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Photograph of Comet Kohoutek 1973f on November 27, 1973, 12 hrs., 3 mins.-12 hrs., 11 mins., Universal Time. Taken by John Laborde with a 10-inch, f/5.6 Newtonian reflector. Site 5,300 feet high Mt. Laguna near San Diego, California. Exposure 8 minutes, 103 af spectroscopic film, developed in MWP-2. The scale of the original print is 12.1 minutes of arc per inch. Position angle of tail about 283°. The bright star on the left edge of the print is 61 Virginis. Notes, photographs, and sketches of Comet Kohoutek appear on pages 177-181 and 208-210.

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ASSOCIATION OF LUNAR & PLANETARY OBSERVERS
ALPO

Founded In 1947

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ABC Print—Las Cruces

MARS 1969 OPPOSITION PERIOD - ALPO REPORT IV

By: C. F. Capen, ALPO Mars Recorder

This Report describes the aspects and behavior of the Martian albedo contrast features (light and dark areas) during the two months centered on the opposition date of May 31, 1969 as recorded by ALPO observers. These data were chiefly responsible for the fine details shown on the photovisual 1969 Mars Chart presented in Report III (Ref. 1). Refer to the ALPO 1967 and 1969 Mars Charts for seasonal and secular changes (Refs. 1, 2). The 1967 chart depicts the Martian surface during northern hemisphere summer and southern winter from 90°-180° L_s, and the 1969 chart gives overlapping seasonal coverage of Martian northern summer and autumn from 110°-270° L_s.

Since the publication of Mars 1969 - ALPO Report I in August, 1970, additional 1969 Mars observations, photos, and drawings have been received from K. Brasch, T. Cave, E. Cross, S. Ebisawa, W. Haas, J. Hobart, D. Louderback, T. Ross, and B. Salmon. The observations by E. Cross were particularly important because they extended the end of the apparition 13° L_s, from 31 January to 25 February, 1970, which gives a Martian seasonal coverage from April MD (Martian Date) 35° L_s through mid-February MD 327° L_s. The total apparition planetocentric orbital coverage was thus 292° of L_s, which is 81% of the entire Martian year. Refer to the observational coverage shown on the seasonal protractor in the Mars 1969 ALPO Report II (Ref. 3).

A selection of May and June TD (Terrestrial Date) disk drawings and photographs has been made from the ALPO Mars Section file for reference and illustration of this report; see Figures 2, 3, and 4. They were chiefly made with the aid of Red, Orange, or Green color filters; or with Integrated light using no filters. The observations extend from 22 Aug. MD (149° L_s) through 24 September MD (182° L_s) in the northern hemisphere. During the period of closest approach on June 10, 1969, when the disk diameter was 19.5 arcseconds, and with good seeing conditions (6-9 on Standard Seeing Scale), the following telescopic aperture resolution was theoretically possible on the surface of Mars: 8-inch/198 km; 10-inch/155 km; 12-inch/132 km; 16-inch/101 km; 24-inch/66 km; 82-inch/19 km. However, because of the intrinsic nature of most Martian albedo features as revealed by Mariners VI and VII, the contrast ability of the telescope is more important than resolution. The 1969 observed features and their changes are next discussed in order of increasing west longitude.

The MERIDIANI SINUS and its environs were well observed and displayed many fine seasonal darkenings in the surrounding light areas. Visual drawings and photographs by K. Brasch (5/24 (May 24)), R. McClowry (5/28), T. Cave (5/26), C. Capen (5/21, 25, 29, 30, 31), B. Salmon (5/26), and R. Hartman (5/31) showed the tri-structure or three-prongs of the Meridian Bay. The east prong, Aken Fons (longitude 352°; latitude -02°), the middle prong, Lex Fons (01°; -01°), and the small curved west prong identified by G. Fournier in 1907-12 as Argus (08°; -08°), and named Brangaena by S. Ebisawa in 1956, were easily recorded on photographs. An irregular dark patch was seen by C. Capen (5/29, 30, 31) between Aken and Lex in the Fastigium Aryn at the position 357°; +02° (Ref. 5). This darkening gave a dual character to the Lex Fons prong, as drawn by G. de Vaucouleurs on his 1939 Chart of Mars. This double feature was named Fontis Valkyrii in 1956 by S. Ebisawa so that it appears to be a summer seasonal occurrence. Refer to the regional chart shown as Fig. 1 of this paper. The Meridiani Sinus regional chart rendered from Mariner '69 TV-photos by C. A. Cross for RAND (Ref. 4) showed it as a combination of a dark irregular albedo patch and several dark-floored craters. The ALPO observers recorded several dark blotches within the Meridiani proper, which have turned out to be large, single craters or concentrated groups of dark-floored craters in Mariner photography. The Lowellian feature, Olympia Depressio (354°; -11°) was one of these features positioned in the southern part of Meridiani. During this apparition, each of the three prongs struck an average center-line angle with the equatorial parallel as follows: Aken, 60°; Lex, 68°; Argus, 115°. The dusky filling-in between the two large prongs and their respective tilt explain and confirm the quadrangular aspect reported by early observers: Schroeter (1798), Kunowsky (1821-2), Beer-Maedler (1839), and Galle (1839).

The GEHON Canal (358°; +15°) was reported to be of low contrast, but was easily observed as a broad and dual feature by K. Brasch, T. Cave, E. Cross, K. Krisciunas, R. Hartman, R. McClowry, T. Osawa, and J. Westfall. Color photos and drawings obtained with the 82-inch McDonald reflector by C. Capen and R. Hartman on May 30-31 showed this canal to be of a double character, and to be combined with a connecting arcuate structure located at 355°; +10°. This aspect of the Gehon is shown best in Mariner '69 7F67, and 6F32 photos.

The EDOM (345°; -04) often appeared light or bright with excellent contrast and registered as a large circular structure in drawings and photos by T. Osawa (5/03, 04; 6/08, 09), T. Cave (5/26, 28), and C. Capen (5/21, 29, 30, 31; 6/1). Mariner '69 photos 7F66 and 7F67 showed the Edom to be a large flat-floored oval crater 600 km. in diameter with a light interior and with relatively dark encompassing walls (Ref. 7). The curved section of the NE wall was seen by several observers and is called Labotas (345°; +02°), which connects the Sigeus Portus to the Aken Fons (352°; -02°). The SW section of the wall can be seen on the best photos, and it has the name of Ajax (348°; -07°) after de Vaucouleurs.

Three faint, curved streaks, the NEUDRUS I (01°; -15°) NEUDRUS II (05°; -15°), and IANI FRETUM (08°; -12°), were collectively noted across the Deucalionis connecting the southwest part of Meridiani to the Margaritifer Sinus by D. Cave (6/28), R. Hartman (5/31), T. Osawa (5/02, 03, 04; 6/1, 8), and C. Capen (5/25, 29, 31). These difficult seasonal objects were well drawn by J. Inge, Lowell Observatory staff artist, on the 1969 Mars Map (Ref. 6). Refer also to Fig. 1.

The ARAM (12°; -05°) was often bright white with morning frosts or fogs. According to ALPO observations, these brightenings usually disappeared by Martian high-noon. When Aram was bright, the Iani Fretum stood out in strong contrast upon the disk.

The Gulf of Pearls, MARGARITIFER SINUS (20°; -10°) was well defined with various dark clumps noted within the Sinus by A. Heath, K. Simmons, K. Krisciunas, E. Mayer, E. Cross, T. Osawa, T. Cave, R. Gordon, and others. It had a fairly strong, curved east component that connected smoothly with the Pandorae Fretum. The northern tip was the darkest part, and it appeared double near opposition in C. Capen's drawings and photos (5/21, 25, 29, 31). The Dargamanes, or spine-streak through the Margaritifer, was not positively identified during the 1969 apparition. The surrounding medium-shaded narrow and curved region on the southern border of the Margaritifer known as the PYRRHAE R. (30°; -22°) and EOS (37°; -15°) had 4 to 6 radiating dark streaks. The S-W ones were identified as Triston (25°; -24°); a projection at Arsinoes (35°; -20°); and Aurorae Fr. (35°; -12°). This area is the region of "chaotic terrain". The Eos displayed some brightening during this epoch when the subsolar and subearth points coincided.

The OXIA PALUS was especially a well defined triangular structure to E. Mayer (5/16, 21), T. Osawa (5/3, 4), B. Salmon (5/21), T. Cave (5/26), and C. Capen (5/21, 25, 29). Mariner photography showed this feature to be composed of an irregular albedo marking surrounding a triangular grouping of three or four craters (Ref. 7).

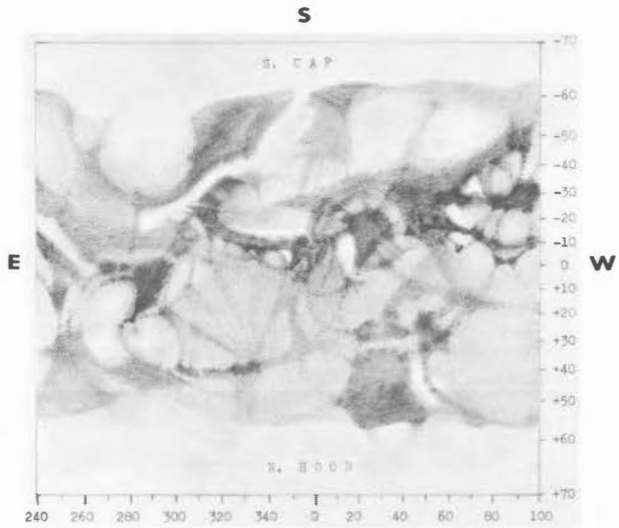
A vague darkening appeared in the Chryse Desert contiguous to the west border of the Margaritifer on the Hydrae Sinus early in May TD, according to T. Osawa (5/02, 04). As opposition approached, this feature was recorded as a vast, medium-contrast darkening on quality photographs M690529R0832 and M690531R0945 and in the drawings of J. Mitchell (5/20), E. Mayer (5/21), and Capen (5/21, 25, 30, 31). The author named this phenomenon the "Hydrae darkening". Refer to Fig. 1 and Refs. 1, 6. Mariner '69 6F31 and 6F33 show the extent and dark contrast of this feature which may be a seasonal or secular event.

The Venusian Sea, ACIDALIUM MARE, was, as usual, the most easily observed feature in the northern hemisphere. This large, graceful feature held a normal seasonal appearance with defined borders. The Callirrhoes S. (30°; +50°) area was the darkest part and, because of its color contrast with the light ocher Cydonia Desert, gave a dark greenish cast to this part of the Acidalium, according to E. Cross, E. Mayer, C. Capen, and J. Mitchell. Several dark concentrations were recorded by observers with 12- to 24-inch apertures. They were identified as Tuderis F. (14°; +38°), Scheria Ins. (29°; +40°), Acadinus F. (40°; +42°), and Acidalia D. (49°; +55°) on the Tanais. From June TD the Acidalium was mostly covered with dense, morning limb mists. The North Polar Hood suddenly formed as a large and dense entity about June 4 TD, which covered the northern part of the Mare to about +53° latitude. Mariner '69 data is of little use in this region. Mariner '71 photos show this feature to be a vast smooth and featureless region.

To the north, the BALTIA (42°; +63°) was seasonally a light ocher and was sharply outlined by the Jaxartes (22°; +65°) and Siton (60°; +65°) canal-streaks.

On the east, the NIX CYDONIA (03°; +40°) occasionally appeared light, but not bright, in integrated-, yellow-, and green-light during this period. Later in the Martian fall it became bright.

