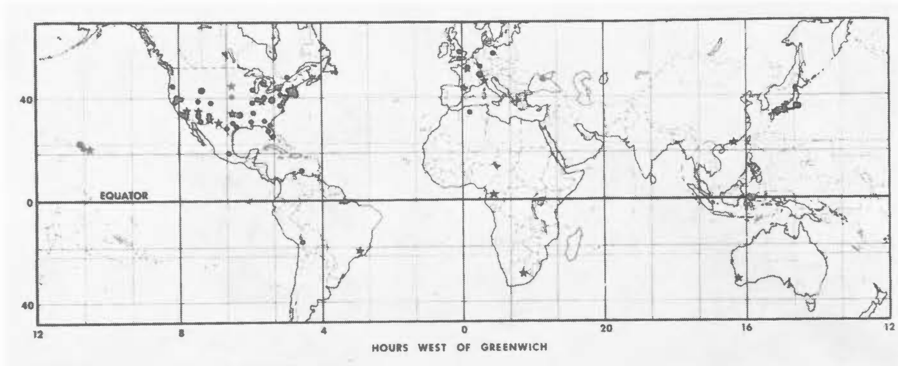

Figure 3. A world map showing the terrestrial position of each observing locale and the longitudes covered. Poor coverage lies between 18 and 22 hours west. Dots indicate visual locales, and stars photographic ones. By C. F. Capen.

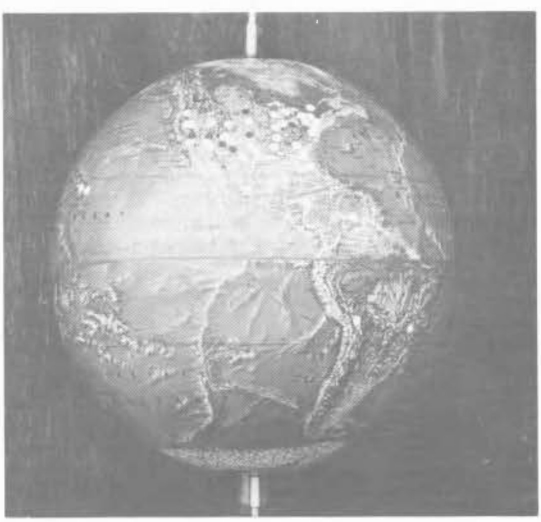

Figure 4. A large globe of the Earth used in the office of the ALPO Mars Section to display and evaluate the current locations of Mars observers. Shown is the hemisphere of the Americas. Light dots represent visual locales, and dark dots are photographic-visual observatories. By C. F. Capen.

Table I (cont.)

NAME	LOCATION	VISUAL	PHOTOGRAPHY B&W	PHOTOGRAPHY COLOR	TELESCOPE(S)
Tom Jeffrey	Salem, Oregon	6			6" Newt.
R. Jones	Levittown, Penna.	13			4.3" Newt.
Karl Kamper	Middletown, Conn., Van Vleck Observatory		2		20" refr.
Billy Keel	Nashville, Tenn.	3			6" refl.
W. Noel Keyes	Albuquerque, N. M.	28			8" Newt.
Donald Kluba	Cincinnati, Ohio, Cincinnati Observatory	4			4.3" Newt., 8.3" refr.
Kevin L. Krisciunas	Naperville, Ill., University of Illinois Observatory	12			12" refr., 6" refl.
Jeff Laird	Riverside, Calif., Idyllwild Observatory	9			12.5" Newt.
John Lankford	Columbia, Mo., Cilley-Davis Observatory	22			4" refr.
Helen Lines and	Phoenix, Arizona,	10			11" Maksutov,
Richard Lines	Lines Observatory	2		12	16" Newt.
Daniel Louderback	South Bend, Wash.	3			8" refl.

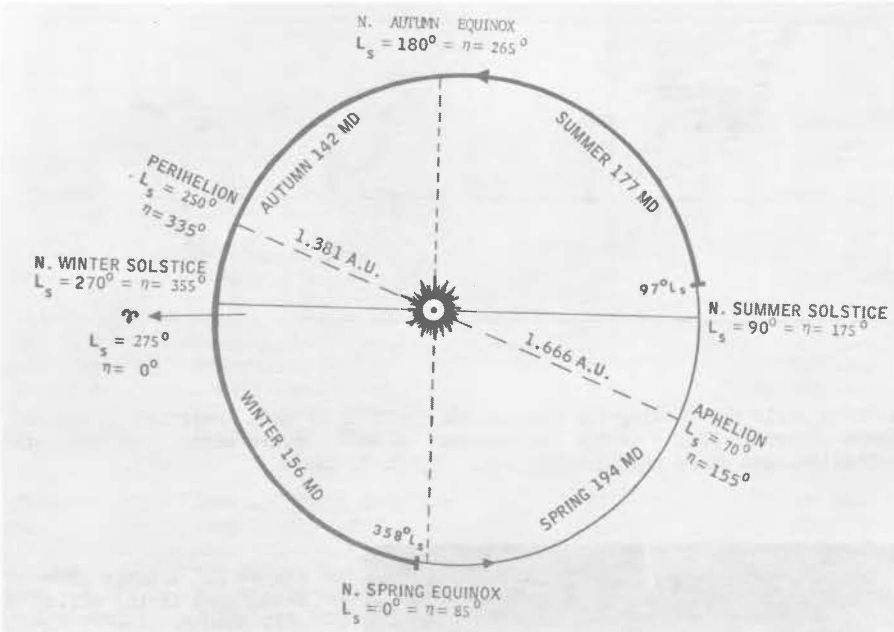

Figure 5. A plan-view of the orbit of Mars that shows the geometry of the Martian seasons in both the planetocentric L_s and heliocentric systems used to define the Martian seasonal date. The heavy line indicates the orbital seasonal coverage of 261°L_s, or 73% of the Martian year, obtained by ALPO Mars observers during 1970-71-72. This figure is corrected for the new 1972 polar axis of rotation. By C. F. Capen.

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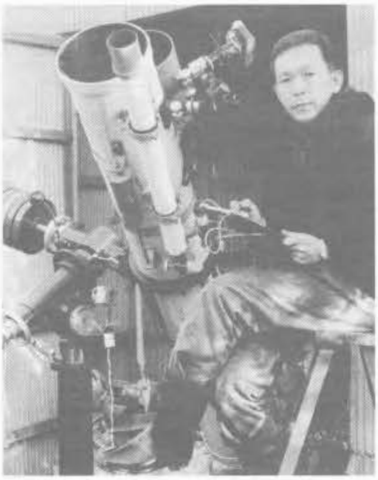
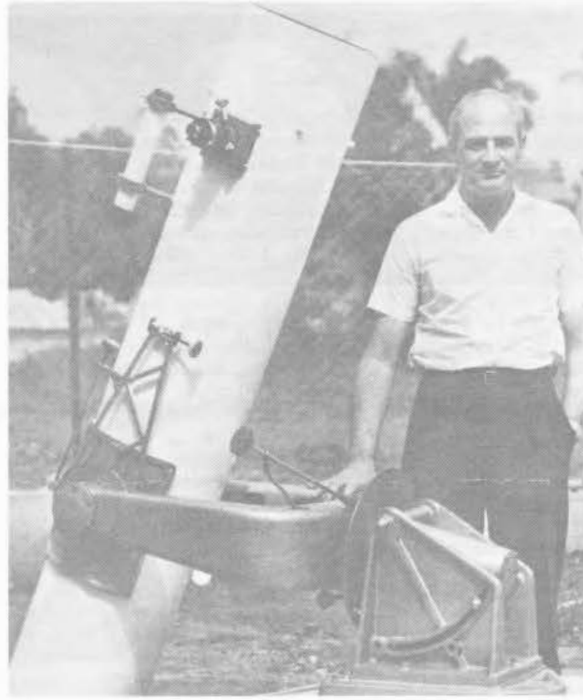
Table I (cont.)

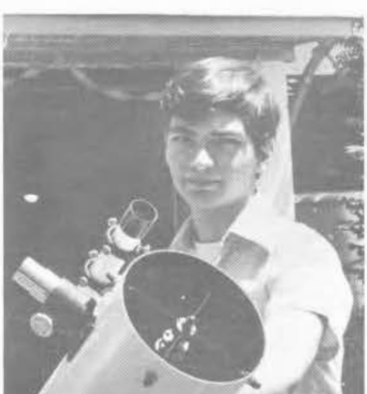
NAME	LOCATION	VISUAL	PHOTOGRAPHY B&W	PHOTOGRAPHY COLOR	TELESCOPE(S)
Walter Lucas	Chicago, Ill.	2			4" refl.
J. Hing-Chai Liu	Kowloon, Hong Kong		12		6" Newt.
George G. Manning	Bronx, N. Y.	2			3.5" catadioptric refl.
Michael Mattei	Harvard, Mass., Harvard Observatory	32			16" refl., 12" refl., 6.5" refr.
Ernst H. Mayer	Baden, Austria	7			10" refl.
Marvin Mayo	Van Nuys, Calif.			2	6" Newt.
Robert McCutcheon	New York, N. Y.	16			6" refl.
Claude M. Michaux	Pasadena, Calif., USGS Gilbert Observatory	10			31" Cass.
Dennis Milon	Cambridge, Mass.	1	51		9" refr.
J. L. Mitchell	Cairo, Georgia	22			6" refl.
King Monroe	S. Lake Tahoe, Calif.	1			12.5" Newt.
Michael J. Morrow	Ewa Beach, Hawaii, Hale Hoku Observatory	4			16" Newt.
Thomas Mulligan	Jamaica, New York	4			6" refl.
Gary Nowak	Cavendish, Va.	16			3" refr.
Toshihiko Osawa	Nara, Japan	93	3		8" Newt.
Mike Otis	Aberdeen, South Dakota	45	42		8" Newt.
E. Ken Owen	Oklahoma City, Okla.		12		10" Newt.
James Paciello	Bayport, L. I., N. Y.	1			8" refr.
Roy Parish	Milton, Fla.	6			8" Newt.
John Pazmino	Brooklyn, N. Y.	15			6" Maksutov



Toshihiko Osawa with his 200 mm Newt.refl. at Nara, Japan in early morning April 1973. T. Osawa is internationally known planet observer and a regular contributor to ALPO Mars Sec. His artistic and technical observing skills are unsurpassed. Note the various accessories on his 8-inch telescope.



Prof. Jean Dragesco, observateur planète très excellent, avec son reflecteur Newton de 260 mm installé à Yaoundé, Cameroun; 12oE long.; 03o52'N lat. President de la Commission des Surfaces Planétaires S.A.F. et U.I.A.A. World renowned observer and longtime contributor of visual drawings and photographs to the ALPO. Author of Mars & Jupiter reports in L'Astronomie and 200 other scientific publications. Note the polar axis is close to horizontal.



Michael Fornarucci with his 150mm Newt. reflector in Garfield, N.J. USA. Michael is a dedicated and astute young observer who makes systematic tricolor filter observations with an artistic skill. He is a graduate of the ALPO Lunar and Planetary Training Program.

ALPO Mars Recorder, Charles F. Capen, observing Mars with the famous Alvan Clark 600mm refr. at Lowell Observatory. Formerly an astronomer directing planetary patrol programs in support of Mariner missions at TMO-JPL, Capen is a pioneer of color astrophotography and author of books and papers on planets, comets, color filters, and observing techniques.

Figure 6. Four prominent ALPO planet observers with their telescopes that were used during the Mars 1971 apparition.

Table I (cont.)

NAME	LOCATION	VISUAL	PHOTOGRAPHY B&W	PHOTOGRAPHY COLOR	TELESCOPE(S)
Ronald E. Powaski	Euclid, Ohio	6			10" Newt.
Gwynn Prideaux and	Richmond, Virginia,	2			12.5" Newt.,
J. P. Prideaux	RAS Observatory	20	5		2.4" refr.
John Prentice	Albuquerque, N. M.	2			8" Newt.
Paul Reddick	Valdosta, Georgia	13			6" Newt.
Robert B. Rhoads	Scottsdale, Arizona, Lowell & Lines Observatories	36			24" refr., 6" & 16" Newts., 11" Maksutov
Charles L. Ricker	Marquette, Mich.	15			4" refr.
Milton Rosenkotter	Pierce, Nebraska	3			10" refl.
Terrence D. Ross	Milwaukee, Wisconsin	11	1		12.5" refl.
James K. Rouse	Naples, Florida	3	1		8" Newt.
Dennis Sandoval	Riverside, Calif.	1			12.5" refl.
Bruce Salmon	Oklahoma City, Okla., Salmon Observatory	106			12.5" refl.
Steven R. Schoner	Flagstaff, Arizona, Lowell Observatory	6		2	20" refr.
Terry Schmidt	Colorado Springs, Colorado	2			8" refl.
Max Schreier	La Paz, Bolivia	40			16" Cass.
Charles E. Scovil	Westport, Conn., Student Observatory	5			22" Maksutov
Steven Sebastian	Dallas, Texas	2			8" refl.
Roberta S. Sklower	Albuquerque, N. M.	6			8" Newt.
Horace A. Smith	Willimantic, Conn., Van Vleck Observatory	75			20" refr., 6" refl., 6" refr.
J. Russell Smith	Waco, Texas	7			8" Newt.
Kenneth Stahl	Albuquerque, N. M.	15			8" refl., 10" refl.
Steven Szczepanski	Harvey, Illinois	6			10" Newt.
Kevin J. Templin	Willingboro, N. J.	33			2.3" refr.
Rick Thomas	Crofton, Maryland	19			6" Newt.
Thomas Tolley	Willingboro, N. J.	2			4" refl.
Nelson Travnik	Minas, Brazil, Flammarion Observatory	24	4	8	6" refr.
Paul D. Turner	Midway City, Calif.	3			8" Newt.
Dave Van Buren	Geneva, N. Y., Stellafane Observatory	6			24" refl., 3" refr., 6" refl.
B. R. Webb	Redondo Beach, Calif.	4			6" Newt.
Herman Verner	Weston, Conn.		4		6" refl.
R. Wessling	Milford, Ohio	3		1	12.5" Newt.
John West	Bryan, Texas	2			6" Newt.
Randall Wilcox	Riverside, Calif.	1			12.5" refl.
J. D. Wiseman	Portland, Oregon	2	41		10" Newt.
Wayne Wooten	De Funiak Springs, Florida, University of Florida	25			8" refr.
Robert A. Yajko	Leechburg, Pennsylvania	30			4" refr.
Howard F. Zeh	Toledo, Ohio		3		8" Newt.

Overview of 1971 Martian Phenomena

A list of the more important phenomena observed on Mars in 1971 by ALPO members is tabulated below. These subjects will be analyzed in more detail in future Mars Reports. A selection of early 1971 apparition observations is reproduced in Fig. 7 for reference with future Mars Reports.