The ACHILLIS PONS (30°; +36°), or bridge of Achilles, was a fairly light and broad



1969 REGIONAL MARS MAP

Figure 1. A 1969 Regional Mars Map displaying the fine surface details which were observed by ALPO observers during the opposition period, May 1 to June 30, 1969 TD. Secular changes and late Martian northern summer (149°-182° L_S) seasonal aspects are in evidence. Prepared by C. F. Capen. See text of his Mars Report for details.

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streak separating the south border of the Acidalium from the Niliacus Lacus. A dark streak (18°; +35°) blocked its east end connecting Jordanis F. to Tuderis F.

The Lake of the Nile, NILIACUS LACUS (32°; +27°), was a prominent feature exhibiting five main concentrations, four of which have names: Jordanis F. (20°; +33°); Endus F. (by Capen, 19°; +26°); Endoris F. (30°; +23°); and Engedii F. (38°; +21°).

Leading off SW from the Acidalium is the NILOKERAS I & II (55°; +28°), Horn of the Nile, which was extremely prominent and full of seasonal detail as shown by the observations of W. Haas, J. Mitchell, E. Mayer, A. Heath, D. Cave, T. Cave, B. Salmon, and R. Rhoads, and upon photos by C. Capen. Within the Nilokeras the Idaeus F. (53°; +35°) and the Achillis F. (53°; +28°) were extremely darkened and broadened since 1967. See photo M69 05 25 R 0741UT. Mariner photos show a few medium size craters and a place of subsidence.

On the western border of Acidalium lies a rather light section of the Tempe Desert, which includes the NIX TANAICA (55°; +52°). This entire area exhibited a seasonal bright covering, as shown in Fig. 1 and photos M69 05 29 M 0836UT and M69 05 29 G 0841UT.

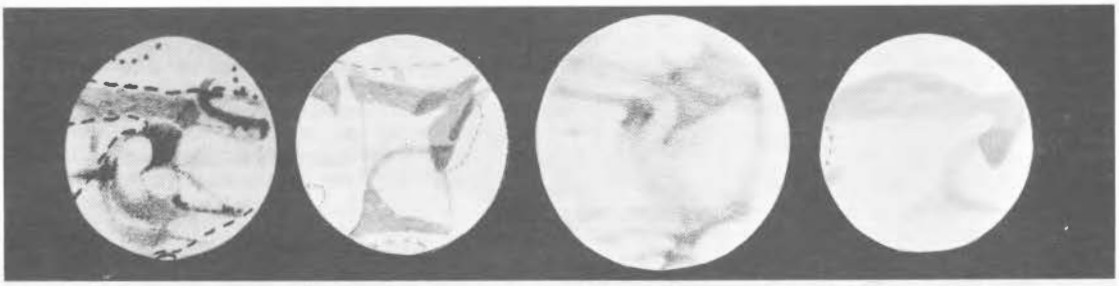
A broad and medium dark streak named TEMPES (63°; +47°; 1963-Capen) separated the above area from the Tempe. It was easily photographed, although it was not so intense as in 1965 and 1967 except when surrounded by local brightening. Mariner IX shows this area to be a well defined and rough area consisting of rills or valleys and many medium size craters stretching between Idaeus F. and Acidalius F. After an inspection of the topography, it is difficult to understand how this feature remained undetected by the telescope for as long as it did.

The AURORAE S. (50°; -13°) had its usual dark gray appearance. This Bay of the Dawn was a black shade in its northern part, including the Gangis S. and Jamunae S. Several dark concentrations were recorded within its borders.

The AGATHODAEMON Canal (65°; -14°) was so intense that it could be detected 2/3 of the way across the Aurorae to the east and was easily seen stretching westward through the Ceti L. (68°; -15°) and the Melos L. (73°; -12°) by all observers. This narrow feature continued on as the COPRATES Canal (85°; -09°), connecting the Melos L. with the Noctis L. (92°; -10°) and forming the south border of the Tithonius L. complex. Mariner IX photography shows the Agathodaemon-Coprates canal to be the remarkable Grand Canyon Lands of Mars, which are estimated to be 3 km. deep. At some points along this vast canyon the bottom is 0.5 km. below the mean elevation of 6.1 mb atmospheric pressure, which means that H_2O could remain in a liquid state. Erosional tributaries are found along the southern rim.

The four main oases and connecting dark streaks of the TITHONIUS L. (Coprates Triangle) were noted by T. Cave, B. Rhoads, T. Osawa, B. Salmon, K. Krisciunas, and J. Mitchell.

Fig. 2 MARS - 1969 OPPOSITION OBSERVATIONS MAY 1 - 24



M 69 05 01 R-B
1215UT;CM 283°
24"Cass; 395X
S6;T5;C.CAPEN

M 69 05 02 I
1125UT;CM 270°
12.5"Newt;305X
S5;T6; W.HAAS

M 69 05 02 I
1735UT;CM 05°
8"Refl; 286X
S4;T4;T.OSAWA

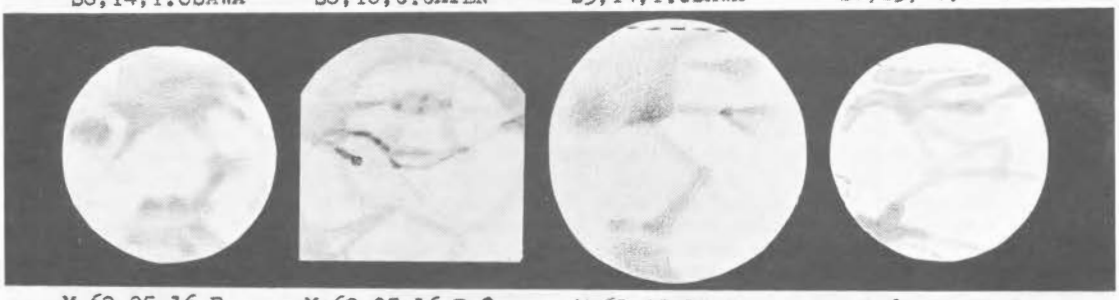
M 69 05 03 R-B
1130UT;CM 253°
9.5"Mack; 300X
S3;T5;R.RHOADS

M 69 05 04 I
1730UT;CM341°
8"Refl; 286X
S6;T4;T.OSAWA

M 69 05 09 R-V
1120UT;CM 200°
24"Cass; 825X
S8;T6;C.CAPEN

M 69 05 11 I
1645UT;CM 267°
8"Refl; 286X
S5;T4;T.OSAWA

M 69 05 15 R-B
1210UT;CM 168°
24"Cass; 825X
S6;T5; C.CAPEN

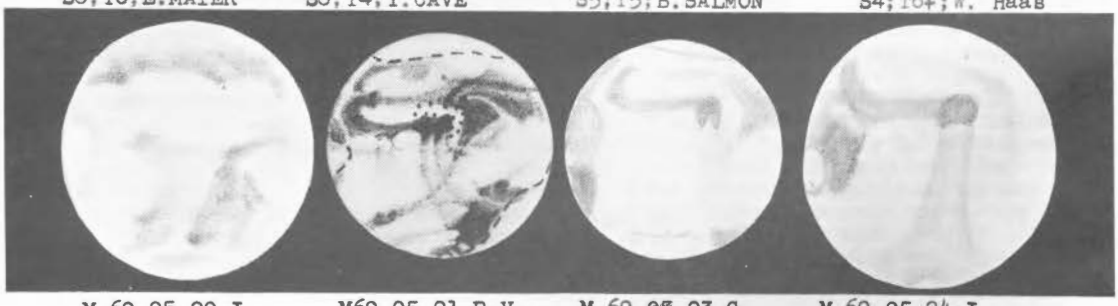


M 69 05 16 R
0425UT;CM032°
6"Newt; 300X
S8;T6;E.MAYER

M 69 05 16 R-O
0705UT;CM 081°
12.5"Newt;500X
S8;T4;T.CAVE

M 69 05 19 I
0720UT;CM 058°
12.5"Newt;425X
S5;T5;B.SALMON

M 69 05 20 I
0845UT;CM 070°
12.5"Newt;300X
S4;T6+;W. Haas



M 69 05 20 I
1605UT;CM 177°
8"Refl; 286X
S5;T4;T.OSAWA

M69 05 21 R-V
0515UT;CM 010°
82"coudé;1000X
S6;T6-;C.CAPEN

M 69 05 23 G
0350UT;CM 335°
3.5" Cat; 200X
S5;T4;R.GORDON

M 69 05 24 I
0510UT;CM 340°
5"Refr; 250X
S4;T4:K.BRASCH

Fig. 3 MARS - 1969 OPPOSITION OBSERVATIONS MAY 25 - 31

M 69 05 25 R
0741UT; CM010°
82"coudé photo
S6; T6; C.CAPEN

M 69 05 26 R
0630UT; CM343°
12.5"Newt; 500X
S9; T5; T. CAVE

M 69 05 27 I
0430UT; CM306°
12.5"Newt; 400X
S4; T3; B.SALMON

M 69 05 29 R-B
0505UT; CM296°
12.5"Cass; 636X
S6; J.MITCHELL

M 69 05 29 R
0639UT; CM320°
82"coudé photo
S9; T6; C.CAPEN

M 69 05 29 G
0646UT; CM321°
82"coudé photo
S8; T6; C.CAPEN

M 69 05 29 M
0653UT; CM323°
82"coudé photo
S8; T6; C.CAPEN

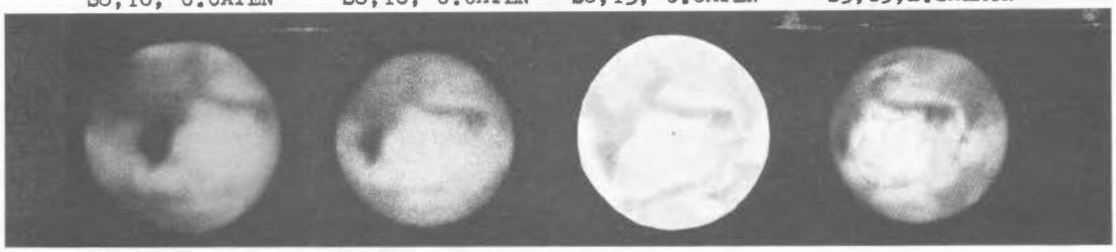
M 69 05 29 R
0832UT; CM346°
82"Hi-contrast
S10; T6; C.CAPEN

M 69 05 29 M
0836UT; CM349°
82"coudé photo
S8; T6; C.CAPEN

M 69 05 29 G
0841UT; CM350°
82"coudé photo
S8; T6; C.CAPEN

M 69 05 30 R-V
0640UT; CM310°
82"coudé; 1000X
S8; T5; C.CAPEN

M 69 05 31 I
0630UT; CM299°
12.5"Newt; 450X
S5; T3; B.SALMON



M 69 05 31 G
0805UT; CM324°
82"coudé photo
S8; T5; C.CAPEN

M 69 05 31 M
0813UT; CM325°
82"coudé photo
S8; T5; C.CAPEN

M 69 05 31 I
0911UT; CM340°
82"photovisual
S8; R.HARTMAN

M 69 05 31 R
0945UT: CM346°
82"photovisual
S9; T5; C.CAPEN

These observers recorded the aspect of the Eye-of-Mars, the SOLIS LACUS (85°; -28°) and THAUMASIA region. The Helli D., Fulgoris D., Phoebi D., Lucis Portus, and Tauri F. were recorded in the Solis L. by T. Osawa (5/31) and T. Cave (5/16). The radiating spokes were the Nectar, Ambrosia, Bathys, Eosphoros, and Geryon. The overview of the Lake-of-the-Sun was similar to that in 1954.

The JUVENTAE FONS (63°; -05°) and the connecting Baetis were quite dark during this epoch. The Juventae consisted of two rather circular patches lying on a SW-NE line.