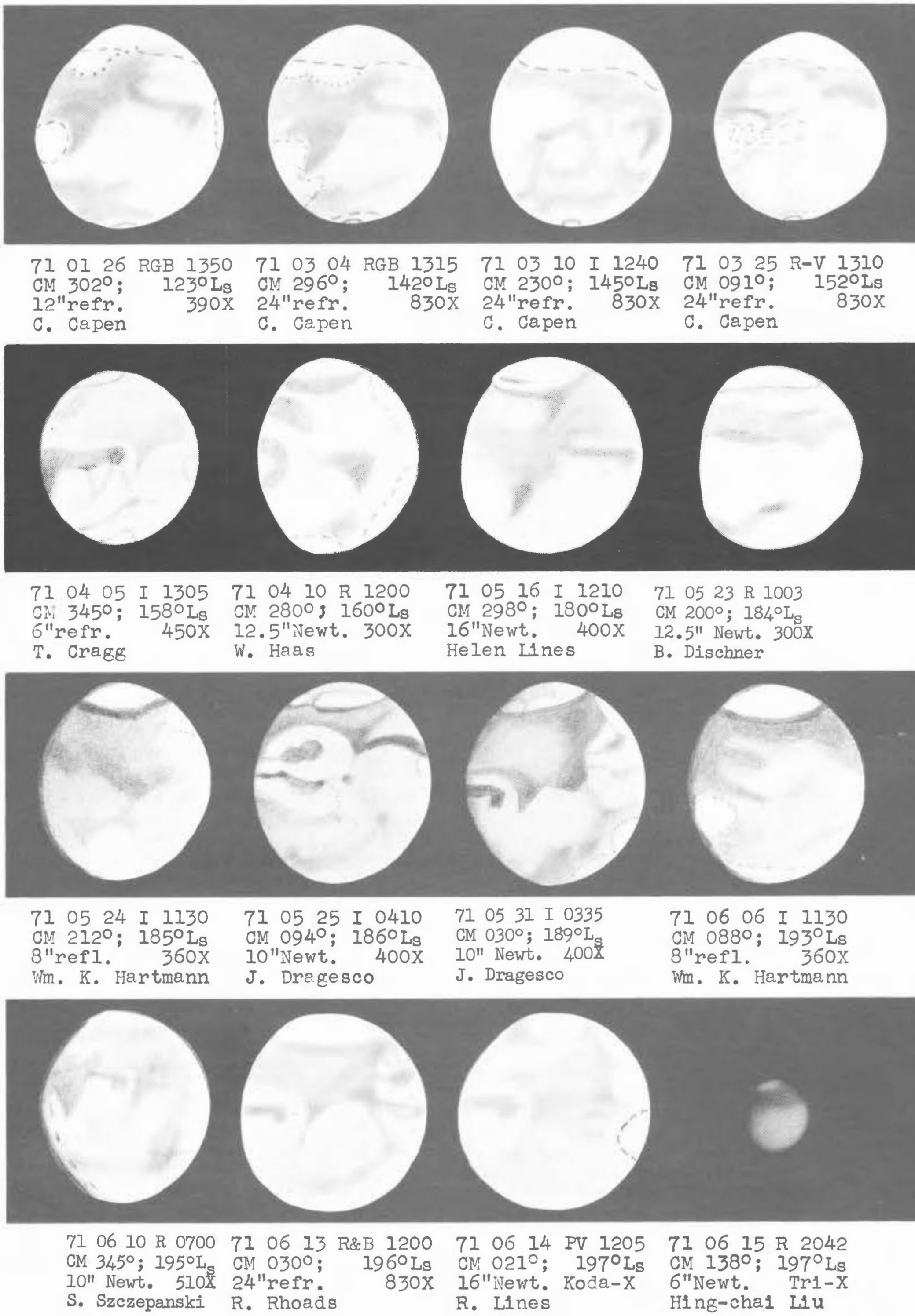


Figure 7. Early 1971 Mars observations show the evening terminator phase, a small NPC (bottom), a large SPH, and later a large SPC. South is up.

1. A large gray-white South Polar Hood dissipated in April, Terrestrial Date.

2. Many bright limb hazes were present during May, June, and July.

3. A maximum diameter 90°-92° bright spring South Polar Cap was seen in early May, 1971.

4. W-clouds and equatorial cloud-bands were active in May and June.

5. Only a few periods of weak blue-clearing were noted.

6. A yellow cloud was discovered in the vicinity of Mare Serpentis-Noachis, which lasted over July 10-22.

7. Exceptional periods of clear Martian atmosphere were noted in August.

8. There were splendid views of the retreating spring South Polar Cap. Bright projections on the SPC edge and dusky rifts within it were present from June to September. Excellent observations were obtained of the Mts.-of-Mitchel.

9. The Great Yellow Storm, with planetwide coverage for about 15 weeks.

References

1. Capen, C. F.; "Observing Mars II - Everything You Want to Know About Mars in 1971 - but do not Have Time to Ask," J. ALPO, Vol. 23, Nos. 1-2, May, 1971.

2. Capen, C. F.; "Observing Mars III - The 1971 ALPO Observing Program," J. ALPO, Vol. 23, Nos. 3-4, Aug., 1971.

3. Several Authors, "A Mars Anthology," Sky & Telescope, Vol. 42, No. 5, Nov., 1971.

4. Eds. Anon.; "A Portfolio of Amateur's Mars Photographs," Sky & Telescope, Vol. 42, No. 5, pp. 310-314, Nov., 1971.

5. Vaucouleurs, G. de; "Telescopic Observations of Mars - 1971," Sky & Telescope, Vol. 42; Part I, Sept., 1971; Part II, Nov., 1971; Vol. 43, Part III, Jan., 1972.

6. Dragesco, J.; "La Planète Mars en 1971," L'Astronomie, Vol. 86, July-Aug., 1972.

7. Salmon, B.; "An Amateur's Map of Mars For 1971," Sky & Telescope, Vol. 44, No. 6, Dec., 1972.

JUPITER IN 1968 - 1969: ROTATION PERIODS

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

The highlights of the 1968-69 apparition were: continued evidence of contraction in length of the three long-enduring white ovals of the $STeZ_n$, evidence of oscillations for the Red Spot, rapid-moving dark spots and a dark streak in the STrZ preceding the Red Spot, observations of the North Temperate Currents "A" and "B", and North North Temperate Current "A".

Some data pertinent to the apparition follow:

Date of Opposition: 1969, March 21.
Dates of Quadrature: 1969, January 4, June 18.
Declination of Jupiter: 1°N (at opposition).
Equatorial Diameter: 44.2 seconds of arc (at opposition).
Zenocentric Declination of Earth: - 2°.5 (at opposition).
Magnitude of Jupiter: -2.0 (at opposition).

This report is based on 3,706 visual central meridian transit observations submitted by 12 observers of the A.L.P.O. When plotted on graph paper, 1,597 transits form usable drifts for 102 Jovian spots distributed in 13 different atmospheric currents. The contributing observers are listed below by name and number of transits submitted, along with station of observation and telescope(s) employed.

Budine, P. W.	Delran, N.J.	4" refr. & 10" refr.*	500 transits
Gordon, R. W.	Pen Argyl, Pa.	3.5" refl.	44 transits

Heath, A. W.	Nottingham, England	12" refl.	21 transits
Hodgson, R. G.	Westford, Vt.	12.5" refl.	403 transits
Krisciunas, Kevin	Naperville, Ill.	6" refl.	36 transits
Mackal, P. K.	Mequon, Wisc.	6" refl	7 transits
Mayer, E. H.	Barberton, Ohio	6" refl.	35 transits
Osawa, Toshihiko	Hyogo-ken, Japan	8" refl.	sectional drawings
Preslar, Tony and Fite, Ronnie	Landis, N.C.	8" refl.	2,579 transits
Smith, H. A.	Willimantic, Conn.	6" refl.	61 transits
Smith, J. R.	Waco, Texas	8" refl.	20 transits

*The Franklin Institute Observatory, Philadelphia.

The distribution of transit observations by months is as follows:

1968, October	1	1969, January	580	1969, May	218
November	24	February	601	June	56
December	515	March	1444	July	41
		April	226		

In the tables which follow, the first column gives an identifying number or letter to each object. The second column indicates whether the object was dark (D) or bright (W) and whether the preceding end (p), center (c), or following end (f) was being observed. The third column gives the first and last dates of observation; the fourth column, the longitudes on those dates. The fifth column gives the longitude at opposition, March 21, 1969. The sixth column gives the number of transits. The seventh column indicates the number of degrees in longitude that the marking drifted in 30 days, negative when the longitude decreased with time. The eighth column shows the rotation period in hours, minutes, and seconds.

S.S. Temperate Current (S. part of STeZ). System II.

No.	Mark	Limiting Dates	Limiting L.	L.	Transits	Drift	Period
1	Dc	Feb. 18-May 6	142°- 73°	123°	15	-27°.0	9:55:04
2	Dp	Mar. 1-Apr. 3	237 -210	221	5	-25.0	9:55:06
3	Wp	Feb. 26-Mar. 17	304 -275	---	8	-29.0	9:55:01
4	Wc	Feb. 26-Mar. 17	308 -279	---	11	-29.0	9:55:01
5	Wf	Feb. 26-Mar. 17	312 -283	---	9	-29.0	9:55:01
				Mean Rotation Period:			9:55:04

Object No. 1 was a "dark-like" feature found first near the center of, and later preceding, the long-enduring oval BC. Referring to Mr. Mackal's descriptive report of the 1968-69 apparition which is found in the J.A.L.P.O., Volume 22, Numbers 5-6, Object 1 is seen on Figure 11 preceding BC, being observed then on April 7 by Mr. Mackal. Marking No. 2 is a dark section of the SSTB observed preceding STeZ oval DE. Object Nos. 3-5 was a curious white oval observed on the south edge of the SSTB following the long-enduring white oval DE. It was observed during April, 1969, by Heath and Mackal. It is recorded on Figure 13 by Mackal and on Figure 16 by Heath in Mr. Mackal's report cited above. It was last observed on April 20. Accurate transits were obtained of the object from Feb. 26 to Mar. 17, 1969.

S. Temperate Current (S. edge STB, STeZ). System II.

No.	Mark	Limiting Dates	Limiting L.	L.	Transits	Drift	Period
F	Wp	Dec. 9-Apr. 9	95°- 19°	30°	36	-19°.0	9:55:15
1	Wc	Dec. 9-Apr. 9	100 - 24	35	36	-19.0	9:55:15
A	Wf	Dec. 9-Apr. 9	106 - 30	41	36	-19.0	9:55:15
2	Wc	Feb. 12-Mar. 28	130 - 98	103	9	-20.0	9:55:13
B	Wp	Dec. 12-Apr. 7	182 -105	118	20	-19.7	9:55:14
3	Wc	Dec. 12-Apr. 7	188 -111	124	20	-19.7	9:55:14
C	Wf	Dec. 12-Apr. 7	195 -118	131	20	-19.7	9:55:14
4	Wc	Apr. 27-May 26	105 - 86	---	6	-19.0	9:55:15
D	Wp	Dec. 18-May 2	289 -200	230	18	-19.8	9:55:14
5	Wc	Dec. 18-May 2	295 -206	236	18	-19.8	9:55:14
E	Wf	Dec. 18-May 2	302 -213	243	18	-19.8	9:55:14
				Mean Rotation Period:			9:55:14

The three long-enduring white ovals of the STeZ remained prominent throughout the 1968-69 apparition. However, the three long-enduring white ovals continued to show evidence of contraction in length! The mean length of each oval was as follows: FA, 11°; BC, 13°; and DE, 13°. Let's now compare the mean lengths of the white ovals with the previous apparitions I have reported on:

	FA	BC	DE
1964-65	18°	17°	17°
1965-66	17	18	17
1966-67	16	16	16
1967-68	13	14	14
1968-69	11	13	13

The oval FA was accelerated during the apparition as it was nearing conjunction with the Red Spot. The center of the Red Spot was in conjunction with the center of FA on April 9, 1969 at 24° (II). During the period April 9-21, 1969, FA remained almost stationary in longitude, being observed always near conjunction with the Red Spot. After April 20th it resumed its decreasing drift in longitude. See Figures 17, 18, and 19 of Mr. Mackal's report. Oval BC was moving towards the Red Spot late in the apparition.

Red Spot Region. System II.

Mark	Limiting Dates	Limiting L.	L.	Transits	Drift	Period
RSp	Dec. 6-Jul. 14	14°- 9°	12°	80	-0°.68	9:55:39.7
RSc	Dec. 6-Jul. 14	25 -21	24	102	-0.54	9:55:39.9
RSf	Dec. 6-Jul. 14	37 -34	37	88	-0.41	9:55:40.1

The Red Spot was very prominent in 1968-69. The mean length of the Red Spot was 23° in longitude compared to 20° for 1967-68. However, during the latter part of the apparition it was even longer, 25° compared to 23° for the latter part of the 1967-68 apparition. Accurate central meridian transit observations continue to indicate oscillations in longitude; the complete period for the oscillations is about 90 days. When studying the drift chart for the center of the Red Spot, one finds the following oscillations:

RSc

1968,	Dec. 6	25°
1969,	Jan. 7	22
	Feb. 4	23
	Mar. 10	21
	Apr. 9	24
	May 5	22
	June 1	23
	July 7	21

South Tropical Zone (STB_n). System II.

No.	Mark	Limiting Dates	Limiting L.	L.	Transits	Drift	Period
1	Dc	Mar. 8-Apr. 24	300°- 95°	243°	7	-134°.0	9:52:38
2	Dc	Apr. 1-July 2	255 -353	---	9	- 84.4	9:53:45
3	Dc	Apr. 3-July 7	268 - 3	---	11	- 80.3	9:53:51
4	Dc	Apr. 3-July 7	280 - 23	---	8	- 78.0	9:53:54
5	Dc	May 28-July 7	137 - 34	---	8	- 74.0	9:54:00
6	Dc	May 28-June 30	168 - 65	---	6	- 86.0	9:53:43
7	Dc	June 26-July 7	70- 35	---	5	- 97.2	9:53:28
				Mean Rotation Period:			9:53:37

During the 1968-69 apparition rapidly moving dark spots were observed in the STrZ, as well as dark streaks following the Red Spot. Most of the spots were observed from early April until mid-July, 1969. The dark spots were found along the north edge of the STB. It all began with a dark streak following the Red Spot which was observed to be connected to the following end of the Red Spot. The "Dark Streak" was observed as early as April 7 by A.L.P.O. members Mayer, Heath, and Budine. It is possible that an earlier stage of development was observed by Mr. Sato of Japan when he observed a faint belt-like feature following the Red Spot and attached to it on March 13, 1969. The dark streak can

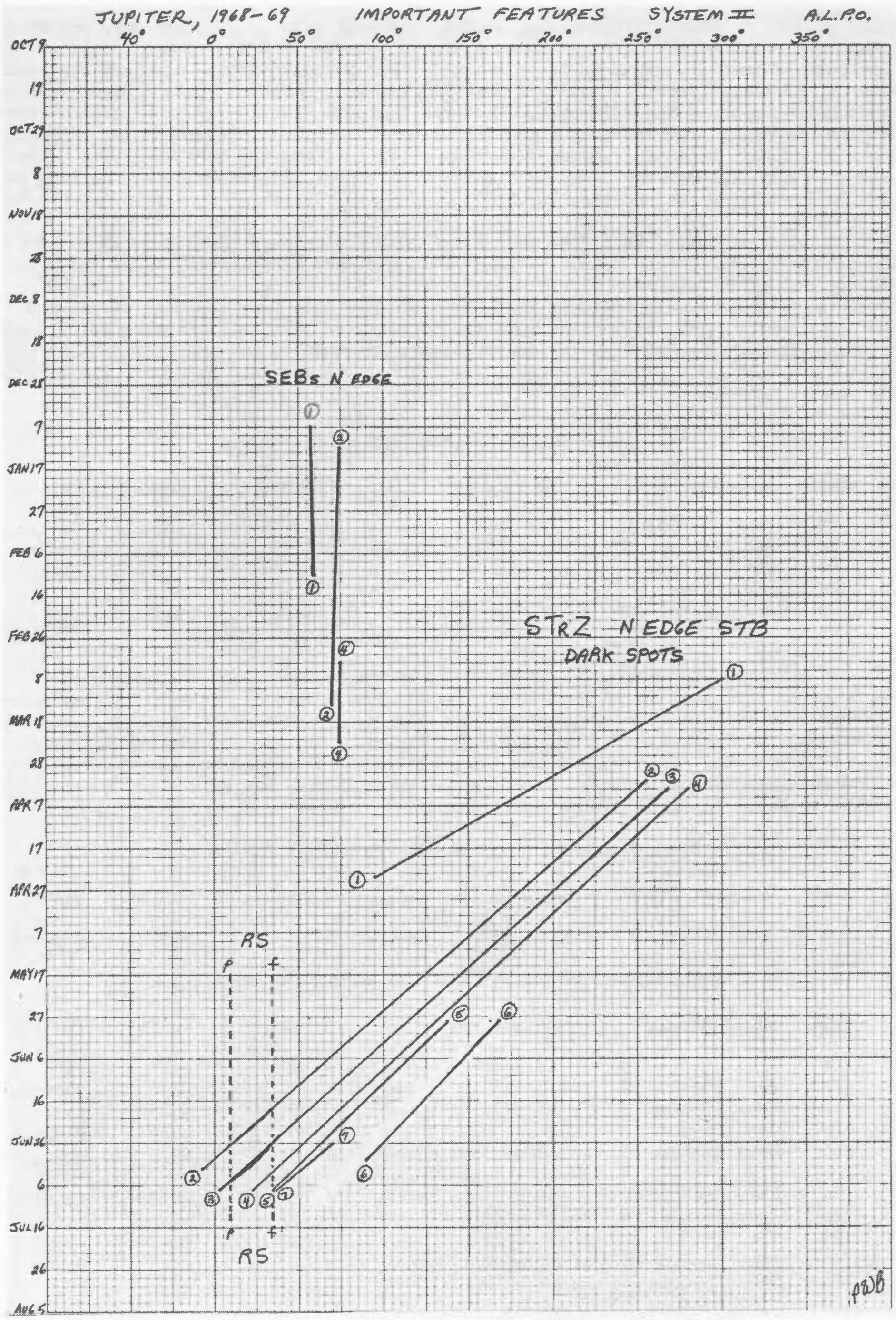


Figure 8. Drift-lines of some important features on Jupiter during its 1968-69 apparition as observed by members of the ALPO Jupiter Section. Graphs prepared and contributed by Phillip W. Budine. See also text of his report on Jovian rotation-periods in 1968-69.