The double Ganges, Lunae Lacus, and Uranius were clearly drawn by E. Mayer (5/16), W. Haas (5/20), T. Osawa (5/31), and A. Heath (6/16).

The difficult region of the Tempe-Arcadia-Amazonis was observed by the astute T. Osawa with his 8-inch Newtonian. He noted the Pavonis L., Mareotis L., Biblis F., and the Ceraunius streak.

The light PHAETHONTIS (150°; -45°) was seen; however, the Icaria (130°; -45°) at its eastern end was dark and filled in. The BOSPOROS and AONIUS SINUS were drawn quite dark.

The MEMNONIA (145°; -15°) had a bright patch on it during the opposition period, and it contrasted with the dark MARE SIRENUM to the south. Sirenum S. (120°; -30°), Gorgonum (148°; -28°), Gigantum S. (160°; -22°), and Titanum S. (166°; -18°) were identified along the north border of the Mare. The TARTARUS canal (180°; 00°) was seen coming off the western tip of Sirenum at Titanum S. and extending across Mesogaea to Trivium Charontis.

The TRIVIUM CHARONTIS (200°; +15°) and CERBERUS (210°; +10°) exhibited good contrast to most observers. The Laestrygon, Cyclops, and Cerberus canals were seen to the south of the Underworld Ferryman. The Trivium was triangular, consisting of three dark blotches. The Erebus streak (190°; +20°) to the NE was noted by Capen, Salmon, Hobart, and Mitchell. The Hades (192°; +27°) leading to Propontis I and the Styx (199°; +25°) leading to Hecates L. were well recorded. See Mariner 7F80-7F84 TV frames.

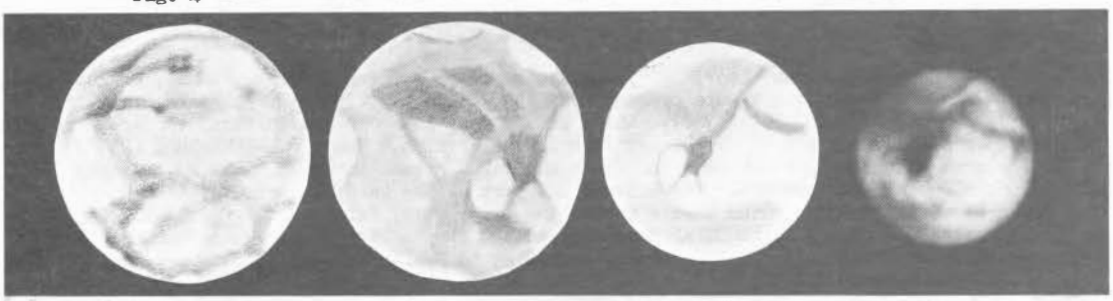
The blessed land of the dead, ELYSIUM, was not brilliant, but was seen by most observers during May and June, 1969 as light to white. It definitely displayed meteorological activity. The Albor (205°; +18°) was the brightest part of the Elysium volcanic shield. This light area was framed by the darker contrasting features: Cerberus I, the circular Pambotis L., Eunostos I, a weak Hephaestus L., Hyblaeus, Morpheos L., Chaos, Hecates L. in the round, and the river Styx. The Aesacus (200°; +45°), which was vaguely seen in 1967, and the Anian (225°; +40°) were not present. The Aethiops II was very dark and broad as it curved SW to the Thoana Palus.

The four components of the Propontis Complex were very dark and enlarged and demonstrated secular change. PROPONTIS I (182°; +40°) continued its SW secular trip toward Hades. It was the darkest of the four. The irregular EUXINUS L. (155°; +43°) appeared SW of Castorius. In 1967 the CASTORIUS L. (142°; +56°) joined the PROPONTIS II to form a single dark bar-like feature. They both faded somewhat in 1969 to become individuals again.

STYMPHALIUS L. (205°; +54°) and SITHONIUS L. (233°; +56°) were gross and notable entities in the lightened CEBRENIA Desert. Mariner 69 photos 6F12, 6F15, 7F50, and 7F52 to 7F55 compare this region with ALPO observations (Ref. 7).

Since 1958 the NODUS LAOCOÖNTIS has displayed the largest secular change of any dark Martian feature. In 1965 and 1967 it appeared visually as a dark green, rather broad, and irregular feature in the Aethiops desert with a centroidal position at about 252°; +17°. It showed up well in color photos. In 1969, ALPO observers recorded it as having intense contrast and with an elongated shape in a N-S direction located at 246°; +15°. This apparent change in its centroid location was only a pseudo-shift eastward. What we believe actually occurred, as determined from measurements of photographs, was a disappearance of the western part of the 1965-67 Nodus. However, there had been a southward increase in darkening along the Serpentinus and Amenthes canals since the 1967 apparition, which shifted the centroid of the Nodus a few degrees south. The Laocoöntis has been a remarkable secular feature for telescopists since 1954. This later phase of its secular development, with 1963 to 1969 observational data, indicates that the 1969 appearance is not that of an entirely new surface feature, as announced by G. de Vaucouleurs, but is the same feature modified by a slow secular process. We feel that the Nodus is in its final phase of evolution. This feature should prove to be most interesting

Fig. 4 MARS - 1969 OPPOSITION OBSERVATIONS MAY 31 - JUNE 30

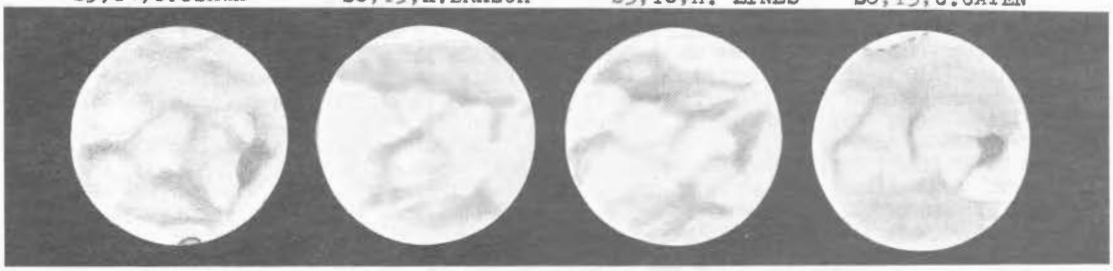


M 69 05 31 I
1555UT; CM077°
8"Newt; 286X
S5; T4; T. OSAWA

M 69 06 01 O
0430UT; CM261°
5"Refr; 250X
S6; T3; K. BRASCH

M 69 06 01 I
0630UT; CM291°
16"Newt; 400X
S5; T6; H. LINES

M 69 06 01 C
0730UT; CM305°
82"photovisual
S8; T5; C. CAPEN

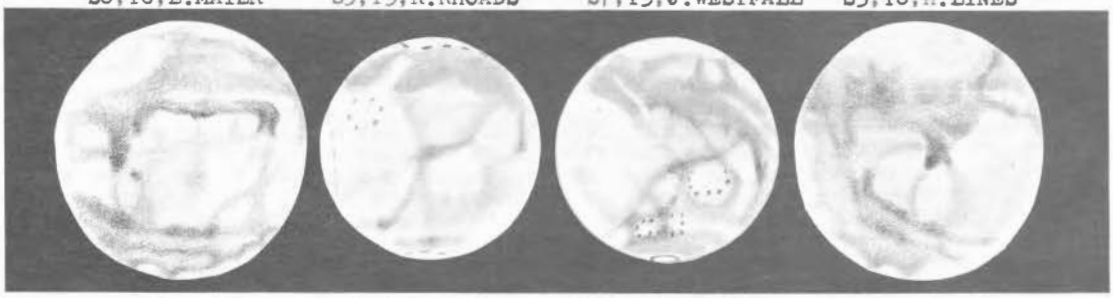


M 69 06 04 I
0445UT; CM230°
6"Newt; 220X
S8; T6; E. MAYER

M 69 06 06 I
0445UT; CM221°
24"Refr; 500X
S3; T5; R. RHOADS

M 69 06 06 G
0615UT; CM240°
10"Cass; 330X
S7; T5; J. WESTFALL

M 69 06 08 I
0815UT; CM254°
16"Newt; 200X
S5; T6; H. LINES

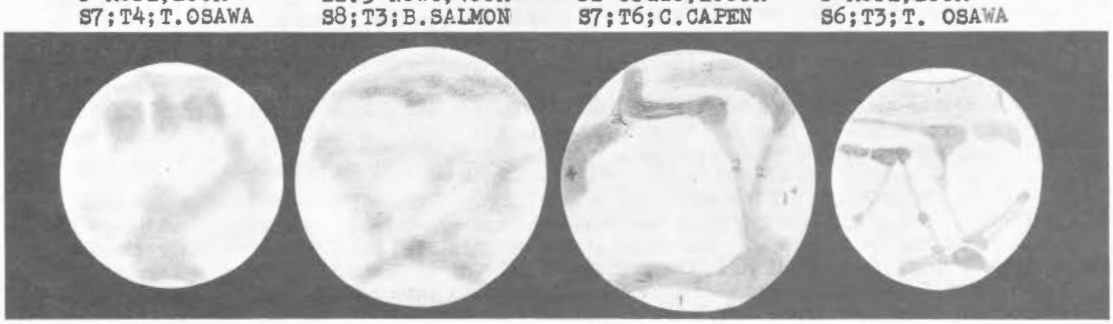


M 69 06 09 I
1310UT; CM318°
8"Refl; 286X
S7; T4; T. OSAWA

M 69 06 10 I
0550UT; CM200°
12.5"Newt; 400X
S8; T3; B. SALMON

M 69 06 12 R-G
0620UT; CM191°
82"coudé; 1000X
S7; T6; C. CAPEN

M 69 06 13 I
1305UT; CM281°
8"Refl; 286X
S6; T3; T. OSAWA



M 69 06 16 I
2230UT; CM032°
12"Refl; 190X
S5; T5; A. HEATH

M 69 06 26 I
1320 UT; CM 169°
8" Refl.; 286X
S5; T3; T. OSAWA

M 69 06 27 I
0145UT; CM350°
8"Refl; 360X
D. LOUDERBACK

M 69 06 30 I
0535UT; CM020°
12.5"Newt; 305X
S4; T6; W. HAAS

through the 1971 and 1973 apparitions. Mariner 69 photos 6F17 and 7F57 to 7F60 show the Nodus to have the same general shape and intensity as shown in the drawings of H. Lines, Rhoads, Mayer, Salmon, Westfall, Mitchell, Haas, Osawa, and Capen.

The Wedge-of-Casius (265°; +40°) and its environs appeared normal. Dense, bright, morning aerosols and frosts were present over the ISIDIS R. (275°; +20°), NEITH R. (275°; +30°), and MERORE IN. (285°; +30°). White clouds were seen over these first two areas on May 4 by J. Mitchell and on May 24 and June 1 by K. Brasch. The THOTH-NEPENTHES (265°; +15°) arch was a disappointment. The Thoth was vague or was not seen. The Nubis Lacus (270°; +22°) was not present. Its absence was part of the general secular fading of features in this region which also affected the Laocoöntis. At the end of June TD a dull white extension of the North Polar Hood covered the Utopia-Dioscuris-Cydonia south to the Ismenius L.-Protonilus to +45° latitude, according to D. Louderback, K. Simmons, R. Rhoads, and B. Salmon.