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be seen on Figures 9, 12, 17, and 18 of Mr. Mackal's report. Beck had a good view of the dark streak on April 21: see Figure 18 in that report. The streak from the Red Spot was moving in the direction of decreasing longitude at the rate of -1°.4 per day; and as the streak reached about 50° (II), it moved south across the STrZ and formed a belt on the north edge of the STB. This is the first time this phenomenon has ever been observed to occur on the planet Jupiter! Also at 50° (II) following the RS, small dark spots were observed moving along the STB_n belt. Sketches indicate that the spots originated from the dark streak and moved from the mid-STrZ latitudes to the latitude of the STB_n and then moved with a rapid decreasing longitude velocity along the STB_n at a rate of between -3°.2 and -4°.4 per day! One spot moved with a period of 9:52:38 (see marking No. 1). The average for the current was 9:53:37.

As a matter of fact, the periods of this current are similar to those of the Circulating Current (South Branch). However, there were no observations of the STrZ Disturbance during the apparition, and there were no SEB_s retrograting spots observed. Therefore, evidence would indicate that the spots did come from the dark streak and its peculiar movements and interaction into the latitude of the STB_n. Marking No. 3 crossed the south edge of the Red Spot on June 27, 1969. Spot No. 4 was near conjunction with the Red Spot on July 7, 1969. As spots No. 2 & No. 3 passed the Red Spot, their velocity was increased.

SEB_s (N. Edge). System II.

No.	Mark	Limiting Dates	Limiting L.	L.	Transits	Drift	Period
1	Dc	Jan. 7-Feb. 11	57°- 60°	----	7	+2°.5	9:55:44
2	Dc	Jan. 12-Mar. 14	75 - 70	----	11	-2.5	9:55:37
3	Dc	Mar. 23-Apr. 9	349 -346	----	5	-1.6	9:55:38
4	Dc	Mar. 4-Mar. 23	75 - 75	75°	7	0.0	9:55:41
5	Dc	Mar. 1-May 27	357 -357	357	11	0.0	9:55:41
				Mean Rotation Period:			9:55:40

The two most interesting features of the current were objects No. 2 and No. 4. Both markings were dark spots recorded by Farrell and Budine on March 4. Farrell shows a festoon from both features connecting them with the south edge of the SEB_n. See Figure 3 of Mr. Mackal's report in Journal A.L.P.O., Vol. 22, Nos. 5-6. On March 11 Budine recorded both objects, but a festoon was observed only with object No. 4. The features resembled somewhat the beginning stages of a SEB Disturbance. Objects 2 and 4 were last observed on March 14 and 23, 1969, respectively.

South Equatorial Current (N. edge SEB_n). System I.

No.	Mark	Limiting Dates	Limiting L.	L.	Transits	Drift	Period
1	Dc	Apr. 13-May 2	40°- 51°	---	5	+15°.7	9:50:51

South Equatorial Current "A" (S. part EZ). System I.

No.	Mark	Limiting Dates	Limiting L.	L.	Transits	Drift	Period
1	Dc	Dec. 21-Jan. 6	89°- 88°	----	6	-1°.7	9:50:28
2	Dc	Jan. 26-Mar. 3	133 -127	----	6	-4.6	9:50:24
3	Dc	Dec. 8-Jan. 25	225 -223	---	7	-1.3	9:50:28
4	Dp	Jan. 16-Mar. 8	227 -215	---	7	-6.7	9:50:21
5	Wc	Dec. 18-Jan. 10	353 -355	---	5	+2.5	9:50:33
6	Dc	Feb. 4-Mar. 12	8 - 0	----	6	-6.2	9:50:22
7	Wc	Jan. 26-Mar. 8	57 - 60	----	7	+2.7	9:50:34
8	Dc	Feb. 12-Mar. 17	112 -117	----	8	+4.2	9:50:36
9	Wc	Feb. 4-Mar. 6	166 -160	----	6	-5.5	9:50:23
10	Wp	Dec. 17-Jan. 26	202 -210	----	6	+5.7	9:50:38
11	Wc	Dec. 25-Jan. 26	253 -253	----	6	0.0	9:50:30
12	Dc	Mar. 4-Mar. 23	270 -276	275°	7	+8.6	9:50:42
13	Wc	Jan. 26-Mar. 13	305 -312	----	6	+4.7	9:50:36
14	Wc	Dec. 7-Dec. 30	323 -323	----	9	0.0	9:50:30
15	Wc	Jan. 20-Mar. 13	342 -338	----	7	-1.9	9:50:27
				Mean Rotation Period:			9:50:30

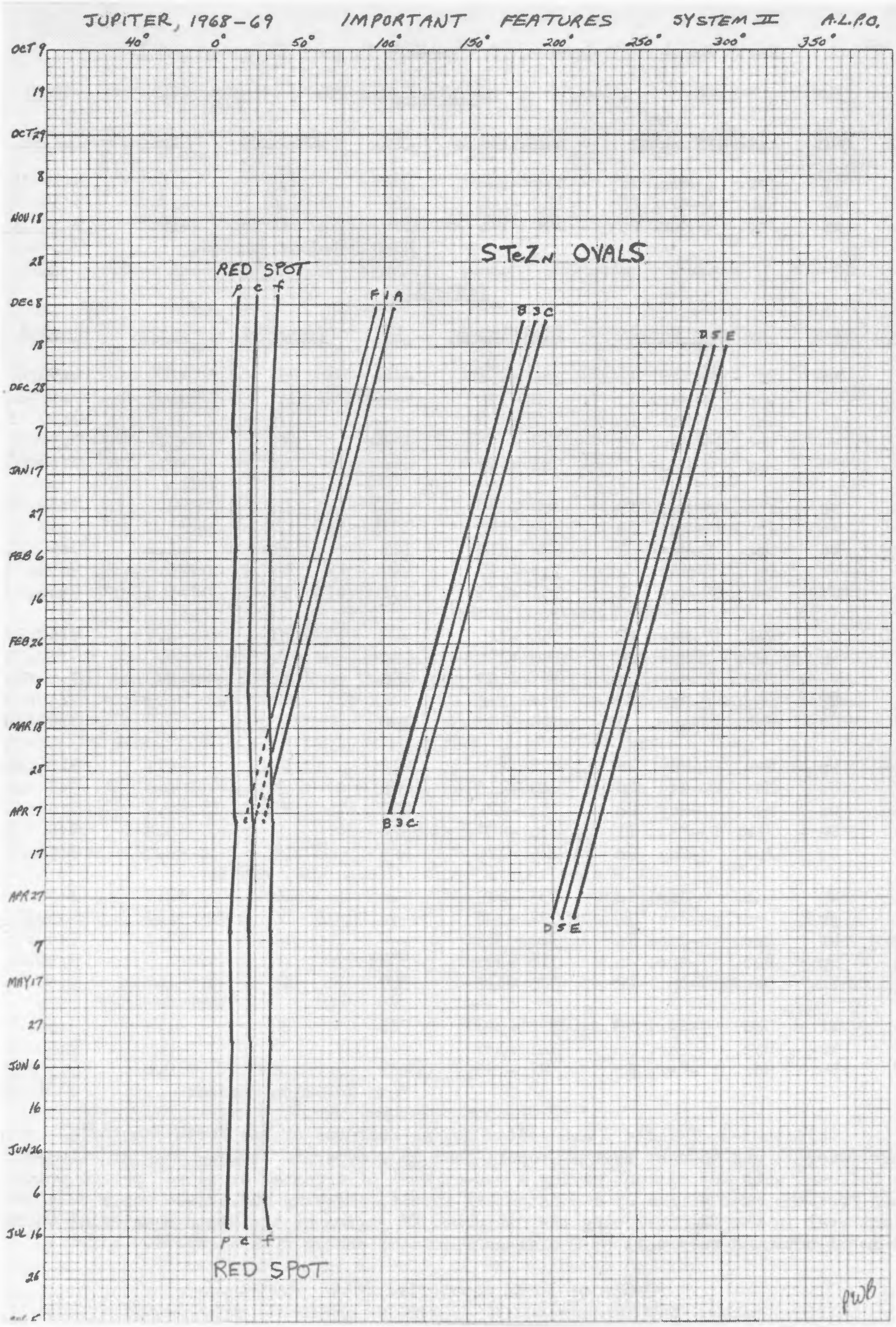

Figure 9. Drift-lines of the Great Red Spot and the three long-enduring South Temperate Zone ovals as observed by members of the ALPO Jupiter Section during the 1968-69 apparition of the Giant Planet. Graphs prepared and contributed by Phillip W. Budine.

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North Equatorial Current (S.edge NEB, N. part EZ). System I.

Table I

No.	Mark	Limiting Dates	Limiting L.	L.	Transits	Drift	Period
1	Wp	Feb. 4-Mar. 28	175°-162°	162°	21	- 8.7	9:50:18
2	Wc	Feb. 4-Mar. 28	183 -168	168	20	-10.0	9:50:17
3	Wf	Feb. 4-Mar. 28	190 -174	176	20	-10.7	9:50:16
				Mean Rotation Period:			9:50:17

Table II

No.	Mark	Limiting Dates	Limiting L.	L.	Transits	Drift	Period
1	Wp	Dec. 9-Mar. 13	355°-351°	----	11	-1.°3	9:50:28
2	Wc	Dec. 9-Mar. 13	0 -356	----	17	-1.3	9:50:28
3	Wf	Dec. 9-Mar. 14	7 - 3	----	16	-1.3	9:50:28
4	Wc	Dec. 16-Mar. 12	22 - 14	----	20	-2.7	9:50:26
5	Dc	May 2-June 7	53 - 49	----	8	-3.3	9:50:26
6	Wc	Feb. 5-Mar. 19	60 - 60	----	22	0.0	9:50:30
7	Wc	Jan. 26-Mar. 23	100 -106	105°	18	+3.2	9:50:34
8	Wp	Dec. 8-May 1	132 -112	122	33	-4.2	9:50:24
9	Wc	Dec. 8-May 1	143 -119	127	29	-5.0	9:50:23
10	Wf	Dec. 8-May 1	151 -125	132	30	-5.4	9:50:23
11	Dc	Feb. 17-Mar. 12	150 -146	---	20	-4.9	9:50:23
12	Wp	Dec. 6-Mar. 29	180 -180	180	31	0.0	9:50:30
13	Wc	Dec. 6-Mar. 29	187 -188	188	35	+0.3	9:50:30
14	Wf	Dec. 6-Mar. 29	195 -194	194	32	-0.3	9:50:30
15	Dc	Feb. 18-Apr. 3	190 -190	190	21	0.0	9:50:30
16	Wp	Nov. 27-May 28	232 -205	212	37	-4.4	9:50:24
17	Wc	Nov. 27-May 28	240 -214	220	43	-4.3	9:50:24
18	Wf	Nov. 27-May 28	254 -221	227	39	-5.4	9:50:23
19	Dc	Feb. 13-Mar. 11	236 -239	---	9	+3.3	9:50:34
20	Dc	Apr. 3-May 28	225 -226	---	15	+0.5	9:50:31
21	Wp	Dec. 6-Jan. 14	295 -299	---	16	+2.9	9:50:34
22	Wc	Dec. 6-Jan. 14	302 -305	---	14	+2.1	9:50:33
23	Wf	Dec. 6-Jan. 14	310 -313	---	12	+2.1	9:50:33
24	Wp	Dec. 9-Apr. 28	316 -307	308°	26	-1.9	9:50:27
25	Wc	Dec. 9-Apr. 28	325 -317	319	28	-1.7	9:50:28
26	Wf	Dec. 9-Apr. 28	332 -323	325	26	-1.9	9:50:27
27	Wc	Dec. 6-Mar. 3	341 -339	---	27	-0.7	9:50:29
28	Wc	Mar. 17-Mar. 25	81 - 85	81	8	+10.0	9:50:44
				Mean Rotation Period:			9:50:29

Objects 1-3 of Table I are faster moving features of the North Equatorial Current. Therefore, it was thought best to report them in a separate table. This practice will be followed with any current having a sub-current of a faster or slower period which differs from the mean period by a substantial amount. Marking Nos. 24-26 was a very brilliant oval in the EZ_n following the disturbed EB region of the North Equatorial Current. It is illustrated very well by Mackal as Figures 8 and 13 of his report.

Middle of North Equatorial Belt. System II.

Table I

No.	Mark	Limiting Dates	Limiting L.	L.	Transits	Drift	Period
1	Wc	Dec. 7-Jan. 16	169°-120°	---	8	-35.°0	9:54:53
2	Wc	Mar. 17-May 28	169 -105	162°	7	-26.6	9:55:05
3	Wp	Jan. 26-Mar. 8	314 -270	---	5	-31.4	9:54:58
4	Wc	Jan. 26-Mar. 8	320 -273	---	6	-33.4	9:54:55
				Mean Rotation Period:			9:54:57

Table II

No.	Mark	Limiting Dates	Limiting L.	L.	Transits	Drift	Period
1	Wp	Feb. 11-Mar. 11	6°-353°	---	5	-13°.0	9:55:23
2	Wf	Feb. 11-Mar. 11	19 - 6	---	6	-13.0	9:55:23
				Mean Rotation Period:			9:55:23

North Tropical Current (N. edge NEB, NTrZ). System II.

No.	Mark	Limiting Dates	Limiting L.	L.	Transits	Drift	Period
1	Dc	Dec. 30-Mar. 23	51°-350°	352°	7	-21°.8	9:55:11
2	Dc	Dec. 16-Feb. 7	80 - 57	---	6	-12.8	9:55:23
3	Wc	Dec. 16-Mar. 23	106 - 32	34	7	-22.4	9:55:10
4	Wf	Dec. 16-Mar. 23	110 - 38	40	8	-21.8	9:55:11
5	Dp	Jan. 10-Mar. 2	152 -125	---	8	-15.0	9:55:20
6	Dc	Feb. 21-Apr. 7	193 -160	173	6	-20.6	9:55:12
7	Wc	Mar. 17-May 28	225 -173	223	11	-20.8	9:55:12
8	Dc	Apr. 7-May 2	173 -155	---	4	-22.2	9:55:10
9	Wc	Feb. 17-Mar. 5	341 -327	---	6	-23.3	9:55:09
10	Wc	Feb. 17-Mar. 11	347 -339	---	5	-16.2	9:55:18
11	Wc	Mar. 1-Mar. 23	23 - 6	8	5	-21.2	9:55:12
12	Wc	May 2-May 28	171 -151	---	5	-22.2	9:55:10
				Mean Rotation Period:			9:55:13

All of the above markings in the table were moving in the North Tropical Current "A". Nos. 10 and 11 were located on the border of the NTrZ Band, which lay slightly south of the center of the NTrZ. The Band is illustrated on Figures 3 and 13 of Mr. Mackal's report. Figure 3 by Joanne Farrell shows Marking No. 11 approaching the central meridian. It is seen as a very small bright spot in the NTrZ Band.