We now come to Padre Secchi's "blue Scorpion", the SYRTIS MAJOR. This region happened to be present on the disk of Mars for American and Japanese observers during the closest approach period. Exceptional observing conditions were shared by Brasch, Capen, Mayer, Hartman, and Osawa. The general appearance of the Grand Syrtis was a dark blue-black triangle with three graceful curving tentacles. It was a dense black triangle in red light. The NW section was the darkest area on the planet. South of the Moreris L. junction (282°; +06°) the Syrtis faded into the half-tones of Crocea-Oenotria. Refer to the observations of Haas (5/02), Rhoads (5/03), Salmon (5/27, 31), Capen (5/29, 30; 6/01), H. Lines (6/01, 08), Brasch (6/01), and Osawa (6/10, 13). The ANTIGONES F. (296°; +20°) and MOERIS L. (276°; +04°) were strong features. The Nilosyrtis, Astusapes, Astaboras I and II, Pallas (265°; +02°), and Nepenthes (double) were well defined. Fine detail and several new features were added to the chart of this region when Capen experienced 8-9 seeing, 0.08 to 0.2 arcseconds image motion, while observing with the McDonald 82-inch reflector (Ref. 5). The oases then appeared to be composed of small triangular blotches and circular objects; the dark maria consisted of various geometric structures and parallel filaments; and canal-like features broke up into dark gray, irregular, and circular patches and parallel filaments. During moments of excellent seeing, more fine detail was seen than could be recorded. In the Aeria desert at areographic longitude 295° to 340°; latitude +49° to -02°, along the west side of the Syrtis, a blotchy linear feature was seen contiguous to the light Nymphaeum area connecting Antigones F. to TYPHONII S. (310°; -02°). A half-tone triangular oasis was located near the center of this new linear feature. It is not known for certain if this is what used to be called the Asopus canal on old Antoniadi maps. Two connecting canal-like features also noted in this area have not previously been mapped. The east border of the Syrtis was double and broken. The Nilosyrtis was a curved chain of irregular shaped blotches. Refer to Fig. 1 and Mariner 7F30, 7F32, 7F33, and 7F62 photos. The COLOE PALUS (303°; +42°) was very dark gray with definite geometric structure and was a completely detached entity from the Boreosyrtis-Protonilus. The high-resolution photos M69 05 29 R 0639UT, 05 29 M 0653UT, 05 31 R 0945UT, and 06 01 C 0730UT show this aspect. T. Cave made an interesting observation of two dark circular features just off the north tip of Syrtis with a 24-inch Cassegrain reflector. One spot was located on the curve of the Nilosyrtis (276°; +25°) and the other in the Meroe In. (285°; +25°). See Mariner photos 7F62 and 7F86.

The IAPYGIA (300°; -15°) appeared a normal smoky contrast. Some 82-inch reflector photos revealed a lighter and semicircular feature within, located at 304°; -14°. Mariner photos 7F63, 7F67, and 7F88-7F93 show this albedo-topographic feature to be a large circular basin 8° or 464 km. in diameter. Barnard and Melish are credited with seeing circular objects similar to this one (Ref. 8).

Farther to the south, in the land of the Greeks, the HELLAS basin was partly covered with a white extension from the South Cap, while its north one-half was a dark ocher hue. Antoniadi has described this color as a rosy hue.

The HELLESPONTUS (328°; -50°) and SERPENTIS M. (320°; -28°) were intense and well defined. During this period these two features became separated by a bright, white-yellow cloud from May 28 to June 4. The cloud streak scintillated brilliantly to observers who saw it through a green filter. The presence of the cloud enhanced the dark contrasts of contiguous features, and gave an anomolus effect north into Ionium-Iapygia. The Mariner fly-bys arrived two months too late to witness this event.

The land of Noah, NOACHIS, showed a strange gross, half-tone darkening in the south which was visible in small telescopes (Ref. 6). This half-tone has been noted in apparitions of decades past and is suspected to be a seasonal spreading. The PANDORAE FR. exhibited a similar seasonal intensification. It extended a smoky appearance E-W from the

borders of the Margaritifer and Erythraeum M. eastward to connect to the curved tail of the Serpent Sea, according to the drawings of Haas, Hartman, Louderback, Osawa, Mitchell, Mayer, Rhoads, Cave, and others. The Pandorae may have been enhanced during this period by the presence of the yellow cloud and its resulting lighter haze.

We now come to the flooded land of DEUCALIONIS R. (345°; -18°). It displayed much seasonal activity. It had a light, rosy-ocher hue; and there were numerous bright patches seen along its north border of the Xisuthri, some of which were photographed in color by Capen. These white areas were brilliant to the eye and scintillated in good seeing, an effect probably due to the fact that the subsolar point and subearth point were commensurate at a nearby latitude upon the disk.

Moving north on to the perfumed sea of Sheba, the SABAEUS S. was its usual sooty-black and charcoal gray shade, with the intense areas of Pharos (Zeos, 322°; -12°) and Sigeus Portus (335°; -08°) appearing in a black-blue hue similar to the north tip of Syrtis Major. The Sabaeus was a striking sight to all observers with large or small instruments, especially when viewed through a red W-25 or magenta W-30 filter. When centered full on, it seemed to extend 2/3 of the way across the disk. High-resolution observations showed the Xisuthrian coast (south) to be serrated and to appear double. C. Cross' regional chart (Ref. 4) shows the serrated effect as due to a series of light-floored craters and surrounding dark terra.

Within the light deserts of Aeria and Moab many prominent oases, blotches, and wispy canal-like features were readily seen and were photographed by observers with telescopes of 8 inches or more aperture. West of Deltoton S., just off of the dark Typhonii S., was a medium dark oasis patch, called here Typhon Fons (319°; -02°). See photos 7F64 and 7F65. From this patch extended the Typhon canal to the west, fading from view at 335° longitude. To the south ran a second parallel streak from Typhonii S. to Sigeus East and Sigeus West. Leaving the dual Sigeus Portus, the Labotas was seen slanting westward at an angle of 145° to the equator while curving around on the north rim of the Edom crater to terminate at the east promontorium of Meridiani Sinus. And so ends our tour de Martien for the 1969 opposition REPORT IV.

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NEWS OF COMET KOHOUTEK

By: Dennis Milon, ALPO Comets Recorder

By mid-November, 1973 Comet Kohoutek 1973f was visible in binoculars in the morning sky and had grown a tail over ½° long. Some 100 reports had been received since the comet was recovered in the morning sky at the end of September, when it was magnitude 10½ in a 6-inch telescope but difficult to find in the twilight. Some early magnitude estimates were made with reference to the nearby AAVSO chart field for S Sextantis, copies of which were mailed out by the Recorder. Later, portions of the Smithsonian Astrophysical Observ-

atory Star Atlas were sent, marked with magnitudes from the SAO Star Catalog. As early as October 2nd, James W. Young noted a tail visually with the 24-inch reflector at the JPL Table Mountain Observatory; and within a month R. B. Minton recorded a 3/4° tail at Tucson, as shown on the photograph reproduced here as Figure 6, which is equal to about six million miles. This result was encouraging for predicting the comet's appearance in the January evening sky, since it represents over twice the length forecast on IAU Circular 2580 by Dr. William Liller of Harvard Observatory. He deduced a maximum tail length of 21° from a study of Comet Arend-Roland of 1957. The coma diameter had grown to 5' or 300,000 miles in early November, when the comet was still two Astronomical Units from the Earth and 1½ A.U. from the Sun.

In a very large telescope a comet has a much different appearance than in an amateur-size one; R. B. Minton reports observing visually with the 61-inch Catalina reflector of the Lunar and Planetary Lab. On November 6.5, U.T. he did not see a stellar nucleus, but rather a bright 2"-3" "false" nucleus which did not have any color. On a two-minute exposure this 12th-magnitude condensation was barely recorded and did not look like a nearby star.

From ALPO visual magnitude estimates from Sept. 29th to Oct. 26th, Charles S. Morris at Purdue University in Indiana found that the comet followed this magnitude formula, adjusted for the standard aperture of 2.67 inches:

$$\text{Mag.} = 4.5 + 5 \log\Delta + 10 \log r, \; n = 4,$$

where 4.5 represents the absolute magnitude, as if a comet were viewed one A.U. from the Earth and one A.U. from the Sun, while n is a measure of the rate of brightening, 4 being an average value. This formula predicts a maximum magnitude of -4, which is fainter than earlier forecasts. However, Brian Marsden of the Smithsonian Observatory advises that Kohoutek could become brighter, especially after perihelion. The Morris formula indicates a magnitude of +1.6 on January 13th and +3.3 on Jan. 23rd for 2-inch binoculars. In the formula r is the distance from the Sun, and Δ is the distance from the Earth.

Starting on July 19th, there have been five mailings from the Comets Recorder about Comet Kohoutek; these now go to 200 observers. Information was also distributed at the Omaha and Stellafane conventions, and I have answered 300 inquiries from many countries. Because of the unusual expense of printing and postage, a $2.00 contribution was requested.

At Goddard Space Flight Center, NASA astronomer Stephen P. Maran has asked for a daily telephone report on Kohoutek observations made by the ALPO, and these will help update a daily news recording, which astronomers can hear by calling 301-441-2666. Dr. Maran, who manages Operation Kohoutek for NASA, has asked for a list of ALPO Kohoutek photographs which will be included in a published directory of observations, telling professional astronomers where to find pictures on a given date.

Another request has come from Klaus Jockers at Sacramento Peak Observatory, who wants gas tail photographs:

> "The Max Planck Institute of Astrophysics, München 40, Föhringer Ring 6, West Germany, plans to evaluate black and white photographs of the plasma tail of Comet Kohoutek 1973f. For this program, daily pictures of the comet tail are needed for the periods Nov. 20 to Dec. 10, Jan. 9 to Feb. 1, and Feb. 8 to Feb. 25. If a Type I (straight, blue) tail is visible, a sequence of six pictures per hour seems most appropriate. Every interested person, equipped with a camera of focal length greater than 100 mm and focal ratio less than f/2.8 which can be guided to the stars, is invited to send in March, 1974 prints of one exposure per day to Ulrich Anzer of the above-mentioned institute or to Klaus Jockers, Sacramento Peak Observatory, Sunspot, New Mexico 88349. He should include information about his equipment, time of observation, exposure time and number of photographs per day. If the pictures are found to be useful the observer will be asked for a loan of the original negatives for a short period of time. Even though panchromatic film is suited to photograph the blue Type I tail, the use of blue filters blocking off all light of wavelength longer than about 4300 Å (like Kodak Wratten 35) or the use of 103-a-0 emulsion seems advisable. Every participant will be informed about the results of the whole program."

In order that we shall have all the necessary photographic information, observers are requested to attach a copy of Figure 5 to each print or slide. Please make your own duplicates of Figure 5.

ALPO COMETS SECTION PHOTOGRAPHIC REPORT COMET_____

Observer_____ UT decimal date of midexposure _____

Address_____

Place of observation_____

Sky conditions_____

Exposure start_____UT End_____UT

Center of field or comet position (1950). R.A._____ Dec._____

Scale of print or slide._____degrees or minutes per inch.

Please indicate North on the print.

Camera focal length, f/no._____aperture_____type_____

Film type_____filter_____developer_____

Tail length (indicate which tail)_____

Position angle of tail (plot on an atlas and measure)_____

Other measurements or star identifications

Figure 5. Form to accompany all photographic observations of Comet Kohoutek 1973f. Its use will insure the completeness of required data items and will make the later analysis of the data easier and more informative. Prepared by Dennis Milon, ALPO Comets Recorder.

Figure 6. Photograph of Comet Kohoutek 1973f on October 27, 1973 at 11^h 50^m, U.T. from JPL's Table Mountain Observatory. Taken by James W. Young and Karen A. Halberg. On the original the tail is ½ to 3/4 of a degree long. 6-inch f/10 lens, II a - O film.

Some observing aids. When the comet is brighter than any star, the planets can be used for naked-eye comparisons, as given in the table reproduced below from The American Ephemeris and Nautical Alamanac. Because atmospheric extinction must be calculated when the comet is near the horizon and comparison stars used are higher, it will be important to give complete details of a magnitude estimate, including the exact time and geographic location; for example, "Comet 1973f was 6/10 of the way from star A to star B at 2^h U.T., as viewed from latitude blank and longitude blank."

The following angular distances in degrees will be useful when the comet has a long tail. They were computed by Roger Sinnott of the ATM's of Boston from a list sent by Thomas Kleine at Hamburger Sternwarte, West Germany.

Alpha Cas - Gamma Cas	4°.7	Alpha UMa - Delta UMa	10°.2	Polaris - Gamma Cas	28°.6

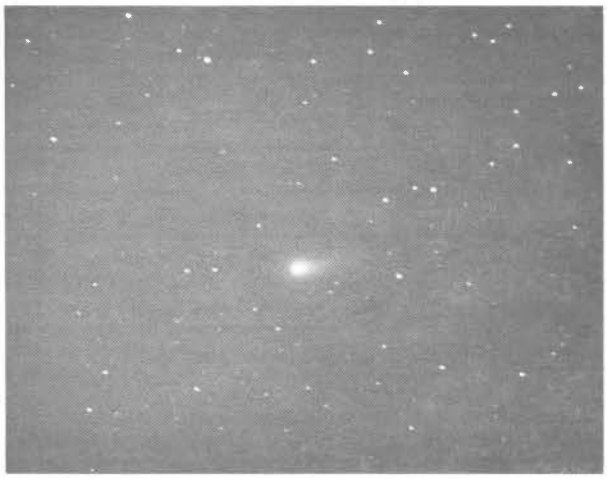

Figure 7. Photograph of Comet Kohoutek 1973f by John Laborde on October 29, 1973 at 12^h26^m - 12^h31^m, U.T. 10-inch, f/5.6 Newtonian reflector, 5-minute exposure, 103a-F film. Development for 10 minutes in MWP-2. Taken in Laguna Mountains about two miles from San Diego State University Observatory. North at top.

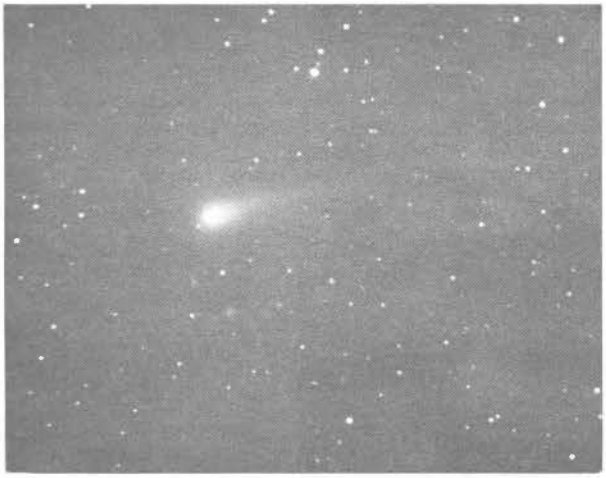

Figure 8. Photograph of Comet Kohoutek 1973f on November 5, 1973 by John Laborde. 15-minute exposure, 12^h0^m - 12^h15^m, U.T. from Mount Laguna. The comet had a tail measured to be one-half degree long and was just north of (above) a faint galaxy.

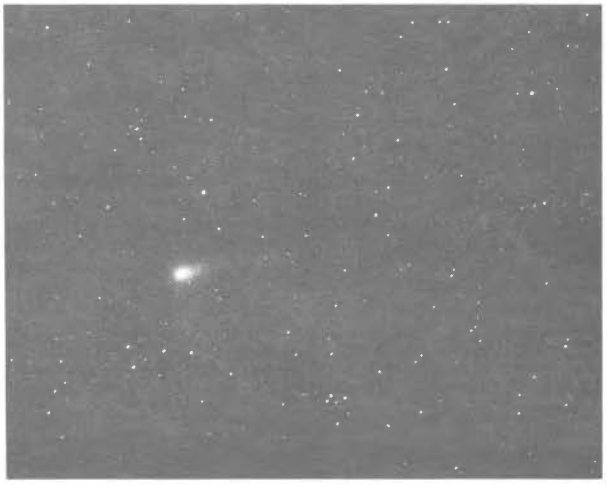

Figure 9. Photograph of Comet Kohoutek 1973f by R. B. Minton of the Lunar and Planetary Laboratory of the University of Arizona. Taken on November 1, 1973, 11^h55^m - 12^h10^m, U.T., from a site in the Catalina Mountains near Tucson. F/3 Schmidt, Tri-X film, no filter. The tail was measured to be 45' long in position angle 282°. The visual magnitude was estimated to be 8.6 in an 8-inch refractor by reference to the SAO Catalogue.

Figure 10. Photograph of Comet Kohoutek 1973f by R. B. Minton with the LPL Schmidt also used for Figure 9. November 6, 1973, 12^h20^m - 12^h35^m, U.T. The tail, 45' long, now had sharper borders than on November 1; and Mr. Minton found that the total magnitude had increased to 8.0 in the 8-inch refractor.

Alpha UMa - Beta UMa	5°.4	Beta UMa - Delta UMa	10°.1	Polaris - Alpha UMa	28°.7
Gamma Cas - Beta Cas	6.2	Beta Cas - Epsilon Cas	13.3	Polaris - Delta UMa	33.6
Gamma Cas - Epsilon Cas	7.3	Alpha UMa - Epsilon UMa	15.2	Polaris - Beta UMa	34.1

Magnitudes of the Planets in 1974

		Mercury	Venus	Mars	Jupiter	Saturn
1974, Jan.	3	-0.7	-4.2	-0.2	-1.6	-0.2
	8	-0.9	-4.1			
	13	-0.9	-3.8	+0.1	-1.6	-0.2
	18	-1.0	-3.5			
	23	-1.0	-3.2	+0.3	-1.5	-0.1
	28	-1.0	-3.4			
Feb.	2	-0.8	-3.7	+0.5	-1.5	0.0
	7	-0.5	-4.0			
	12	+0.1	-4.2	+0.7	-1.5	0.0
	17	+1.0	-4.3			
	22	+2.3	-4.3	+0.9	-1.5	+0.1
	27	+2.6	-4.3			

From The American Ephemeris and Nautical Almanac. Prepared by Betty Goddard, ATM's of Boston.

Comet report forms for visual observations should be used when sending your Kohoutek sightings -- observers are urged to duplicate these themselves, or to obtain them at $2.00 for 50 from the Comets Recorder. There is a sample form on pg. 153 of Vol. 24, Nos. 7-8 of this Journal. To receive the comet announcement service of new discoveries and current observations, send a supply of addressed and stamped long envelopes. Those persons already on this mailing list should send additional postage because of the coming rate increase of January 5th.

Astronomical League Program. Headed by Robert E. Fried, 4610 Orkney Lane, Atlanta, Georgia 30331, who offers an observing kit for $3.00, the AL photography program now asks for 5-by-7 inch prints taken on Tri-X with the following Wratten gelatin filters:

1.) A photograph taken in "continuum" light (reflected sunlight not including any bright band heads) 4200Å. Use a #2E + #35 Wratten Filter together.
2.) A photograph taken in the near red light, 5000Å to 6500Å. Use a #12 Wratten Filter alone.
3.) A photograph taken in the blue-green light 4100Å to 5300Å. Use a #2E + #44A Wratten Filter together.
4.) A photograph taken in the ultraviolet-blue light 3500Å to 4500Å. Use a #34 Wratten Filter alone.

SATURN CENTRAL MERIDIAN EPHEMERIS: 1974

By: John E. Westfall

The two tables on pages 182 and 183 give the longitude of Saturn's geocentric central meridian (C.M.) for the illuminated (apparent) disk for 0^h U.T. for each day in 1974. These tables are a continuation of those for 1970-73, previously published in the J.A.L.-P.O., and incorporate corrections for phase, light-time, and the Saturnicentric longitude of the Earth.

"System I" assumes a sidereal rotation rate of 844°.00/day (period = $10^h14^m13^s.1$), intended for use with features in the NEB, EZ, and SEB. "System II", intended for the

SATURN, 1974

LONGITUDE OF CENTRAL MERIDIAN OF ILLUMINATED DISK

SYSTEM I -- 0^h U.T.

Day	JAN.	FEB.	MAR.	APR.	MAY	JUNE	JULY	AUG.	SEP.	OCT.	NOV.	DEC.
1	274°.5	159°.7	030°.4	270°.9	026°.1	264°.8	020°.1	260°.4	142°.4	262°.2	147°.7	270°.5
2	038.6	283.7	154.3	034.7	149.9	028.6	144.0	024.3	266.3	026.2	271.8	034.6
3	162.7	047.6	278.2	158.6	273.8	152.5	267.8	148.2	030.3	150.2	035.9	158.7
4	286.7	171.6	042.2	282.4	037.6	276.3	031.7	272.1	154.3	274.2	159.9	282.8
5	050.8	295.6	166.1	046.3	161.4	040.1	155.6	036.1	278.3	038.3	284.0	046.9
6	174.9	059.6	290.0	170.1	285.2	164.0	279.4	160.0	042.2	162.3	048.1	171.0
7	298.9	183.6	053.9	294.0	049.1	287.8	043.3	283.9	166.2	286.3	172.2	295.1
8	063.0	307.5	177.8	057.8	172.9	051.7	167.2	047.8	290.2	050.4	296.3	059.2
9	187.0	071.5	301.7	181.7	296.7	175.5	291.0	171.7	054.2	174.4	060.4	183.3
10	311.1	195.5	065.6	305.5	060.6	299.3	054.9	295.6	178.1	298.5	184.4	307.4
11	075.1	319.5	189.5	069.4	184.4	063.2	178.8	059.6	302.1	062.5	308.5	071.5
12	199.2	083.4	313.4	193.2	308.2	187.0	302.6	183.5	066.1	186.5	072.6	195.6
13	323.3	207.4	077.3	317.1	072.0	310.8	066.5	307.4	190.1	310.6	196.7	319.7
14	087.3	331.3	201.2	080.9	195.9	074.7	190.4	071.3	314.1	074.6	320.8	083.9
15	211.3	095.3	325.0	204.7	319.7	198.5	314.3	195.3	078.1	198.7	084.9	208.0
16	335.4	219.3	088.9	328.6	083.5	322.4	078.1	319.2	202.1	322.7	209.0	332.1
17	099.4	343.2	212.8	092.4	207.4	086.2	202.0	083.1	326.1	086.8	333.1	096.2
18	223.4	107.2	336.7	216.3	331.2	210.1	325.9	207.1	090.0	210.8	097.2	220.3
19	347.5	231.1	100.6	340.1	095.0	333.9	089.8	331.0	214.0	334.9	221.3	344.4
20	111.5	355.0	224.5	103.9	218.8	097.7	213.7	095.0	338.0	098.9	345.4	108.5
21	235.5	119.0	348.3	227.8	342.7	221.6	337.6	218.9	102.1	223.0	109.5	232.6
22	359.6	242.9	112.2	351.6	106.5	345.4	101.4	342.8	226.1	347.0	233.6	356.7
23	123.6	006.9	236.1	115.4	230.3	109.3	225.3	106.8	350.1	111.1	357.7	120.8
24	247.6	130.8	359.9	239.3	354.2	233.1	349.2	230.7	114.1	235.2	121.8	244.9
25	011.6	254.7	123.8	003.1	118.0	357.0	113.1	354.7	238.1	359.2	245.9	009.0
26	135.6	018.7	247.7	126.9	241.8	120.8	237.0	118.6	002.1	123.3	010.0	133.1
27	259.6	142.6	011.6	250.8	005.7	244.7	000.9	242.6	126.1	247.4	134.1	257.2
28	023.7	266.5	135.4	014.6	129.5	008.6	124.8	006.5	250.1	011.4	258.2	021.3
29	147.7	-----	259.3	138.4	253.3	132.4	248.7	130.5	014.1	135.5	022.3	145.4
30	271.7	-----	023.1	262.3	017.1	256.3	012.6	254.5	138.2	259.6	146.4	269.5
31	035.7	-----	147.0	-----	141.0	-----	136.5	018.4	-----	023.6	-----	033.6