North Temperate Current (NTB, NTeZ). System II.

Table I

North Temperate Current "A" (N. edge NTB)

No.	Mark	Limiting Dates	Limiting L.	L.	Transits	Drift	Periods
1	Dc	Mar. 4-Mar. 11	16°-355°	---	4	-70°.0	9:54:05
2	Dp	Feb. 20-Mar. 3	88 - 53	---	4	-87.4	9:53:41
3	Df	Feb. 20-Mar. 4	105 - 63	---	5	-84.0	9:53:46
				Mean Rotation Period:			9:53:50

Table II

North Temperate Current "B"

No.	Mark	Limiting Dates	Limiting L.	L.	Transits	Drift	Period
1	Dc	Mar. 2-Mar. 11	97°- 47°	---	4	-125°.0	9:52:50

In Table 1 Marking No. 1 was recorded as a narrow dark streak in the NTB just past the central meridian on Figure 3, by Farrell, in Mr. Mackal's report.

North North Temperate Current (NNTB, NNTeZ). System II.

No.	Mark	Limiting Dates	Limiting L.	L.	Transits	Drift	Period
1	Dc	May 2-May 28	177°-172°	---	5	-5°.4	9:55:33
2	Dc	Feb. 17-Mar. 23	347 -347	347°	7	0.0	9:55:41
				Mean Rotation Period:			9:55:37

The markings in the above table were moving in the North North Temperate Current "A".

JUPITER IN 1969-70: ROTATION PERIODS

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

The highlights of the 1969-70 apparition were: observations of a "Classical South Tropical Zone Disturbance", the prominence of the Red Spot Region, and evidence of final stability in the contraction of the long-enduring $STeZ_n$ white ovals.

Some data pertinent to the apparition follow:

Date of Opposition: 1970, April 21.
Dates of Quadrature: 1970, January 25 and July 21.
Declination of Jupiter: 10°S (at opposition).
Equatorial Diameter: 44.4 seconds of arc (at opposition).
Zenocentric Declination of Earth: -3.°2 (at opposition).
Magnitude of Jupiter: -2.0 (at opposition).

This report is based on 562 visual central meridian transit observations submitted by 14 observers of the A.L.P.O. When plotted on graph paper, 525 transits form usable drifts for 26 Jovian spots distributed in 4 different atmospheric currents.

As noted above, we received only 562 transits for the apparition - not nearly enough to assure adequate coverage of the various atmospheric currents. As a matter of fact, it represents the lowest contribution to the Jupiter Section, except for the 1956-57 apparition when we received 560 transits. However, all was not lost; we had enough data to obtain reliable rotation periods for the South Temperate Current, the Red Spot Region, the Disturbance in the South Tropical Zone, and the North Equatorial Current. The contributing observers are listed below by name and number of transits submitted, along with the station of observation and telescope(s) employed.

Budine, Phillip W.	Willingboro, N.J.	3.5-in. & 6-in. refls. 4-in. & 10-in. refrs.*	160t
Doel, Ron	Willingboro, N.J.	8-in. refl.	112t
Gordon, Rodger W.	Nazareth, Pa.	3.5-in. refl.	43t
Hicks, Bob	Los Angeles, Calif.	6-in. refl., 12.0-in. & 26-in. refrs.**	50t
Kluba, Don	Willingboro, N.J.	4.25-in. refl.	9t
Krisciunas, Kevin L.	Naperville, Ill.	6-in. refl.	28t
Mackal, Paul K.	Mequon, Wisc.	6-in. refl.	2t
Mayer, Ernst H.	Barberton, Ohio	6-in. refl.	18t
McIntosh, Patrick L.	Boulder, Colo.	6-in. refl.	11t
Olivarez, José	Mission, Tex.	12.5-in. refl.	1t
Pearson, Ken	Wheaton, Ill.	6-in. refl.	47t
Smith, Horace A.	Willimantic, Conn.	6-in. refl.	47t
Smith, J. Russell	Waco, Tex.	8-in. refl.	29t
Wood, Gary L.	Galesburg, Ill.	6-in. refl.	5t

*The Franklin Institute Observatory, Philadelphia.
**U.S. Naval Observatory, Washington, D.C.

The distribution of transit observations by months is as follows:

1969,	November 15	1970,	March 3	1970,	July 52
	December 45		April 45		August 40
1970,	January 3		May 108		Sept. 9
	February 25		June 217		

In the tables which follow the first column gives an identifying number or letter to each object. The second column indicates whether the object was dark (D) or bright (W) and whether the preceding end (p), center (c), or following end (f) was being observed. The third column gives the first and last dates of observation; the fourth column, the longitudes on those dates. The fifth column gives the longitude at opposition, April 21, 1970. The sixth column gives the number of transits. The seventh column indicates the number of degrees in longitude that the marking drifted in 30 days, negative when the longitude decreased with time. The eighth column shows the rotation period in hours, minutes, and seconds.

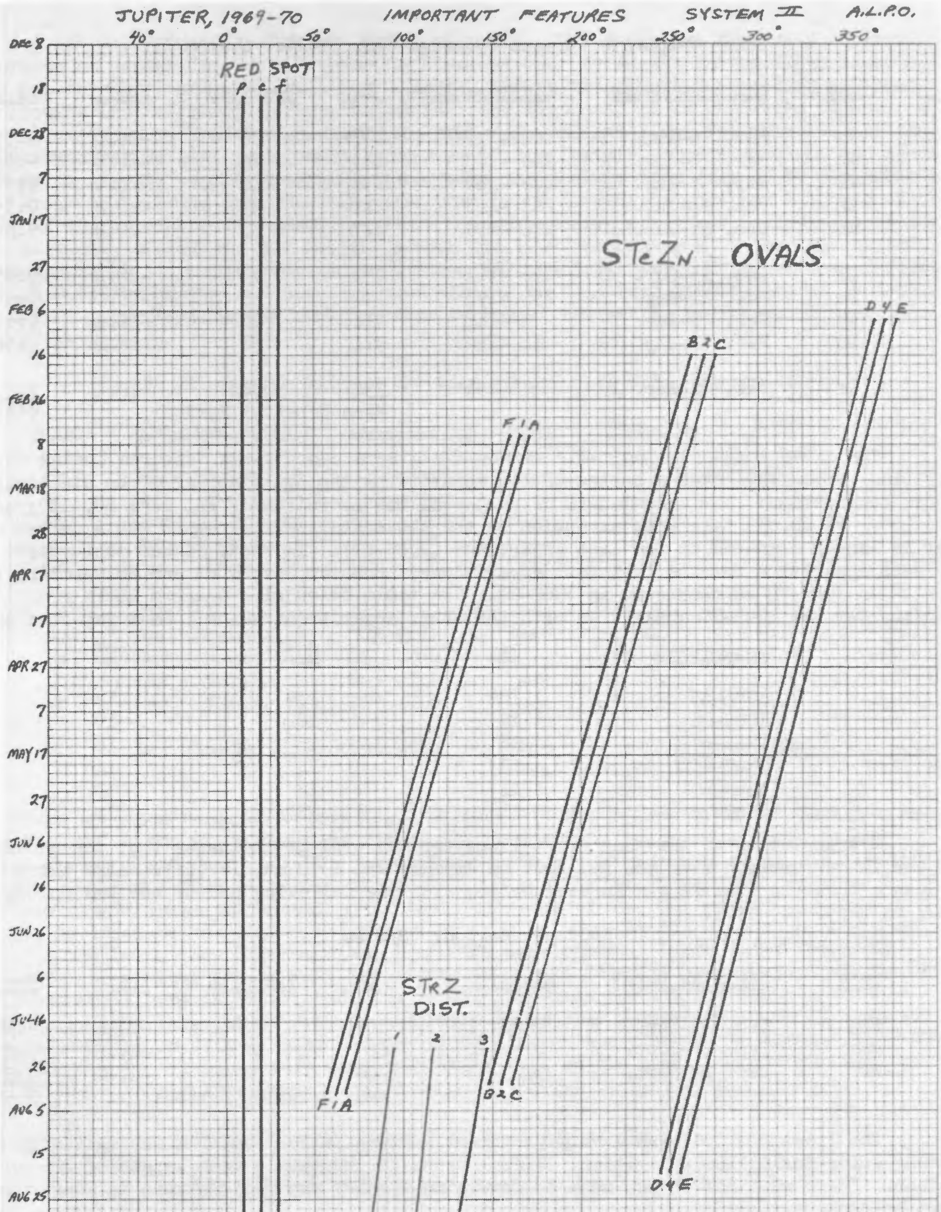

Figure 10. Drift-lines of some important features on Jupiter during its 1969-70 apparition as observed by members of the ALPO Jupiter Section. Graphs prepared and contributed by Phillip W. Budine. See also text of his report on the 1969-70 apparition.

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South Temperate Current (S. edge STB, STeZ). System II.

No.	Mark	Limiting Dates	Limiting L.	L.	Transits	Drift	Period
F	Wp	Mar. 6-Aug. 1	160°- 57°	127°	26	-20°.6	9:55:12
1	Wc	Mar. 6-Aug. 1	166 - 63	133	26	-20.6	9:55:12
A	Wf	Mar. 6-Aug. 1	171 - 68	138	26	-20.6	9:55:12
B	Wp	Feb. 16-Jul. 30	263 -148	220	33	-20.2	9:55:13
2	Wc	Feb. 16-Jul. 30	270 -155	227	33	-20.2	9:55:13
C	Wf	Feb. 16-Jul. 30	276 -161	233	33	-20.2	9:55:13
3	Dc	May 21-Aug. 7	255 -193	---	8	-23.0	9:55:09
D	Wp	Feb. 8-Aug. 19	5 -244	318	32	-18.4	9:55:15
4	Wc	Feb. 8-Aug. 19	11 -250	324	32	-18.4	9:55:15
E	Wf	Feb. 8-Aug. 19	17 -256	330	32	-18.4	9:55:15
				Mean Rotation Period:			9:55:13

The three long-enduring ovals of the $STeZ_n$ were conspicuous features during the apparition. Finally, after a period of six apparitions the ovals appear to be stablizing in their contraction! The mean length of each oval was as follows: FA, 11°; BC, 13°; and DE, 12°. We should take some exception to the above statement since DE was a degree shorter in length compared to the last apparition (1968-69). In fact, it has contracted 1° in each apparition for the last four apparitions. However, ovals FA and BC were the same length in 1969-70 as they were in 1968-69. The table below will compare their mean lengths for the 1969-70 apparition with the other apparitions which I have reported on:

Apparition	FA	BC	DE
1964-65	18°	17°	17°
1965-66	17	18	17
1966-67	16	16	16
1967-68	13	14	14
1968-69	11	13	13
1969-70	11	13	12

Extrapolation of the mean drift lines for the oval DE indicates that the center of DE was in conjunction with the Red Spot on January 25, 1970 at 21° (II). Also there is evidence that the oval FA was in conjunction with the following end of the Red Spot at 30° (II) on Sept. 16, 1970.

Red Spot Region. System II.

Mark	Limiting Dates	Limiting L.	L.	Transits	Drift	Period
RSp	Dec. 20-Sept. 2	11° - 10°	10°	32	-0°.12	9:55:40
RSc	Dec. 20-Sept. 2	21 - 20	20	32	-0.12	9:55:40
RSf	Dec. 20-Sept. 2	31 - 30	30	32	-0.12	9:55:40
			Mean Rotation Period:			9:55:40

The Great Red Spot was a very prominent feature in 1969-70. It was dark with a strong color during the apparition. Visual transits indicate a mean length of 20° in longitude. There were not enough data to determine whether any oscillations in longitude were present.

South Tropical Zone Disturbance. System II.

No.	Mark	Limiting Dates	Limiting L.	L.	Transits	Drift	Period
1	Dp	Jul. 22-Sept. 5	95° - 81°	---	8	- 9°.3	9:55:28
2	Df	Jul. 22-Sept. 5	117 -106	---	8	- 7.3	9:55:31
3	Df	Jul. 22-Sept. 5	147 -128	---	6	-12.6	9:55:23
				Mean Rotation Period:			9:55:27

A Disturbance in the STrZ was last previously observed during the early part of the 1967-68 apparition. During 1969-70 prior to July 19, the STrZ was brighter than it had been for several apparitions. Elmer J. Reese observed the beginning of activity for this region of the planet when, on June 25, he recorded a small dark projection on the north edge of the STB at 143° (II). On July 19 Reese observed the preceding end of a "Classical Disturbance" at 98° (II). The above data are from Mr. Mackal's report on the 1970 apparition, J.A.L.P.O., Volume 23, Numbers 11-12, page 204. Mr. Reese was examining Jupiter photographs at New Mexico State University Observatory. By August 14 the Disturbance had become a prominent feature of the Giant Planet. Budine observed the preceding end near the following limb of the planet on August 26. See Figure 43 of Mr. Mackal's report. Sectional drawings by Budine illustrate the preceding end and first following end of the STrZ Disturbance, as well as interior structure of the feature. See Figures 44 and 45 of Mr. Mackal's report. A.L.P.O. observers recorded the feature from July 22 to September 5, 1970. Transits indicate that the main dark portion of the Disturbance had a length of 52° on July 22 and of 46° on September 5, 1970. However, there were other following ends and darker sections; therefore, the overall length was 100°, according to Reese, who stated that on August 29 it covered the region between 80° and 180° (II). Evidence does indicate that this Disturbance was a "classical one" similar to the Great Disturbance of 1901-39. Our A.L.P.O. transits indicate that the mean period of the entire region was 9 hrs., 55 mins., 27 secs.

North Equatorial Current (S. edge NEB, N part EZ). System I.

No.	Mark	Limiting Dates	Limiting L.	L.	Transits	Drift	Period
1	Wc	May 30-Jun. 25	45°- 44°	---	7	-1°.1	9:50:29
2	Wc	May 9-Jun. 25	73 - 75	---	10	+1.3	9:50:32
3	Dp	Apr. 26-Jun. 26	83 - 86	---	8	+1.5	9:50:32
4	Dc	Apr. 28-Aug. 13	91 - 88	---	17	-1.2	9:50:28
5	Wc	Jan. 6-Jun. 25	117 -115	117	21	-0.4	9:50:29
6	Wc	May 17-Aug. 18	162 -170	---	9	+2.7	9:50:34
7	Dc	Apr. 29-Aug. 18	182 -181	---	12	-0.3	9:50:30
8	Wp	May 5-Jun. 24	201 -206	---	6	+2.9	9:50:34
9	Wc	May 5-Jul. 3	205 -214	---	9	+4.5	9:50:36
10	Wf	May 5-Jul. 3	209 -218	---	9	+4.5	9:50:36
11	Wc	Dec. 13-May 19	263 -260	260	18	-0.6	9:50:29
				Mean Rotation Period:			9:50:32

Osawa of Japan recorded Object No. 2 on June 7: see Figure 36 of Mr. Mackal's report. Figures 32 and 47 of the same report illustrate Nos. 3-4 as seen by Hicks and Dragesco on May 3 and June 1, 1970, respectively. No. 1 was a bright white oval in the EZ_n. Nos. 3-4 are a dark elongated section of the south edge of the NEB. Feature No. 5 was a very bright large white oval along the south edge of the NEB seen by Dragesco on April 19; by April 21 the region had made a protrusion into the NEB forming a "gap like" feature in the belt. See Figures 9 and 10 of the same report. Osawa later recorded it as a large oval feature on June 28; see Figure 40 of the descriptive report. Marking Nos. 8-10 is seen on Figure 19 in Mr. Mackal's report just past the central meridian. This feature is another large white oval in the North Equatorial Current recorded by Dragesco. Rhoads recorded it on June 21 near the following limb of the planet; see Figure 38 of the report. Object No. 11 was a very brilliant white oval on the south edge of the NEB recorded by Dragesco and Krisciunas. See Figures 6, 7, and 27 of Mr. Mackal's report.