MOTION OF THE CENTRAL MERIDIAN

01^h -- 035°.2	09^h -- 316°.5	17^h -- 237°.8	10^m -- 005°.9	01^m -- 000°.6
02 -- 070.3	10 -- 351.7	18 -- 273.0	20 -- 011.7	02 -- 001.2
03 -- 105.5	11 -- 026.8	19 -- 308.2	30 -- 017.6	03 -- 001.8
04 -- 140.7	12 -- 062.0	20 -- 343.3	40 -- 023.4	04 -- 002.3
05 -- 175.8	13 -- 097.2	21 -- 018.5	50 -- 029.3	05 -- 002.9
06 -- 211.0	14 -- 132.3	22 -- 053.7		06 -- 003.5
07 -- 246.2	15 -- 167.5	23 -- 088.8		07 -- 004.1
08 -- 281.3	16 -- 202.7	24 -- 124.0		08 -- 004.7
				09 -- 005.3

Figure 11

rest of the ball (excluding the NPR and the SPR), assumes a sidereal rotation rate of 812°.00/day (period = $10^h38^m25^s.4$). These rates are only approximations because latitude-dependent rotation rates for Saturn are more uncertain than, say, for Jupiter; but longitudes calculated from the accompanying tables should give conveniently small drift rates for most features. A.L.P.O. Saturn observers are strongly urged to make central meridian timings, combined with latitude measures (or at least estimates), whenever possible so that these rotation rates, and any future C.M. tables, can be made more accurate.

To find the central meridian at any given time, find the 0^h U.T. central meridian longitude for the appropriate date and System; and then add the hours and minutes correction from the related table, "Motion of the Central Meridian", as shown in the example

SATURN, 1974

LONGITUDE OF CENTRAL MERIDIAN OF ILLUMINATED DISK

SYSTEM II -- 0^h U.T.

Day	JAN.	FEB.	MAR.	APR.	MAY	JUNE	JULY	AUG.	SEP.	OCT.	NOV.	DEC.
1	162°.3	135°.5	190°.3	158°.9	034°.2	001°.0	236°.3	204°.6	174°.5	054°.2	027°.6	270°.3
2	254.4	227.5	282.2	250.7	126.0	092.8	328.1	296.5	266.4	146.2	119.7	002.4
3	346.5	319.5	014.2	342.6	217.9	184.6	060.0	028.4	358.4	238.2	211.8	094.5
4	078.5	051.5	106.1	074.4	309.7	276.5	151.9	120.3	090.4	330.2	303.9	186.6
5	170.6	143.5	198.0	166.3	041.5	008.3	243.7	212.2	182.3	062.3	035.9	278.7
6	262.7	235.4	289.9	258.1	133.4	100.1	335.6	304.1	274.3	154.3	128.0	010.8
7	354.7	327.4	021.8	350.0	225.2	192.0	067.5	036.0	006.3	246.3	220.1	102.9
8	086.8	059.4	113.7	081.9	317.0	283.8	159.3	127.9	098.3	338.4	312.2	195.0
9	178.9	151.4	205.6	173.7	048.8	015.6	251.2	219.9	190.2	070.4	044.2	287.1
10	270.9	243.4	297.5	265.6	140.7	107.5	343.1	311.8	282.2	162.4	136.3	019.2
11	003.0	335.3	029.4	357.4	232.5	199.3	074.9	043.7	014.2	254.5	228.4	111.4
12	095.0	067.3	121.3	089.3	324.3	291.2	166.8	135.6	106.2	346.5	320.5	203.5
13	187.1	159.3	213.2	181.1	056.2	023.0	258.7	227.5	198.1	078.5	052.6	295.6
14	279.1	251.2	305.1	272.9	148.0	114.9	350.6	319.5	290.1	170.6	144.7	027.7
15	011.1	343.2	037.0	004.8	239.8	206.7	082.4	051.4	022.1	262.6	236.8	119.8
16	103.2	075.1	128.9	096.6	331.7	298.5	174.3	143.3	114.1	354.7	328.9	211.9
17	195.2	167.1	220.8	188.5	063.5	030.4	266.2	235.3	206.1	086.7	060.9	304.0
18	287.3	259.0	312.7	280.3	155.3	122.2	358.1	327.2	298.1	178.8	153.0	036.1
19	019.3	351.0	044.5	012.2	247.1	214.1	089.9	059.1	030.1	270.8	245.1	128.2
20	111.3	082.9	136.4	104.0	339.0	305.9	181.8	151.1	122.1	002.9	337.2	220.3
21	203.4	174.9	228.3	195.8	070.8	037.8	273.7	243.0	214.1	094.9	069.3	312.4
22	295.4	266.8	320.2	287.7	162.6	129.6	005.6	334.9	306.1	187.0	161.4	044.5
23	027.4	358.8	052.1	019.5	254.5	221.5	097.5	066.9	038.1	279.0	253.5	136.6
24	119.4	090.7	143.9	111.3	346.3	313.3	189.4	158.8	130.1	011.1	345.6	228.7
25	211.5	182.6	235.8	203.2	078.1	045.2	281.3	250.8	222.1	103.2	077.7	320.8
26	303.5	274.6	327.7	295.0	170.0	137.0	013.2	342.7	314.1	195.2	169.8	052.9
27	035.5	006.5	059.5	026.9	261.8	228.9	105.1	074.7	046.1	287.3	261.9	145.0
28	127.5	098.4	151.4	118.7	353.6	320.7	197.0	166.6	138.1	019.3	354.0	237.1
29	219.5	-----	243.3	210.5	085.5	052.6	288.9	258.6	230.1	111.4	086.1	329.2
30	311.5	-----	335.1	302.4	117.3	144.4	020.8	350.6	322.2	203.5	178.2	061.3
31	043.5	-----	067.0	-----	269.1	-----	112.7	082.5	-----	295.6	-----	153.4

MOTION OF THE CENTRAL MERIDIAN

01^h -- 033°.8	09^h -- 304°.5	17^h -- 215°.2	10^m -- 005°.6	01^m -- 000°.6
02 -- 067.7	10 -- 338.3	18 -- 249.0	20 -- 011.3	02 -- 001.1
03 -- 101.5	11 -- 012.7	19 -- 282.8	30 -- 016.9	03 -- 001.7
04 -- 135.3	12 -- 046.0	20 -- 316.7	40 -- 022.6	04 -- 002.3
05 -- 169.2	13 -- 079.8	21 -- 350.5	50 -- 028.2	05 -- 002.8
06 -- 203.0	14 -- 113.7	22 -- 024.3		06 -- 003.4
07 -- 236.8	15 -- 147.5	23 -- 058.2		07 -- 003.9
08 -- 270.7	16 -- 181.3	24 -- 092.0		08 -- 004.5
				09 -- 005.1

Figure 12

below:

Example.—A dark spot in the SEB transits the central meridian at 07^h23^m on February 7, 1974 U.T. (System I applies to the SEB.)

System I C.M. at 0^h U.T., 7 Feb., 1974	. . . . .	183°.6
+ Motion of the System I C.M. in: 07^h	. . . . .	246.2
20^m	. . . . .	011.7
03^m	. . . . .	001.8
System I C.M. at 07^h23^m, 7 Feb., 1974 U.T.	. . .	443°.3
		- 360.0
		083°.3 (083°)

Note that, if the calculated longitude exceeds 360°, one subtracts 360°. Also, in general, it is more realistic to round calculated longitudes to the nearest whole degree.

LUNAR NOTES

By: John E. Westfall and Harry D. Jamieson, A.L.P.O. Lunar Recorders

Luna Incognita For 1974
(John E. Westfall)

Program Status

The A.L.P.O. "Luna Incognita" Program (LIP) was begun in 1972 in order to map that portion of the Moon not adequately photographed by the Orbiter and Apollo Missions (see: J.A.L.P.O., 23 (1972), 118-22, 134-36; 24 (1972), 20-22). Briefly, this region includes the south polar zone (south of approximately 82°S) and the area "beyond" the (IAU) southwest limb (south of approximately 52°S).

In 1973, other duties prevented the writer from devoting his full attention to this project. Nonetheless, useful observations were received from Roy Parish, Alain C. Porter, and the writer. What is particularly needed now is photographs of this area. Enlargements on 8 X 10-inch double-weight paper, or original negatives or positives, are suitable for mapping and measurement. Recommended is Kodak Photomicrography Color Film 2483, a high resolution, 35 mm positive, high contrast film on highly-stable ESTAR base. Times accurate to one minute must be supplied with each photograph. Photographers with calculating ability can also be supplied with "A.L.P.O. Lunar Photograph Supporting Data" forms, which allow conversion from geocentric to topocentric libration.

Such photographs are necessary to prepare outline maps for visual sketching. At present, experienced observers are requested to sketch this region at the times indicated in the observing schedule which follows, even though they must do so without the aid of outline maps. Such sketches should be done on a fairly large scale (e.g., 50 inches to the Moon's diameter); and the portion of the limb so sketched should be clearly indicated (e.g., with one or more named features).

Luna Incognita Observing Schedule, 1974

The following table gives those dates in 1974 when at least part of "Luna Incognita" will be satisfactorily presented, with favorable lighting and libration. The south polar zone is readily visible (i.e., with the south pole tilted at least 5° toward Earth) for some period in every lunation, but the area "beyond" the southwest limb is less often visible. For this latter region, a combination of southerly (negative) latitude libration and westerly (negative) longitude libration is desirable. In the table:

1. All data are for 0^h U.T.
2. Asterisked (*) colongitude values indicate a low to medium sun angle for the southwest limb area. (The sun is always low for the south polar zone.)
3. The Earth's selenographic latitude/longitude are geocentric.
4. "Latitude Zone" indicates the approximate range of (southerly) latitudes visible in "Luna Incognita". "SPZ" refers to the south polar zone; "All" indicates that the entire latitude range of "Luna Incognita" is at least partly visible. For reference, the latitudes of some prominent craters adjoining "Luna Incognita" are:

Pingré	52° - 61° S	Legentil . . .	72° - 77° S
Bailly	62° - 72° S	Drygalski . .	77° - 82° S
Hausen	62° - 68° S		

Earth's Selenographic

1974 Date	Colongitude	Latitude	Longitude	Latitude Zone Visible (all Lats. South)
Jan. 01	359°	-7°	-7°	SPZ
02	011	-7	-8	SPZ
03	023	-6	-8	SPZ
04	035	-5	-7	SPZ
Jan. 25	290°	-5°	-4°	SPZ
26	303	-6	-5	SPZ
27	315	-7	-6	SPZ
28	327	-7	-6	SPZ
29	339	-7	-7	SPZ
30	351	-6	-7	SPZ
31	003	-5	-7	SPZ
Feb. 18	222°	-2°	+1°	70-75°
19	234*	-3	0	60°-SPZ
20	246*	-4	-1	60°-SPZ
Feb. 24	295°	-7°	-5°	SPZ
25	307	-6	-6	SPZ
26	320	-6	-6	SPZ
27	332	-5	-6	SPZ
Mar. 17	191°	-2°	+2°	70-75°
18	203	-3	+1	65°-SPZ
19	215	-4	-1	60°-SPZ
20	227*	-5	-2	60°-SPZ
21	240*	-6	-3	All
22	252*	-6	-4	All
Mar. 26	300°	-5°	-5°	SPZ
Apr. 13	160°	-2°	+2°	70-75°
14	172	-3	+1	65°-SPZ
15	184	-4	0	60°-SPZ
16	196	-5	-2	60°-SPZ
17	209	-6	-3	60°-SPZ
18	221	-6	-4	All
19	233*	-7	-5	All
20	245*	-7	-5	All
May 10	129°*	-1°	+2°	70-75°
11	142	-3	+1	70-75°
12	154	-4	0	60°-SPZ
13	166	-5	-1	60°-SPZ
14	178	-6	-3	60°-SPZ
15	190	-6	-4	All
16	203	-7	-5	All
17	215	-7	-6	All
18	227*	-6	-6	All
19	239*	-6	-6	All
June 07	111°*	-2	+2	70-75°
08	124*	-4	0	60°-SPZ
09	136	-5	-1	60°-SPZ
10	148	-6	-2	60°-SPZ
11	160	-6	-3	All
12	172	-7	-5	All
13	185	-7	-6	All
14	197	-7	-6	All
15	209	-6	-7	All
16	221	-5	-6	All
17	234*	-4	-7	60°-SPZ
18	246*	-3	-6	60°-SPZ

1974 Date	Colongitude	Earth's Selenographic Latitude	Earth's Selenographic Longitude	Latitude Zone Visible (all Lats. South)
July 05	094°	-3°	+1°	60°-SPZ
06	106*	-4	0	60°-SPZ
07	118*	-5	-1	60°-SPZ
08	130*	-6	-3	60°-SPZ
09	142	-7	-4	All
10	155	-7	-5	All
11	167	-7	-6	All
12	179	-6	-7	All
13	191	-6	-7	All
14	204	-4	-7	All
15	216	-3	-7	60°-SPZ
16	228*	-2	-6	60°-SPZ
17	240*	0	-5	60-75°
Aug. 03	088°	-5	0	SPZ
04	100*	-6	-1	60°-SPZ
05	113*	-6	-3	60°-SPZ
06	125*	-7	-4	All
07	137	-7	-5	All
08	149	-6	-6	All
09	161	-6	-6	All
10	174	-5	-7	60°-SPZ
11	186	-3	-7	60°-SPZ
12	198	-2	-7	60°-SPZ
13	210	0	-7	60°-75°
Aug. 30	058°	-5°	+1°	SPZ
31	070	-6	0	SPZ
Sept. 01	082	-6	-1	SPZ
02	095*	-7	-2	60°-SPZ
03	107*	-6	-3	All
04	119*	-6	-4	All
05	131*	-6	-5	All
06	143	-5	-6	60°-SPZ
07	155	-3	-6	60°-SPZ
08	168	-2	-6	60°-SPZ
09	180	-1	-6	60 -75°
10	192	+1	-6	60 -75°
Sept. 26	028°	-5°	+2°	SPZ
27	040	-6	+1	SPZ
28	052	-6	0	SPZ
29	064	-7	-2	SPZ
30	076	-7	-3	SPZ
Oct. 01	088	-6	-3	SPZ
02	101*	-6	-4	All
03	113*	-5	-5	60°-SPZ
04	125*	-4	-5	60°-SPZ
05	137	-2	-5	60°-SPZ
06	149	-1	-5	60 - 75°
07	161	+1	-5	65 - 75°
Oct. 23	357°	-5°	+3°	SPZ
24	009	-6	+1	SPZ
25	021	-6	0	SPZ
26	033	-7	-1	SPZ
27	045	-7	-2	SPZ
28	057	-6	-3	SPZ
29	070	-6	-4	SPZ
30	082	-5	-4	SPZ
Nov. 01	106°*	-2°	-5°	60°-SPZ
02	118*	-1	-4	65 - 75°
03	130*	+1	-4	65 - 75°

1974 Date	Colongitude	Earth's Selenographic Latitude	Longitude	Latitude Zone Visible (all Lats. South)
Nov. 19	325°	-5°	+3°	SPZ
20	338	-6	+1	SPZ
21	350	-6	0	SPZ
22	002	-7	-1	SPZ
23	014	-7	-2	SPZ
24	026	-7	-3	SPZ
25	038	-6	-4	SPZ
26	050	-5	-5	SPZ
Nov. 30	099°*	0°	-4°	65 - 75°
Dec. 17	305°	-5°	+2°	SPZ
18	318	-6	0	SPZ
19	330	-7	-1	SPZ
20	342	-7	-2	SPZ
21	355	-7	-3	SPZ
22	007	-6	-5	SPZ
23	019	-6	-5	SPZ

Observations of "Luna Incognita" will be useful if made on any of the dates in the schedule above. Particularly favorable presentations occur on:

April 19**, 20**	June 17
May 16, 17, 18**, 19**	July 9, 10, 11, 12, 13, 14
June 12, 13, 14, 15	August 6**, 7, 8, 9, 10

**Indicates a low sun angle.

The ALPO Lunar Dome Survey: A Progress Report (II)

(Harry D. Jamieson)

In our first progress report of this series,[1] this writer dealt with a number of newly found domes located, primarily, in the Moon's eastern hemisphere. This report will serve to extend the list given in that report into the western hemisphere. Here east and west are in the IAU sense, where east is the hemisphere of the Mare Crisium.

Position (xi, eta)	Adjacent Feature	Diameter (kms.)	Observer*	Remarks
+245+361	S. Gallus	0 - 5	MWH	Circular and gentle
+245+342	S. Gallus		MWH	Uncertain
+239+346	S. Gallus		MWH	Uncertain
+235+371	S. Gallus	5 - 20	MWH	Circular and flat
+225+365	S. Gallus	0 - 5	MWH	Elliptical and gentle
+222+362	S. Gallus	0 - 5	MWH	Ill-defined
+201+326	S. Gallus	5 - 20	MWH	Split by cleft
+185+353	S. Gallus	0 - 5	MWH	Circular and moderate
+176+648	Alexander	5 - 20	MWH	Circular and moderate
+119+738	Egede	0 - 5	MWH	Circular and gentle
+101+775	Egede	5 - 20	MWH	Circular and gentle
+095+768	Egede	5 - 20	MWH	Irregular and rough
+095+775	Egede	0 - 5	MWH	Circular and gentle
+095+911	W. Bond	5 - 20	MWH	Circular and gentle
+092+774	Egede	0 - 5	MWH	Circular and sharp
+013-032	Reaumur	7	HDJ	Slightly oval and gentle
-097+565	Spitzbergen A	18	TH	Circular
-100+558	Spitzbergen A	7	TH	Circular
-110+560	Spitzbergen A	14	TH	Circular
-116+547	Spitzbergen A	9 X 7	CP	Circular and flat
-120+575	Spitzbergen A	22 (N-S)	TH	Irregular in shape
-145-307	Lassell	10 X 20	KJD	Oval

Position (xi, eta)	Adjacent Feature	Diameter (kms.)	Observer*	Remarks
-147+451	Beer	3	HDJ	Small and low
-222+065	Gambart	Over 20	MWH	Very low and difficult
-254+915	Carpenter	0 - 5	MWH	Circular with craterlets
-262+560	Carlini	About 10	HDJ	Many others possible
-305+670	Helicon	Small	HDJ	Uncertain
-325+653	Helicon	Small	HDJ	Uncertain
-452+122	Hortensius	8	HDJ	Difficult
-473+134	Hortensius	5 - 20	MWH	Low and flat
-740+250	Marius Hills	3	CP	Very uncertain
-741+374	Herodotus	5 - 20	MWH	Somewhat uncertain
-776+207	Marius Hills	0 - 5	MWH	Irregular and gentle
-777+253	Marius Hills	4	CP	Flat and circular
-778+195	Marius Hills	2	CP	Oval and flat
-781+208	Marius Hills	5 - 20	MWH	Circular and moderate
-781+241	Marius Hills	5	CP	Hemispherical
-785+141	Marius Hills	5 - 20	MWH	Very steep
-788+227	Marius Hills	5	CP	Flat and circular
-789+163	Marius Hills	8	CP	Sharp summit
-793+133	Marius Hills	5	CP	Circular and flat
-891-182	Sirsalis C	About 5	HDJ	Very gentle
-892-188	Sirsalis C	About 5	HDJ	Difficult
-896-185	Sirsalis C	About 5	HDJ	Difficult
-898-199	Sirsalis C	About 5	HDJ	Difficult
-899-171	Sirsalis C	About 5	HDJ	Difficult
-901-175	Sirsalis C	About 5	HDJ	Difficult
-901-168	Sirsalis C	About 5	HDJ	Difficult
-901-178	Sirsalis C	About 5	HDJ	Difficult
-902-185	Sirsalis C	About 5	HDJ	Difficult
-903-170	Sirsalis C	About 5	HDJ	Difficult
-904-176	Sirsalis C	About 5	HDJ	Difficult
-906-168	Sirsalis C	About 5	HDJ	Difficult
-908-167	Sirsalis C	About 5	HDJ	Difficult

*KJD - Kenneth J. Delano
TH - Todd Hansen
CP - Chet Patton
MWH - Marvin W. Huddleston
HDJ - Harry D. Jamieson

The domes given in this article and the previous progress report comprise about 30 per cent of the total number of unconfirmed domes in our files. It should thus be apparent that much work remains to be done before our final dome catalog can be considered complete and the program closed down. That the program's three most active observers have been able to do so much with two 6-inch reflectors (Hansen and Huddleston) and one 5-inch refractor (Patton) speaks well for their skill and patience.

A few words about some of the domes included in this list might be of some help to observers interested in trying to confirm them. All of them need confirmation, of course, even though a number of them have been found on high-quality photographs. Huddleston's new domes near S. Gallus (Figure 13) range from fairly easy to rather difficult for observers using moderate instruments. Most of them have been hinted at strongly on photographs taken by Richard Wessling (12½-inch reflector), however; and so they should not be difficult for visual workers using telescopes larger than 8 inches. Colongitudes between 346° and 351° are recommended.

Mr. Huddleston's new domes near Egede (Figure 15) are a part of a much larger cluster first noted some years ago by the writer and others. These domes should have about the same difficulty factor as those near S. Gallus. Recommended colongitudes are from 349° to about 354°.