ADDENDUM TO MR. BUDINE'S TRANSIT REPORT FOR 1969-70

By: Paul K. Mackal, A.L.P.O. Jupiter Recorder

In Dr. Clark R. Chapman's thesis, "The Characteristics and Motions of Jupiter's Spots during a One-year Period" [M.I.T., 1968], a startling conclusion is stated (p. 46):

> "Also, for the NEB Z and NTB, both dark spots and smaller spots (the same, sic) seem to rotate more rapidly than light spots and larger spots (the same, sic)."

The eleven spots of Mr. Budine's table on pg. 239 in this current report were all identified on drawings published in my own earlier qualitative report and suggest that Mr. Chapman's thesis applies to the $N.E.B._s$ as well as to the NEB Z and the NTB. The spots in Budine's list were classified by the Recorder (myself) as being large, small, or intermediate (any spots that were neither large nor small). This trichotomy correlated fairly well with the rotation periods of the features in question! The analysis for a pre-test is presented below:

Hypothesis: Larger spots in the North Equatorial Current move more slowly than all other spots in the NEC.

Table A:

Budine's spot no. 1	W, large	$9^h\ 50^m\ 29^s$
" " " 2	W, large	9 50 32
" " " 3	D, large	9 50 32
" " " 4	D, large	9 50 28
" " " 5	W, intermediate	9 50 29
" " " 6	W, large	9 50 34
" " " 7	D, small	9 50 30
" " " 8	W, large	9 50 34
" " " 9	W, large	9 50 36
" " " 10	W, large	9 50 36
" " " 11	W, large (bright)	9 50 29

Using no. 7 as a comparison standard, for numbers 2, 3, 6, 8, 9, 10 we have six favorable cases out of nine. The residuals are (in respective order): 2^s, 2^s, 4^s, 4^s, 6^s, and 6^s. Adding these residuals and dividing by six yields $+4\overset{s}{.}0$. Taking into account an error of about $\pm 1\overset{s}{.}5$, the range of this mean is $+2\overset{s}{.}5$ to $+5\overset{s}{.}5$. [The altitude of the spots is ignored in this addendum, just as was the case in Mr. Chapman's thesis.]

Using no. 7 again as a comparison for numbers 1, 4, and 11, we have three unfavorable cases out of nine. The new residuals are (in respective order): -1^s, -2^s, and -1^s. Adding these and dividing by three yields $-1\overset{s}{.}33$.

To obtain the "drag" parameter with such pre-test data we simply use a weighted average:

$$[6 \times (+4\overset{s}{.}0) + 3 \times (-1\overset{s}{.}33)] /9 = + 2\overset{s}{.}22.$$

Making spot number 5 our comparison ($9^h 50^m\ 29\overset{s}{.}5$) gives:

$$[6 \times (+4\overset{s}{.}5) + 3 \times (-0\overset{s}{.}83)] /9 = + 2\overset{s}{.}72.$$

By "drag" is meant the extent to which a large white spot increases the rotation period.

Let us pass to another hypothesis and use spots 5 and 7 of Table A:

Hypothesis: Smaller spots in the NEC rotate more rapidly than the intermediate spots.

The residual is found to be $-1\overset{s}{.}0$. Since only one comparison has been made, no pre-test suggestions have been authenticated. The hypothesis stands, for the present, neither confirmed nor refuted.

Both of these hypotheses should be tested extensively again to demonstrate whether Mr. Chapman's useful hypothesis is confirmed for Jupiter's North Equatorial Current.

JOVIAN RED SPOTS IN 1973-74

By: C. F. Capen

Several reddish and magenta (red plus blue) spots were observed on the Jovian disk from June through September, 1973, by the author with an Alvan Clark 30-cm. refractor. Note the accompanying drawing, Figure 11. International Planetary Patrol photographs also showed some of these same disk features. A salient red oval was observed in the EZ during the latter part of June. This new red feature rivaled the classical Red Spot in color, was approximately two-thirds of its size, and its E-W end arcs showed similar morphology. It was considered a transient cloud phenonenon at the time.

Measurements with orthographic grids over June 29 and 30 photographs showed the center-of-area (ca.) of the new reddish feature in System I at about long. 52°, lat. +06°. The ends of the oval were at 43° and 60°, defining a length of 17°. For comparison, the Red Spot was located in System II at about long. 08°, lat. -20°. The RS extended from longitude (II) 356° to 19°, thus having a length of 23°.

A similar reddish feature, or possibly the same new feature, was recorded by the

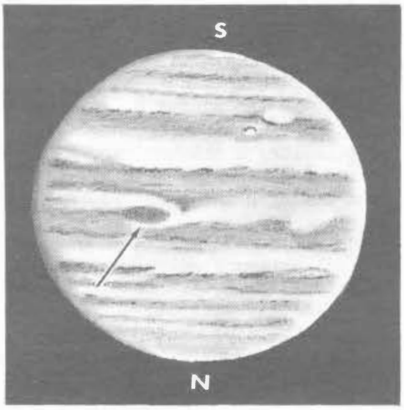

Figure 11. Drawing of Jupiter by C. F. Capen on June 30, 1973 at 8^h20^m, U.T. 30-cm. Clark refractor, 300X-400X. Magenta light (Wratten 30 filter). $C.M._1 = 70°$. $C.M._2 = 113°$. The arrow indicates a red oval atmospheric feature located at about zenographic longitude 52° (System I), latitude 6° N.

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Pioneer 10 spacecraft during its fly-by of Jupiter early in December, 1973. The physical appearance, location, time of occurrence, and duration of red or orange spots are of interest to those research scientists concerned with theoretical models of the Jovian atmosphere. ALPO observers are requested to send related data to C. F. Capen, Lowell Observatory, Flagstaff, Arizona 86001. Dr. G. E. Hunt of England is making a similar request of the BAA. Observations during the 1974 apparition using magenta (Wratten 50) and light blue (Wratten 38 or 82A) filters may give further information concerning these reddish features.

BOOK REVIEWS

Jupiter: The Largest Planet, by Isaac Asimov. Lothrop, Lee, and Shepard Company, New York, N. Y. 1973. 224 pages. $5.95.

Reviewed by Paul K. Mackal

Jove, Jupiter, Jovis, or Zeus has tantalized religious mystics, astrologers, and astronomers for some 5500 years of oral and written history. It still does. Legends about some mythical being from the point of light so bright, yet so remote, originated in Asia Minor thousands of years ago, according to Sir L. Woolley in his monograph on the ancient world written for the U.N.E.S.C.O. history sequence. The Babylonians regarded Merodach (not Mar-Duk) to be a divine being, a god of justice, who ordained the laws among the pantheon of astral gods, who by being close to us in their influence were all regarded as good--the demons presumably coming from further reaches of our universe.

Numerous useful tables (fifty-four in all) are provided with some elementary statistics of the planet. A few of these tables, especially of the Galilean satellites, are most impressive and show a high degree of originality. For example, escape velocity from Jupiter at the distance of satellites I, II, III, or IV is of more importance than escaping the gravitational field of the satellites themselves! The satellite can push the rocket away, by its motion in its orbit about Jupiter, cancelling a portion of the planet's gravitational attraction.

However, we are informed that the four outer retrograde satellites [XI, VIII, IX, and XII] are most certainly captured asteroids, when I now think they might just as easily be captured comets. [Ove Havnes hints as much in two of his recent papers.] Dr. Asimov tells us about companions to nearby stars which are no larger than Jupiter with centers of mass far enough from these stars (just as the Sun-Jupiter center of mass is at 450,000 miles) to wobble or perturb the star in our telescopes! He does not enter into a discussion of the formation of Jovian type planets in our Solar System and other stellar systems. Presumably Jovian planets may have been formed in a proto gas cloud first, while Terran (Earth-like) planets may have been formed much later in a younger gas cloud arising from materials liberated from a star, and possibly from the large planets themselves.

This book is every bit as engaging as those we have come to expect from Isaac Asimov (or even Patrick Moore). It makes a good gift for a young man or woman at Christmas time or on a birthday. I missed paintings by Mel Hunter, however.

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Space Physics and Space Astronomy, by M. D. Papagiannis, Gordon and Breach Publishers. New York, 1972, 293 pages. (Price not specified)

Reviewed by Dale P. Cruikshank

In a review of a book for The Journal of the ALPO, it appears more appropriate to describe the book's contents and level of presentation rather than to catalog typographical errors and minor blemishes in fact or presentation. Readers with a serious interest in space physics and astronomy will want to be familiar with this book because it presents a unified survey of a rapidly growing field which is the source of great excitement in the scientific community and with the public. While the author assumes an understanding of basic university-level physics and the calculus, I think advanced high-school students could learn much from several chapters in the book. Aside from the mathematics, the level of presentation is not much different from articles in Scientific American.

The first chapter surveys planetary atmospheres and constitutes a good 27-page summary, though the treatment is more of the physics of planetary atmospheres than of a consideration of the details of the atmospheres of individual planets. Chapter 2, on the ionosphere, is a good technical summary for anyone unfamiliar with our current understanding of the results from rocket and satellite investigations of the uppermost parts of the atmosphere of the Earth. Chapter 3, on the Earth's magnetosphere, is a good summary of the complex series of envelopes of charged particles surrounding our planet. Any such chapter written now would have to discuss the magnetosphere of Jupiter in greater detail than in the present book.

Amateur astronomers interested in the Sun will find a good detailed but concise discussion of the active Sun in the fourth chapter. This chapter is largely descriptive and covers the main aspects of solar activity. Interplanetary space and the gases and plasmas that fill it are the subject of the fifth chapter, which is some 29 pages long. This discussion is a very useful introduction to a highly complex subject and can serve as the gateway to the more specific and detailed literature which appears in great profusion in current scientific journals.

A lengthy descriptive chapter on the interaction of the Earth and the Sun comprises Chapter 6, on solar-terrestrial relations. Amateurs who monitor radio emission from the Sun or who are interested in short-wave radio transmission on Earth will find this chapter of considerable interest. In Chapter, 7, on solar and planetary space astronomy, space probes are discussed as well as is the need for going outside the Earth's atmosphere for studies of gamma- and x-rays from astronomical bodies. The portion of this chapter on actual planetary studies from spacecraft is very brief.

Gamma-, x-ray, and ultraviolet studies of a non-Solar System nature are discussed in the next chapter, on galactic space astronomy. Infrared studies from balloons and rockets are also discussed in a descriptive way. There are interesting appendices on the development of the space age and on the problem of radiative transfer.

Each chapter of this interesting book is accompanied by a wide selection of references to other books and to current journal papers. The value of the book is enhanced by an index. While Space Physics and Space Astronomy may not be an entirely self-sufficient text for a course in space studies, it will be very helpful supplementary reading. As noted above, each chapter can be read as a valuable introduction to the extensive literature on the individual subjects.

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An Introductory Survey of the Constellations, by Reverend Richard G. Hodgson. Director, Dordt College Observatory, Sioux Center, Iowa, 1973. 34 pages. Price: $1.50 ppd.

Reviewed by Bruce M. Frank

As Rev. Hodgson states in his introduction, this handbook is designed to meet a need expressed by students of astronomy for practical field observing experience. However, this booklet is equally useful as an aid to the novice in acquainting him or her with the major constellations. As An Introductory Survey contains no star charts, Rev. Hodgson lists a number of well known star atlases and reference texts to be used in visualizing the stellar patterns as their descriptions are read in the handbook. The majority of the text is devoted to concise summaries of 95 major constellations in both the northern and southern skies grouped into bimonthly segments starting with September 1st (i.e., the start of the academic year). The author gives the position in stellar coördinates, the historical origins, and the prominent clusters, double stars, and variable stars for each constellation. An index of the constellations discussed is appended at the end to facilitate locating their descriptions. The Introductory Survey is spiral bound with heavy paper covers, making for ease of use in the field. In reading through the handbook, I would make two minor criticisms. First, at least one fold-in comprehensive star chart might have been included to allow direct visual comparison with the verbal discussion without having to refer to a supplementary atlas all the time. Second, although the order of constellations is arranged according to the annual cycle of approximate midnight culminations, the author does not state what is meant by the term. These errors of omission make the text less clear than it might be to a novice observer. Nevertheless, An Introductory Survey of the Constellations is a good introduction at a modest cost to the beginner for gaining practical experience in observing the guideposts of the sky-the constellations.

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Black Holes, edited by C. DeWitt and B. S. DeWitt, New York. Gordon and Breach Science Publishers, 1973. 552 + xii pages. Price $32.50.

Reviewed by Fred J. Lazor

Yearly since 1951, forty physicists from throughout the world gather at Les Houches, France. There for eight weeks they engage in the very intensive intellectual study of some phase of theoretical physics which has seen recent progress. The lecturers are the most eminent names in the field.

In 1972 the phase of theoretical physics discussed at Les Houches was black holes. This book, Black Holes, is the edited lectures delivered at that summer institute. Aside from the chapter of lectures by Herbert Gursky on "Observations of Galactic X-Ray Sources", this book delves deeply into the theoretical astrophysics of black holes. Since mathematics is the language of theoretical astrophysics, this book is, necessarily, extremely mathematical in nature. The book is excellently edited by the DeWitts; but aside from the section by Gursky, this text would only be useful, perhaps even only readable, to a researcher in the field suitably versed in the extensive mathematical language of theoretical astrophysics.

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City of the Stargazers, by Kenneth Heuer. Charles Scribner's Sons, New York, 1972. 170 pages. Price $7.95.

Reviewed by Fred J. Lazor

The rise and fall of ancient Alexandria is traced masterfully in this brief book by Kenneth Heuer. Heuer describes Alexandria from its founding by Alexander the Great in 332 B.C. through its ultimate destruction in 646 A.D. at the hands of Amru the Mohammedan. It is men who make a city great, and such was certainly true of this ancient metropolis. Therefore, the story of ancient Alexandria is really the account of its greatest citizens: the Ptolemys, Eratosthenes of Cyrene, Aristophanes of Byzantium, Aristarchus of Samothrace, and the great mathematicians Euclid, Archimedes, Apollonius of Perga, Conon of Samos, Heron, and Diophantus. Alexandria was also the home of some of the greatest astronomers of antiquity. Aristarchus, the mathematician, proposed a Sun-centered universe eighteen centuries before Copernicus. Eratosthenes, who invented the armillary sphere, measured the obliquity of the ecliptic and the circumference of the Earth. Perhaps the greatest astronomer of antiquity was Hipparchus of Alexandria, who was the first to discover and measure the precession of the equinoxes and who compiled one of the earliest star catalogs. Another Alexandrian, Claudius Ptolemy, used the observations of Hipparchus as the basis for his theory of an Earth-centered universe that was accepted for fourteen hundred years.

Heuer makes use of an extraordinary number of excellent photographs, particularly of ancient coins, to illustrate this short work. The very large print used throughout also shortens the actual text. This large type is very easy to read but reminiscent of "My First Reader". The only important fault with the book is that the transition from one chapter to another and within chapters is not always smooth but frequently is abrupt and at times leads to confusion.

The people described in City of the Stargazers read like a "who's-who" of major lunar crater names and should be fascinating reading for anyone truly interested in lunar study. Actually, this book is suited to anyone interested in ancient history or archeology as well as in astronomy. The great number of coins used as illustrations should make this book attractive to the numismatist as well. In short, it is an enjoyable book, simply written, suitable to readers of many interests, and a refreshing change from pure astronomy.

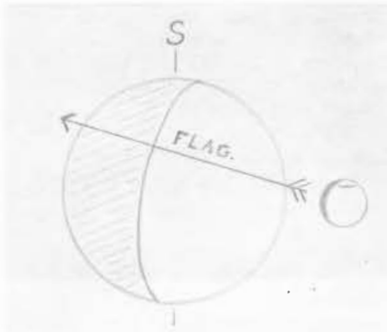

Figure 12. The aspects of the Moon and Mars during the occultation of May 16, 1971. The track of Mars behind the Moon as seen from Flagstaff, Arizona is indicated by the arrow. South is at the top. Graph prepared by Charles Capen. See text of article by Capen and Otis in this issue.

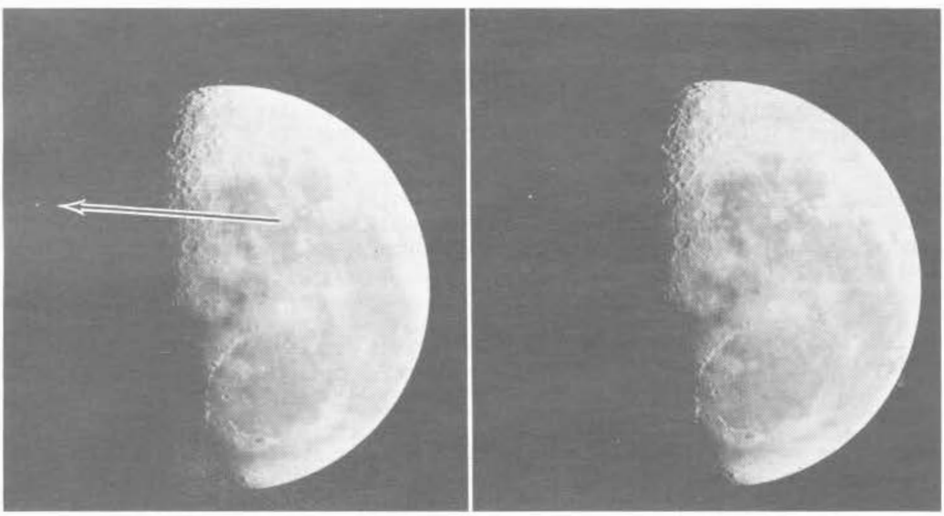

Figure 13. The reappearance of the planet Mars from behind the dark limb of the Moon is shown in these two Kokachrome-X photographs of the May 16, 1971 occultation of Mars. Taken by V. Capen and C. Capen with a 127-mm. refractor. Left picture at 8 hrs., 57 mins., 33.2 secs., U.T.; right picture at 8 hrs., 58 mins., 6.0 secs. Lunar south at top, west (IAU convention) at right.

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THE OCCULTATION OF MARS BY THE MOON ON MAY 16, 1971

By: Charles Capen and Mike Otis, A.L.P.O. Mars Section

The first known picture of an occultation of the planet Mars by the Moon was taken 63 years ago when planetary photography was in its infancy. It was taken by Dr. Earl C. Slipher only a few days after the opposition of Mars on December 4, 1911. This extraordinary photograph exposed just before occultation shows the Martian apparent disk no larger than a small size lunar crater. This picture has been admired through the years by thousands of visitors to the Lowell Observatory Library, and it is shown on page 77 of E. C. Slipher's classic volume MARS - THE PHOTOGRAPHIC STORY. Another opportunity to observe and record this kind of splendid event from North America occurred on the morning of May 16, 1971. The entire occultation (four contacts) was visible from mid-continent, whereas the egress occurred after sunrise in New England and Quebec and the ingress happened before Moonrise after midnight on the West Coast.

The gibbous, near Last Quarter Moon was observed to occult Mars on May 16 by ALPO observers M. Otis, Aberdeen, South Dakota; D. Kluba, Cincinnati, Ohio; and V. and C.

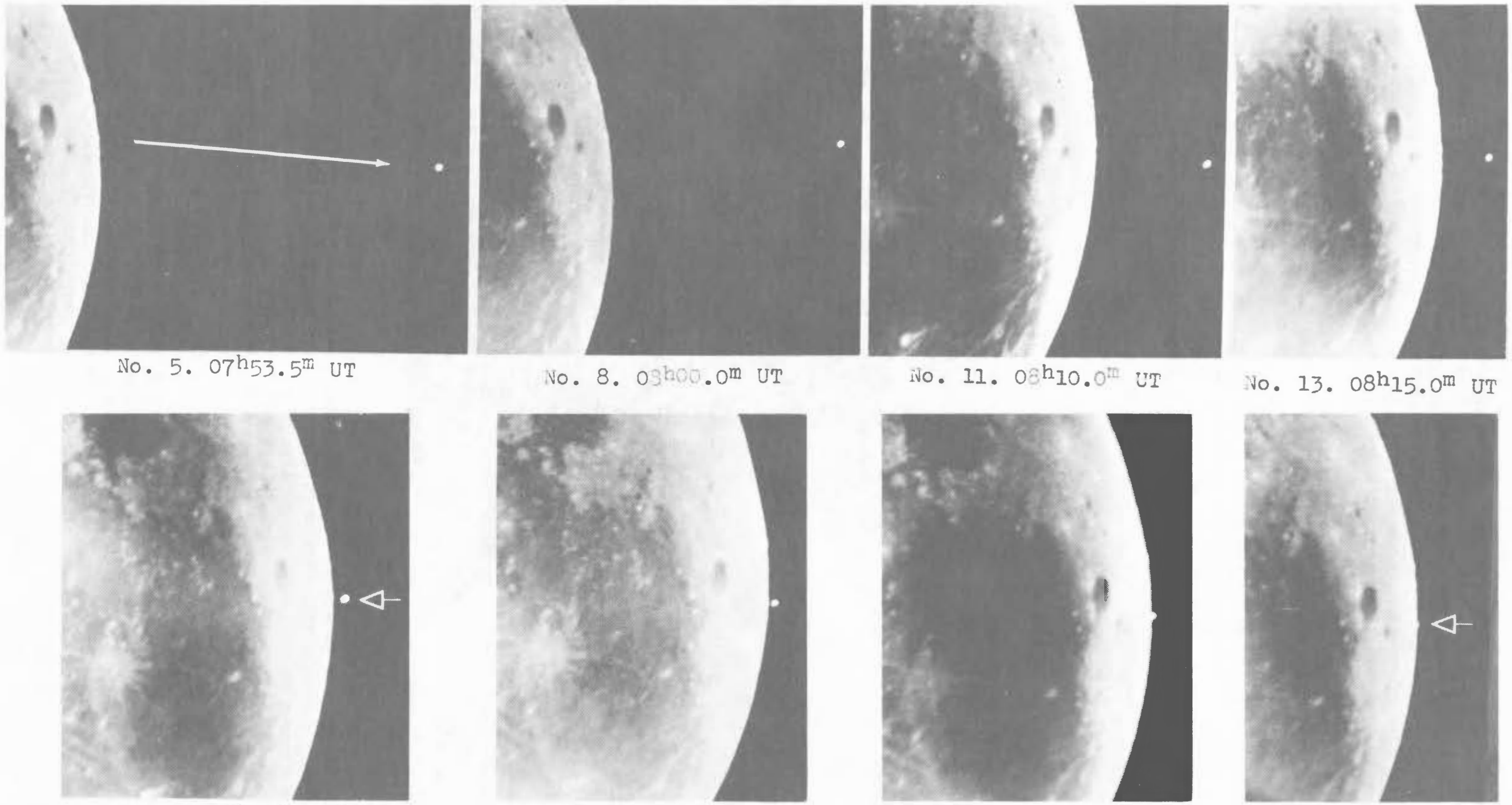
Capen, Flagstaff, AZ. Small aperture telescopes using low to moderate magnifications of 40X to 200X giving full views of the Moon were most effective because of the problem of locating the exact place of emergence of Mars from behind the dark limb of the Moon . A tape-recorder receiving WWV time signals, camera shutter clicks, and visual audio reference marks was used for time-and-events. The planet Mars on May 16, 1971 was -0.4 magnitude, 12 arc seconds disk diameter, and 88% illuminated or 10.5 arc seconds in gibbous phase. The ingress-egress track of Mars behind the lunar disk was different for each observer because of different site locations. The part of the Martian disk in shadow, 1.5 arc seconds width of the terminator, made first contact appear late. Of course, the Moon's limb is a rugged figure at planetary scales of 10 to 20 arc seconds, which introduced unpredictable differences in timing contacts. The aspects of the Moon-Mars occultation for Flagstaff are shown in Fig. 12. The two disks are not drawn to an equal scale. M. Otis obtained timed photographs of the first part of the occultation through second contact. D. Kluba visually timed the entire occultation with $\pm 0^s.1$ accuracy from first through fourth contacts. The Capens were restricted to timed visual and photographic observations of the third and fourth contacts since the planet was occulted before the Moon cleared local tree tops.

Mike Otis used a 200-mm. refl. with a Barlow lens to obtain an effective scale for an excellent series of 17 pre-occultation photos on Tri-X film (ASA 400). Refer to Table I and Fig. 14. Otis performed an interesting experiment with 16 of these Moon-Mars photos starting 38 minutes before first contact. Each photo was carefully measured for the Mars-to-Moon distance. A sequence of time differences from one photo to the next was obtained. An average of the distances and times produced an average rate of 0.011 cm./sec. in terms of the plate scale used by Otis. A least squares fit of the parameters to a straight line was run on a computer, which produced graphs from which the respective values for first contact of $08^h21^m.22$ UT, mid-disk $08^h21^m.44$ UT, and second contact $08^h 21^m.66$ UT were directly read. The difference between first and second contacts indicates that the Martian disk required $26^s.4$ for complete disappearance. According to the photographic evidence shown in Fig. 14, the first contact occurred at about $08^h 19^m.3$ UT in the D'Alembert Mt. range. The large dark-floored crater seen in the photos just south of the point of contact is Grimaldi, and the smaller one nearer the lunar limb is Riccioli.

TABLE I. Measured distances from center of Martian photo disk to edge of Moon in cms. versus U.T. M. Otis.

No. photo	Average distance from disk center	U.T.
1	24.09 cms.	07^h 42.5^m, May 16, 1971
2	23.42	07 45.0
3	20.38	07 50.0
4	18.24	07 52.5
5	17.29	07 53.5
6	16.47	07 55.0
7	15.37	07 57.0
8	12.47	08 00.0
9	09.52	08 05.0
10	07.20	08 08.0
11	06.16	08 10.0
12	04.74	08 12.0
13	02.65	08 15.0
14	00.70	08 18.0
15	00.39	08 18.9
16	00.10	08 19.5
17	-----	08 20.1

Don Kluba used a 107-mm. reflector at 270X with seeing 6 (0 t0 10 scale) and transparency 5 (limiting magnitude) to record the first contact at $08^h32^m49^s.5$ UT and the second contact at $08^h33^m10^s.7$ UT. This second contact occurred 7 minutes early from that predicted for Cleveland, Ohio by D. Dunham in Sky and Telescope, May 1971. The disappearance of the Martian disk required 21.2 secs., which agrees well with M. Otis' results. A magnification of 90X was used to time the third contact at $09^h48^m53^s.0$ UT and the fourth one at $09^h49^m15^s.8$ UT. These values indicate that it required 22.8 seconds for the



No. 5. $07^h53.5^m$ UT

No. 8. $08^h00.0^m$ UT

No. 11. $08^h10.0^m$ UT

No. 13. $08^h15.0^m$ UT

No. 14. $08^h18.0^m$ UT

No. 15. $08^h18.9^m$ UT

No. 16. $08^h19.5^m$ UT

No. 17. $08^h20.1^m$ UT

Figure 14. The approach of the lunar limb toward the Martian disk is dramatically shown in photographs of the occultation of Mars by the Moon on May 16, 1971 made with a 200 mm Newtonian telescope by Mike Otis at Aberdeen, So. Dakota. See text.

Martian disk to clear the lunar limb. Mars was completely obscured by the Moon for 01^h-16^m, which is exactly what Dunham had predicted to the nearest minute. Kluba comments: "The occultation was quite an event. To see an object with a perceptible disc pass behind the Moon is quite a sight indeed! Third contact was rather difficult to make as it required keeping my eye literally glued to the eyepiece while waiting for Mars to pop out from behind the Moon . . . . Mars seemed to 'cling' to the Moon at fourth contact. It reminded me of the same effect seen when Mercury transits the Sun."

Virginia and Charles Capen used a 127-mm. f/10 refractor at 50X with seeing 5 and transparency 5-6 for visual timing and color photography of the post-occultation. A 35-mm. SLR camera with Kodachrome-X film (ASA 64), a tape-recorder, and a WWV National receiver were used for a series of 20 timed photos. Refer to Table II and Figure 13. A constant film exposure was used for the first 30 seconds following reappearance. Other exposures ranged from 0.04 to 0.2 seconds. The third contact was recorded at $08^h57^m27\overset{s}{.}0$ $\pm 0.1^s$. Dunham had predicted the reappearance at 08^h51^m for Tucson, AZ. The first glimpse of Mars' evening terminator limb light from behind the Moon's darkened limb was spectacular! The light from Mars was first a faint, dull red hue that very slowly increased in brightness during the first 5 seconds. Afterwards, the brightness increased rapidly for the next 12 to 13 seconds. The first four color photos of the series showed this increase in brightness. The Moon's dark limb became extremely difficult to see as the Martian disk moved toward last contact. The fourth contact was estimated at approximately $08^h57^m52^s$ $\pm 5^s$. The fourth contact probably really occurred closer to $08^h57^m46^s$, when the brightness of Mars became constant. A set of color photographs was also taken at 1-minute intervals for educational illustration and lectures.

TABLE II. Visual observations and Kodachrome-X photographs of the Moon-Mars occultation, May 16, 1971 by V. and C. Capen.

Event No.	U.T.	Event No.	U.T.
visual 3rd contact	$08^h57^m27\overset{s}{.}0$	photo 5.	$08^h58^m00\overset{s}{.}2$
photo 1.	08 57 29.8	photo 6.	08 58 06.0
photo 2.	08 57 33.2	photo 7.	08 58 14.0
photo 3.	08 57 41.2	photo 8.	08 58 25.1
photo 4.	08 57 45.8	photo 9.	08 58 40.0
visual 4th contact	08 57~46	photo 10.	08 58 52.1

We may conclude that an occultation of Mars by the Moon is an unique illustration of apparent planetary proportions and a time-and-events challenge; and the color contrast exhibited between ruddy Mars and the silver-yellow hue of the Moon is a splendor which is recommended to all planetary observers.

LUNAR NOTES

By: John E. Westfall, A.L.P.O. Lunar Recorder

Additions to the A.L.P.O. Lunar Photograph Library: A.L.P.O. Member, Apollo-8, and Apollo-15 Photographs

Since the last A.L.P.O. Lunar Photograph Library report was published, 81 additional photographs have been received. It is particularly gratifying that 19 of these were taken by A.L.P.O. members. The sources of the new photographs are as follows:

7 photographs by Billy Keel (10-in. Refl.; BK code number).
10 photographs by Roy Parish (8-in. Refl.; P code number).
2 photographs by William Pohnan (16-in. Refl.; WP code number).
5 Apollo-8 photographs, copied and supplied by Billy Keel.
57 Apollo-15 photographs, supplied by NASA-NSSDC.

Unless otherwise noted, all photographs listed in the three tables below are black-snd-white enlargements, 8 x 10 inch format. Scales are given as follows: 4.5M = 1/4,500,000; 840T = 1/840,000, etc.

Readers are reminded that the A.L.P.O. Lunar Photograph Library lends photographs to our members. This service can greatly assist lunar research and study. For details, write to John E. Westfall, San Francisco State University, 1600 Holloway Ave., San Francisco, California 94132.

Table 1. A.L.P.O. Member Photographs

Code Number	Area Covered	Date & Time (U.T.)	Colongitude	Scale
BK-1	Petavius-M. Australe-Rheita Valley-Janssen (Overlaps BK-2)	1972 APR. 19, 0210	335°.2	5.9M
BK-2	M. Fecunditatis-Petavius- M. Australe-Janssen (Overlaps (BK-1 & BK-3)	1972 APR. 19, 0210	335.2	5.9M
BK-3	M. Crisium-M. Fecunditatis (Overlaps BK-2 & BK-4)	1972 APR. 19, 0210	335.2	5.9M
BK-4	Endymion-Cleomedes-M. Crisium (Overlaps BK-3)	1972 APR. 19, 0210	335.2	5.9M
$BK\text{-}5_{i}$	Quadrant IV (dark print)	1972 FEB. 01, 0415	106.1	11.8M
$BK\text{-}5_{ii}$	Quadrant IV (medium print)	1972 FEB. 01, 0415	106.1	11.8M
$BK\text{-}5_{iii}$	Quadrant IV (light print)	1972 FEB. 01, 0415	106.1	11.8M
P110-4	Schiller-Schickard-S. M. Humorum	1972 JUL. 24, 0229	068.0	4.5M
P111-7	Kepler-Aristarchus-Hevelius (Overlaps P112-28)	1972 JUL. 24, 0237	068.1	4.5M
P112-28	Hevelius-Byrgius (Overlaps P111-7)	1972 JUL. 24, 0256	068.2	4.5M
P114-1	Copernicus-M. Nubium-Ptolemaeus (Infrared; 5x7 format; (Overlaps P116-9)	1972 JUL. 27, 0459	105.9	8.8M
P116-9	S. Highlands-S.Medii-Theophilus (Infrared; 5x7 format; Overlaps P114-1 & P117-16)	1972 JUL. 27, 0516	106.0	8.8M
$P117\text{-}16_{i}$	Pitatus-Tycho-S. Limb (Infrared; 5x7 format; Overlaps P116-9)	1972 JUL. 27, 0526	106.1	8.8M
$P117\text{-}16_{ii}$	S. Polar Region (Infrared)	1972 JUL. 27, 0526	106.1	6.1M
P129-4	Copernicus Region	1972 SEP. 18, 0247	032.1	4.5M
P130-9	M. Imbrium-M. Frigoris	1972 SEP. 18, 0257	032.2	5.7M
P130-10	Central M. Imbrium	1972 SEP. 18, 0259	032.2	4.8M
WP-1	Gassendi-M. Humorum	1973 APR. 14, 0317	044.3	2.7M
WP-2	Sinus Iridum	1973 APR. 14, 0320	044.3	2.6M

Table 2. Apollo-8 Photographs

NOTE: L-OBL means "low oblique"; oblique angle of view, entire photograph is below the lunar horizon.

Code Number	Format	Sun Angle	Description
AS8 -			
14-2494	Whole-Disk	variable	Centered ca. 0°N/70°E (blue filter)
18-2851	L-OBL	35°	M. Crisium-M. Undarum (18°N/67°E) (Overlaps AS8-18-2863 & -2879)
18-2863	L-OBL	35°	S. M. Crisium-N.E. M. Fecunditatis (07°N/62°E) (Overlaps AS8-18-2851 & 2879)
18-2879	L-OBL	35°	M. Crisium (17°N/67°E) (Overlaps AS8-18-2851 & -2863)
18-2890	Whole-Disk	variable	Centered ca. 10°S/70°E

Table 3. Apollo-15 Photographs

NOTES: (a) Format--"M" refers to Metric Camera photographs, generally wide-angle, extending from the nadir area to the horizon. "H" refers to Hasselblad Camera photographs, with the lens focal length in millimeters given. "L-OBL" is as in Table 2; "H-OBL(N)" refers to a northward-looking photograph showing from the nadir to the horizon; "H-OBL(S)" is similar, but with the camera pointed south.

(b) Scale--As before, the letter "v" following the scale indicates that this scale applies only to the vertical (nadir) area of the photograph; the scale decreases as one moves away from this area.

Figure 15. The Copernicus area, photographed by Roy Parish with an 8-inch reflector at Colongitude 032°.1 (south on top; Lunar Photograph Library photograph P129-4). This view extends from the Riphaeus Mts. (upper right) to Timocharis (lower left), including parts of Maria Cognitum and Imbrium and Oceanus Procellarum.

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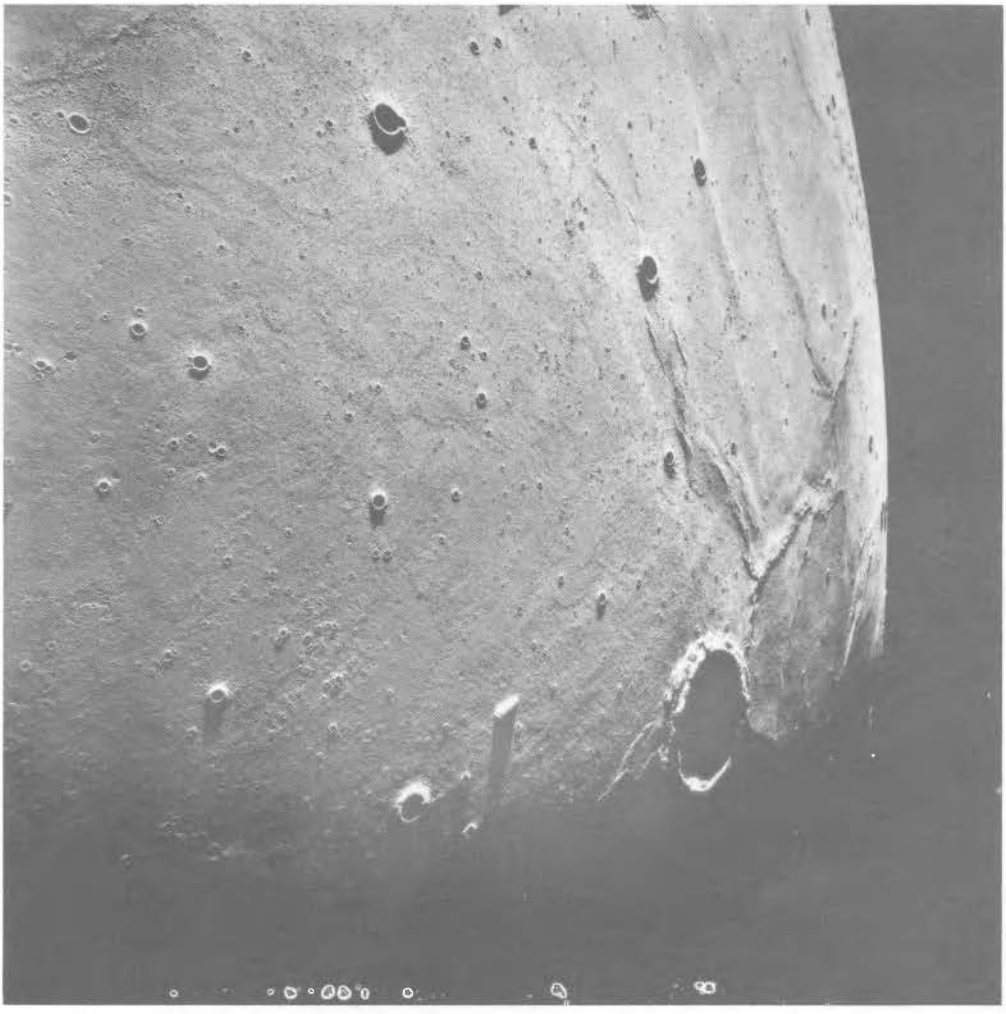
(c) Description--In a strip series, a portion of each photograph overlaps with the preceeding, and also the following, photograph of the series. "Stereo." refers to a stereoscopic overlap.

Code Number	Format	Sun Angle	Scale	Description
AS15-1475	M, H-OBL(N)	High	$700T_V$	M. Smythii-Neper (02°S/84°E) (#1 of strip of 18)

Table 3. Apollo-15 Photographs (cont.)

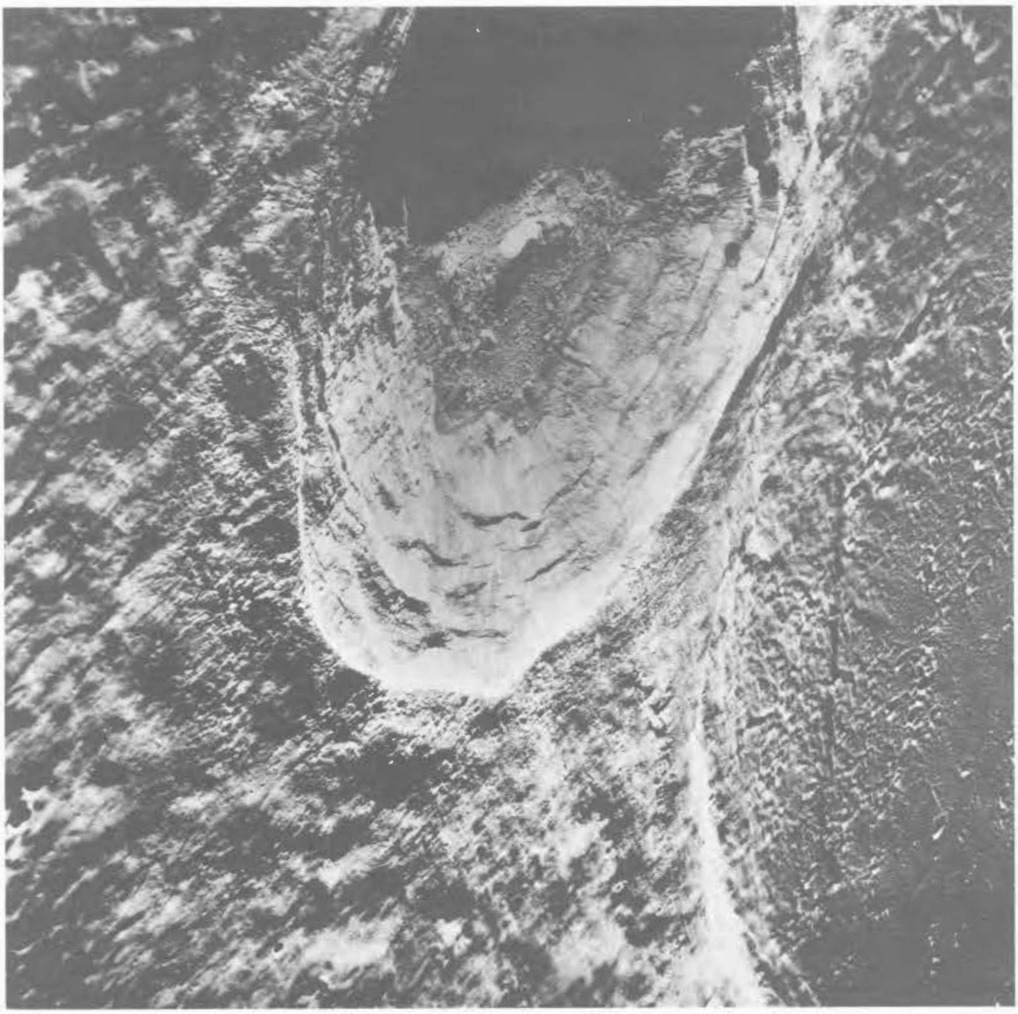
Code Number	Format	Sun Angle	Scale	Description
AS15-1480	M, H-OBL(N)	High	$700T_V$	Gilbert-Neper (00°N/77°E) (#2 of strip of 18)
1485	M, H-OBL(N)	High	$700T_V$	Webb J - M. Undarum (05°N/74°E) (#3 of strip of 18)
1490	M, H-OBL(N)	High	$700T_V$	M. Spumans-M. Undarum-Condorcet (08°N/69°E) (#4 of strip of 18)
1495	M, H-(OBL(N)	High	$700T_V$	S.E. M. Crisium-Azout (10°N/62°E) (#5 of strip of 18)
1500	M, H-OBL(N)	High	$700T_V$	Central & W. M. Crisium-Picard-Pierce (14°N/57°E) (#6 of strip of 18)
1505	M, H-OBL(N)	High	$700T_V$	Proclus-N.W. M. Crisium (17°N/51°E) (#7 of strip of 18)
1510	M, H-OBL(N)	High	$700T_V$	Macrobius-Newcomb-P. Somnii (19°N/45°E) (#8 of strip of 18)
1515	M, H-OBL(N)	High	$700T_V$	Römer-Kirchoff-Taurus Mts. (22°N/37°E) (#9 of strip of 18)
1520	M, H-OBL(N)	High	$700T_V$	E. M. Serenitatis-Mt. Argaeus-Posidonius (22°N/30°E) (#10 of strip of 18)
1525	M, H-OBL(N)	High	$700T_V$	Central M. Serenitatis-Bessel A-Posidonius (25°N/22°E) (#11 of strip of 18)
1530	M, H-OBL(N)	Medium	$700T_V$	W. Central M. Serenitatis-Linné-Linné B, E (26°/15°E) (#12 of strip of 18)
1535	M, H-OBL(N)	Medium	$700T_V$	Fresnel Pr.-Aristillus-Caucasus Mts. (29°N/07°E) (#13 of strip of 18)
1540	M, H-OBL(N)	Medium	$700T_V$	Archimedes-Autolycus-Aristillus (29°N/00°W) (#14 of strip of 18)
1545	M, H-OBL(N)	Medium	$700T_V$	Beer-Spitzbergen Mts. (29°N/08°W) (#15 of strip of 18)
1550	M, H-OBL(N)	Medium	$700T_V$	Lambert γ -Timocharis D-Carlini-Le Verrier-Helicon (30°N/16°W) (#16 of strip of 18)
1555	M, H-OBL(N)	Low	$700T_V$	La Hire-Carlini-Le Verrier-Helicon (30°N/25°W) (#17 of strip of 18)
1559	M, H-OBL(N)	Low	$700T_V$	Heis-Heis D-C.Herschel (31°N/29°W) (#18 of strip of 18)
1848	M, Vertical	Low	840T	Diophantus-Diophantus A-Euler E (26°N/36°W)
2010	M, Vertical	High	970T	Tauruntius-Taruntius M (04°N/46°E)
2084	M, Vertical	Low	840T	Krieger-Wollaston-N. Prinz Rimae (28°N/47°W) (Overlaps AS15-2200Stereo.)
2200	M, Vertical	Low	810T	Herodotus H,χ -N. Vallis Schröteri (28°N/50°W) (Overlaps AS15-2084 Stereo.)
2405	M, Vertical	High	970T	Messier-Messier A, B, D, E-Secchi K (01°S/47°E)
2435	M, Vertical	High	980T	Menelaus-Manilius-Haemus Mts. (15°N/13°E)
2510	M, H-OBL(S)	Medium	$940T_V$	Humboldt-Barnard (23°S/86°E) (#1 of strip of 23)
2515	M, H-OBL(S)	Medium	$940T_V$	Hecataeus-Humboldt-Phillips (22°S/79°E) (#2 of strip of 23)
2520	M, H-OBL(S)	Medium	$940T_V$	Kapteyn B-Balmer-Petavius (19°S/72°E) (#3 of strip of 23)
2525	M, H-OBL(S)	Medium	$940T_V$	Lame-Vendelinus (15°S/66°E) (#4 of strip of 23)
2530	M, H-OBL(S)	Medium	$940T_V$	Langrenus-Vendelinus-S. M. Fecunditatis (14°S/58°E) (#5 of strip of 23)
2535	M, H-OBL(S)	High	$940T_V$	Messier G-Goclenius-N.W. M. Fecunditatis (10°S/53°E) (#6 of strip of 23)

Figure 16. Apollo-15 Metric Camera photograph AS15-2620 (in the A.L.P.O. Lunar Photograph Library). This south-looking view is in western Oceanus Procellarum, showing the crater Seleucus (diameter 27 miles or 43 kms.) on the terminator. The low Sun brings out clearly the rectangular system of ridges south and east of (above) Seleucus. Note that the craterlets in the lower left part of the photograph appear circular, indicating that this area is directly underneath the spacecraft.



Code Number	Format	Sun Angle	Scale	Description
AS15-				
2540	M, H-OBL(S)	High	$940T_V$	Lubbock-Gutenberg-Goclenius (05°S/45°E) (#7 of strip of 23)
2545	M, H-OBL(S)	High	$940T_V$	Gutenberg-Capella-Censorinus (02°S/39°E) (#8 of strip of 23)
2550	M, H-OBL(S)	High	$940T_V$	Censorinus-Maskelyne-Torricelli (01°N/33°E) (#9 of strip of 23)
2555	M, H-OBL(S)	High	$940T_V$	Maskelyne-Sabine-Ritter-S.W. M. Tranquillitatis (04°N/26°E) (#10 of strip of 23)
2560	M, H-OBL(S)	High	$940T_V$	Maclear-Arago-Cayley (08°N/20°E) (#11 of strip of 23)

Figure 17. Aristarchus as it appears in photograph AS15-96-13050 in the A.L.P.O. Lunar Photograph Library, taken with a Hasselblad camera equipped with a 250-millimeter telephoto lens during the Apollo-15 mission. This oblique view looks southwest over the crater (diameter 26 miles or 42 kms.); the plateau that connects it with Herodotus is on the lower right. The radial streaks of darkish material on the west (right) inner wall of Aristarchus comprise the famous "bands" observed from Earth.



Code Number	Format	Sun Angle	Scale	Description
AS15-				
2565	M, H-OBL(S)	High	$940T_V$	J. Caesar-Agrippa-Godin-Hyginus (11°N/14°E) (#12 of strip of 23)
2570	M, H-OBL(S)	High	$940T_V$	Manilius-M. Vaporum-Hyginus (14°N/08°E) (#13 of strip of 23)
2575	M, H-OBL(S)	High	$940T_V$	Marco Polo-W. M. Vaporum-S. Aestuum (16°N/02°E) (#14 of strip of 23)
2580	M, H-OBL(S)	High	$940T_V$	Wallace-S. W. Apennine Mts.-Eratosthenes-S. Aestuum (18°N/07°W) (#15 of strip of 23)
2585	M, H-OBL(S)	High	$940T_V$	Wallace-Eratosthenes-Carpathian Mts. (21°N/13°W) (#16 of strip of 23)

Code Number	Format	Sun Angle	Scale	Description
AS15-2590	M, H-OBL(S)	Medium	$940T_V$	Lambert-Pytheas-Copernicus (22°N/19°W) (#17 of strip of 23)
2595	M, H-OBL(S)	Medium	$940T_V$	Euler-T. Mayer (23°N/28°W) (#18 of strip of 23)
2600	M, H-OBL(S)	Medium	$940T_V$	Diophantus-Euler β - Brayley-Bessarion (24°N/34°W) (#19 of strip of 23)
2605	M, H-OBL(S)	Medium	$940T_V$	Harbinger Mts.-Prinz-Brayley-Bessarion (25°N/42°W) (#20 of strip of 23)
2610	M, H-OBL(S)	Medium	$940T_V$	Aristarchus-Herodotus-Vallis Schröteri (25°N/49°W) (#21 of strip of 23)
2615	M, H-OBL(S)	Medium	$940T_V$	Schiaparelli-Herodotus A (25°N/57°W) (#22 of strip of 23)
2620	M, H-OBL(S)	Low	$940T_V$	Seleucus-Galilaei (24°N/64°W) (#23 of strip of 23)
2674	M, Vertical	High	960T	Messier-Messier A, B, D, E, H-Secchi K (01°S/47°E)
2704	M, Vertical	High	1000T	Manilius-Haemus Mts. (16°N/11°E) (Overlaps AS15-2706 Stereo.)
2706	M, Vertical	High	1000T	Manilius-Haemus Mts. (17°N/08°E) (Overlaps AS15-2704 Stereo.)
81-10990	H, L-OBL 500 mm.	High	---	Messier (02°S/48°E)
81-10991	H, L-OBL 500 mm.	High	---	Messier A (W. H. Pickering) (02°S/47°E)
90-12269	H, L-OBL 60 mm.	Low	---	Prinz-Krieger-Wollaston-Aristarchus Plateau-Vallis Schröteri (29°N/45°W)
92-12484	H, L-OBL 500 mm.	Medium	---	Aristarchus--N. & W. interior (24°N/47°5W)
92-12493	H, L-OBL 500 mm.	Medium	---	Herodotus--S. & E. interior (23°N/49°5W)
96-13050	H, L-OBL 250 mm.	Low	---	Aristarchus (24°N/48°W)
98-13343	H, L-OBL 250 mm.	Low	---	Vallis Schröteri-Cobra Head (25°N/49°5 W)

ANNOUNCEMENTS

WAA/ALPO Convention. Our annual meeting this summer will be a joint Convention of the Western Amateur Astronomers and the Association of Lunar and Planetary Observers on August 9, 10, and 11, 1974 on the UCLA campus, situated between downtown Los Angeles and Santa Monica, California. The host society is the Los Angeles Astronomical Society. The dates given fall on Friday, Saturday, and Sunday. Rooms will be available at the University and (with more luxury) at Holiday Inn in Westwood. Prices at the Holiday Inn are not known at present. The rates at the UCLA dormitory are as follows:

$14 per day per person, single occupancy, three meals included.
$13 per day per person, single occupancy, breakfast and dinner.
$10.25 per day per person, single occupancy, breakfast only.
$9.00 per day per person, single occupancy, no meals.

For double occupancy each of the above rates becomes $2.00 per day less. For those not rooming at UCLA, prices for meals are: breakfast, $1.50 per meal; lunch, $2.00 per meal; and dinner, $3.00 per meal. The campus rooms are within easy walking distance of many facilities and within easy driving distance of Beverly Hills, Santa Monica, and downtown Los Angeles. Persons desiring to reserve a room - and promptness is greatly appreciated by convention planners - should write directly to:

Conference Coordinator UCLA
Charles H. Rieber Hall
310 De Neve Circle
Los Angeles, California 90024

Papers of interest are heartily invited, and surely many of our members have ideas well worth communicating to others. Papers intended for the Proceedings, which will be distributed during the meeting itself, must be typed on $8\frac{1}{2}$ by 11 inches, white bond paper, left margin $1\frac{1}{2}$ inches and all others 1 inch. Drawings must be in black ink with typed or neat hand lettering. The paper must be mailed flat and unfolded to: Mr. C. L. Tichenor, 15524 Cohasset St., Van Nuys, California 91406. Photographs accompanying papers should be 8x10-inch glossy prints.

Field trips and other astronomical and non-astronomical activities are still in the planning stages. Ideas are most welcome. We would hope to have a worthwhile ALPO Exhibit of drawings, photographs, and charts. The President of the Western Amateurs at present is our own Tom Cragg, long on the Saturn Section staff.

Those wishing further information should write to: Edward J. Johnston
Conference Committee Chairman
P. O. Box 3201
Long Beach, California 90803

New Address for Saturn and Venus Recorders. The address of Julius Benton, who heads both our Saturn and Venus Sections, is now as follows:

Julius L. Benton, Jr.
Piedmont Station
Highland Point Astronomical Observatory
P. O. Box 839
Clinton, South Carolina 29325

New Assistant Saturn Recorder. There has now been appointed to this post as a needed helper to Dr. Benton in the Saturn studies of the ALPO:

Clay Sherrod
900 Mission Road
North Little Rock, Arkansas 72116

Mr. Sherrod will be in charge of satellite observing programs and studies of Saturn's rings, including the curious bicolored aspect. He has been an active observer of Saturn in recent years. He is a teacher of physical sciences at the Edgewood Academy in North Little Rock, where he is also in charge of a small private campus observatory, which houses a 5-inch Unitron refractor. We extend our gratitude to Mr. Sherrod for joining our staff, where his qualifications as an experienced observer will make him an asset.

All correspondence and routine business of the Saturn Section will continue to be the responsibility of Dr. Benton, and all observations should be mailed to him. Those materials which pertain to Mr. Sherrod's programs will be forwarded to him, and he will acknowledge correspondence and observational material accordingly.

Saturn Section Newsletter. This publication in the future will be sent free of charge to interested observers of Saturn. Because of the increased costs of printing in small quantities, Julius Benton has decided to purchase a mimeograph machine; and this method of reproduction will replace the more costly photo-offset process. Those who wish to receive the publication regularly should supply the Saturn Section with about 10 stamped, self-addressed envelopes; the ALPO Comets Section has been using such a means of distributing current news items for several years now with great success.

Joint Meeting of RASC and AAVSO. The 1974 General Assembly of the Royal Astronomical Society of Canada will be hosted by the Winnipeg Centre at the University of Manitoba in Winnipeg, Canada. The dates are June 28-July 1. This meeting will be a joint one with the American Association of Variable Star Observers. A special feature of the Assembly will be Centrascope, '74, Festival of Telescopes. Amateur telescope makers are invited to display their creations. There will be judging and awards in five different categories. For details, please contact Mr. B. F. Shinn, 173 Kingston Row, Winnipeg, Manitoba, Canada. The city of Winnipeg is celebrating its Centennial in 1974, and many colorful and exciting events will be taking place during the Assembly dates.

Outline of the ALPO Lunar and Planetary Training Program. The Program Director is Joe Olivarez, Hutchinson Planetarium, 1300 No. Plum, Hutchinson, Kansas 67501. The program is open to all members, novice and experienced, with the goal of helping them to become proficient observers. The program consists of learning the techniques of useful lu-

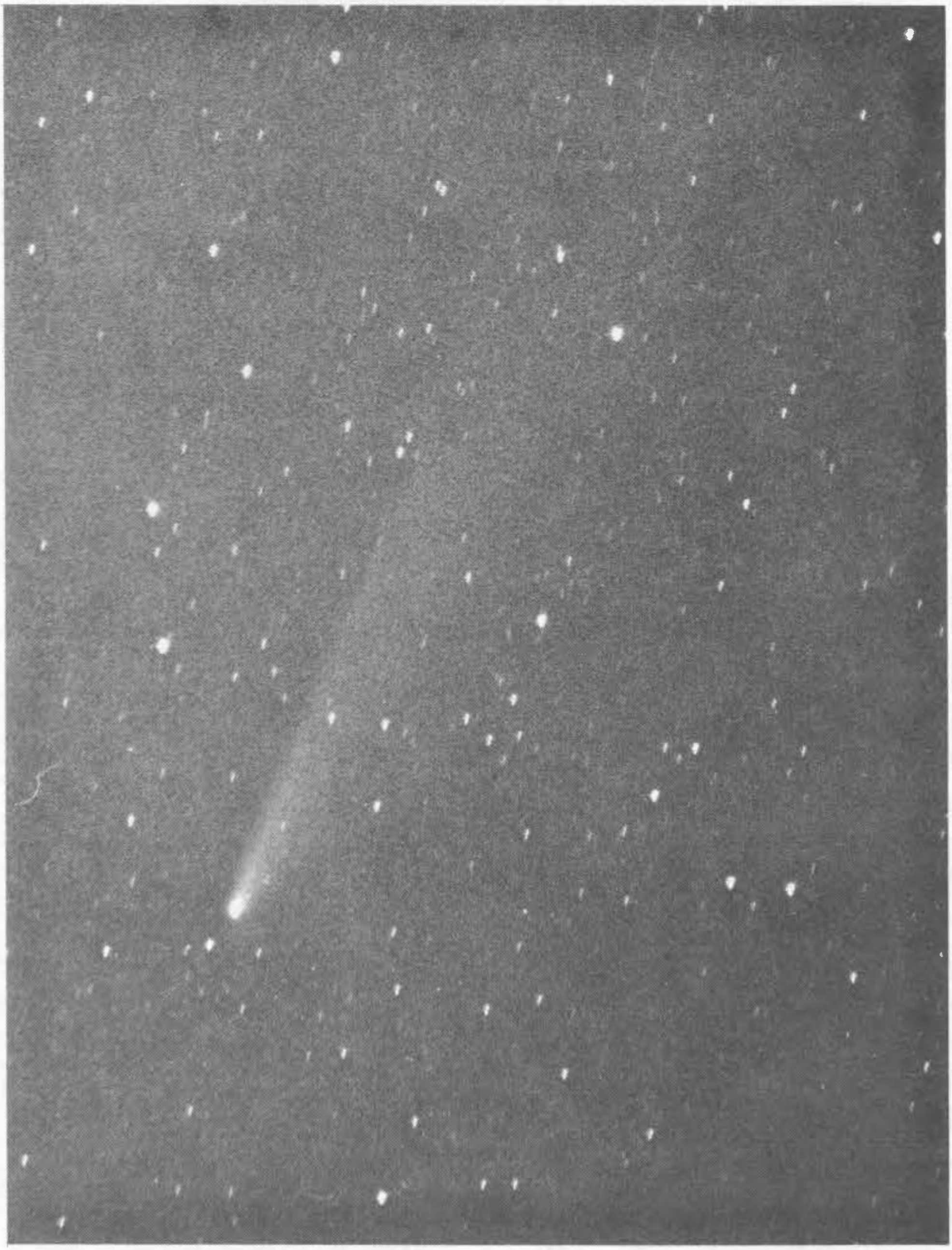


Figure 18. Photograph of Comet Kohoutek (1973f) by Marvin J. Mayo of Los Angeles. Taken at 4^h20^m, U.T., on January 14, 1974 from the Malibu Mountains, California. 270-mm., f 5.6 lens. Exposure 2 minutes. 35-mm. Pentax camera. Tri-X film. Developer Acufine. Tail measured to be 8 degrees long. Guided with 8-inch, f 10 Celestron.

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nar and planetary observing, the proper method of recording the observations, and the development of a drawing skill. The learning process consists mainly of practice at the telescope and a constant effort to improve the observations by training the eye and improving drawing and recording techniques. The student should have either a refractor 3 inches or more in aperture or else a reflector $4\frac{1}{4}$ inches or more in aperture. He should gather as recommended supplies publications, handbooks, ephemerides, drawing pencils, papers, filters, etc.

Subject matter treated in the program includes the estimation of seeing and transparency on numerical scales, the computing of the Moon's selenographic colongitude and the central meridians of Mars and Jupiter, and the use of appropriate portions of The American Ephemeris and Nautical Almanac. Selected past JALPO papers showing observational methods are studied. The student is assisted to develop skill in lunar and planetary drawing and in timing transits of surface features of Jupiter across the central meridian. Finally, the successful and persistent participant is certified to be a graduate of the Training Program.

OBSERVATIONS AND COMMENTS

Photograph of Comet Kohoutek. The attention of readers is invited to Mr. Marvin J. Mayo's photograph of this recent famous visitor on page 255. Mr. Mayo is keenly interested in correspondence with other comet photographers. His address is: 10915 Rose Ave., Apt. 4, Los Angeles, California 90034.

Front Cover Drawing of Jupiter. The drawing mentioned, by Mr. Ron Doel, shows the Great Red Spot, the South Temperate Zone oval DE, and many other features discussed in the Jupiter articles in this issue. The major belts were brown, the Red Spot was red-orange, and the zones were a dull white. Mr. Doel is now a student at Northwestern University. In Our Next Issue. Articles planned for Vol. 25, Nos. 1-2 include a comprehensive report on ALPO studies of Lunar Transient Phenomena and Section Reports on Jupiter and Venus observational studies. You will not want to miss them!

The Strolling Astronomer

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STAFF