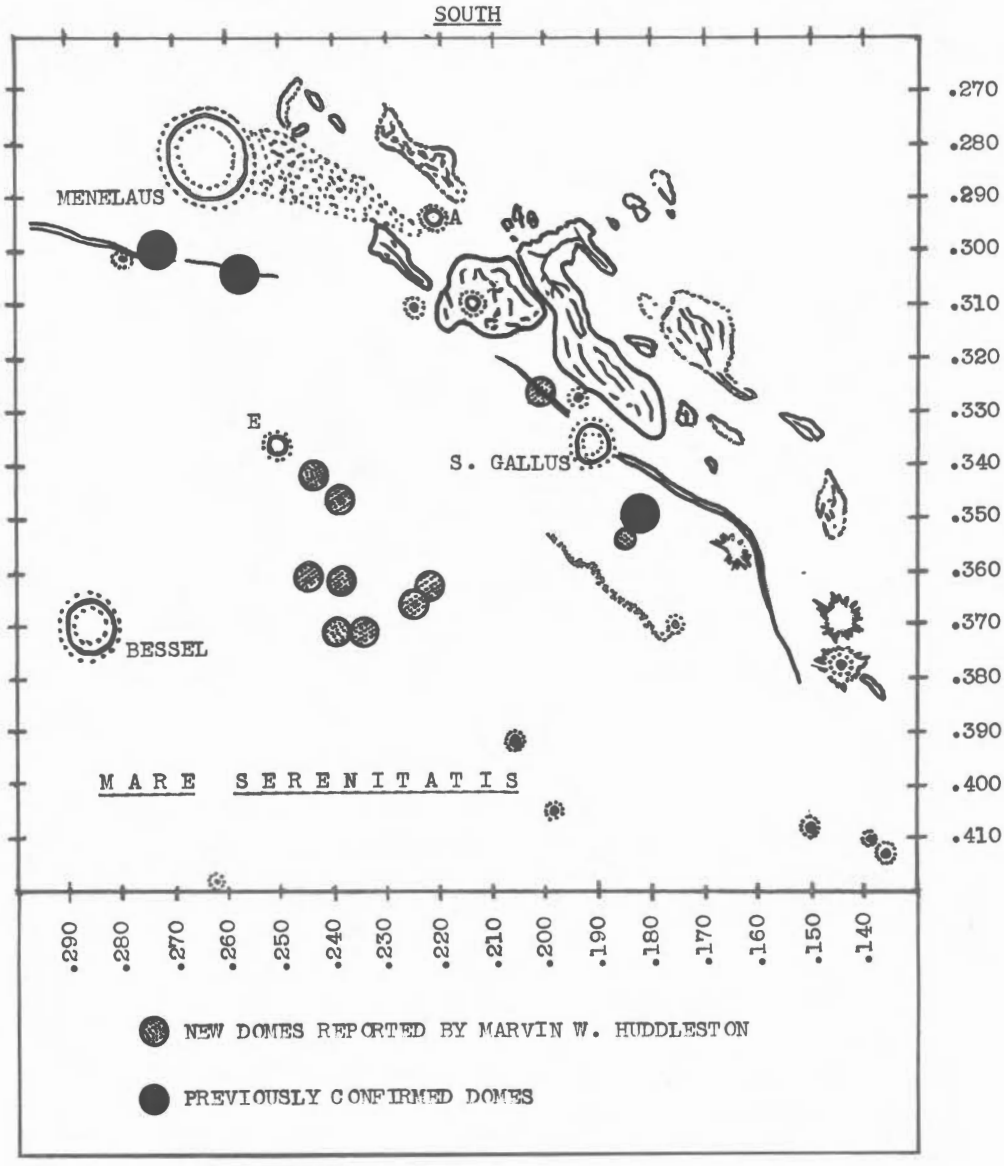

Figure 13. Chart of domes near Sulpicius Gallus. See text of report by Harry D. Jamieson in "Lunar Notes" in this issue. The xi and eta lunar coordinates are marked along the margins of the chart.

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The domes near Spitzbergen A were first noted by the writer on a photograph taken by Richard Wessling during the search for Inez Beck's dome near Kirch. Four of them were later seen visually by Todd Hansen, while the fifth was noted at about the same time by Chet Patton. While it seems fairly certain that they exist, we need to know much more about them. Ideal colongitudes are from 007° to about 012°.

The domes recently found in the Marius Hills region by Huddleston and Patton (Figure 14) represent something of a breakthrough in our efforts to catalog the domes in this region. However, these domes still require confirmation; and many new ones are still awaiting discovery. The greatest difficulty for observers in this area is the large amount of

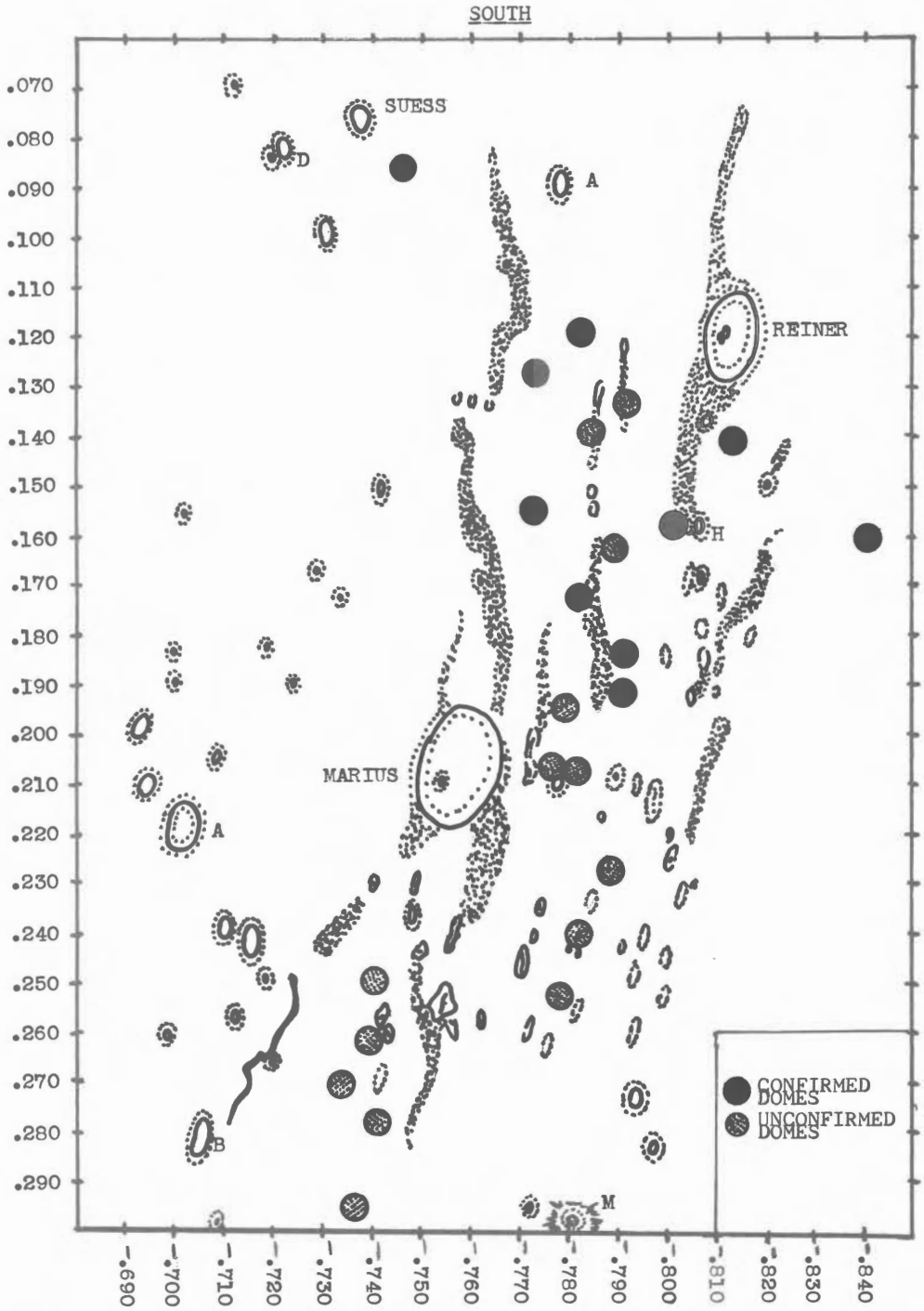

Figure 14. Chart of domes in Marius Hills Region. Note xi and eta coördinates. See also text.

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detail to be found. The region abounds with hills, ridges, small peaks, and craterlets;

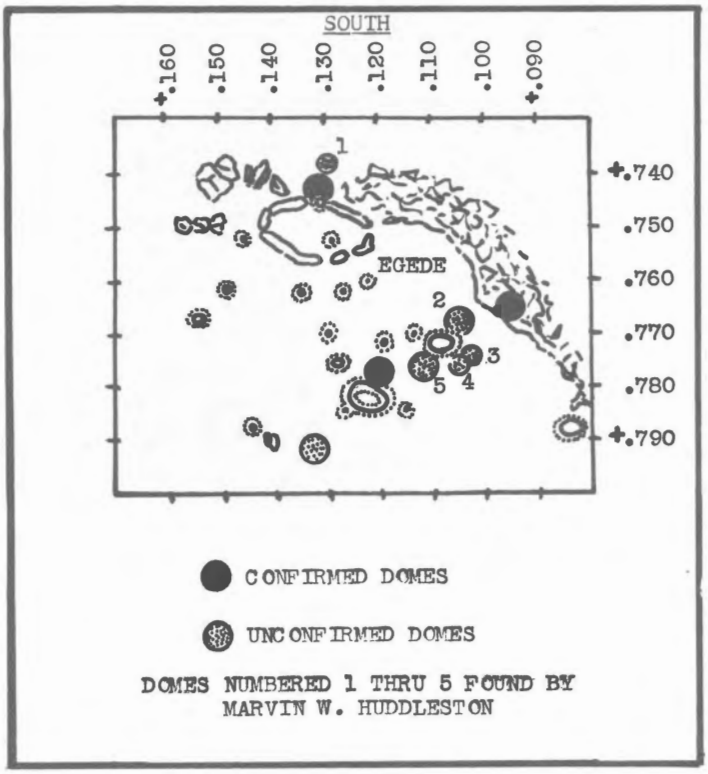

Figure 15. Chart of Lunar domes near Egede. See also text of Lunar Recorder Jamieson's article.

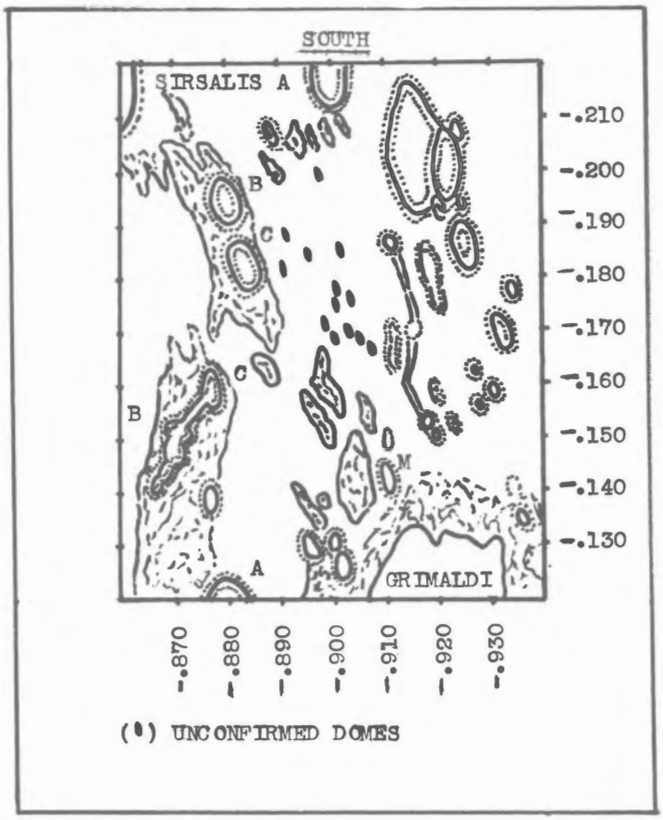

Figure 16. Map by Harry D. Jamieson of lunar domes south of Grimaldi and west of Sirsalis C. See also text.

and it is very difficult to draw a really good map of it. Ideal colongitudes range from 047° to about 060°, depending on the portion of the region under observation.

A small region west of Sirsalis C and south of Grimaldi abounds with some 15 or 20 small domes. Todd Hansen has had some success in confirming a few of the objects to be found there, but all of them are difficult and require good seeing and libration plus a telescope of at least 8 inches in aperture. The writer will be happy to provide interested observers with a list of dates when libration and colongitude will be at their best for observing these domes, on request. Colongitudes most favorable to observers range from 066° to about 071° (see map in Figure 16).

The writer at this time would like to point out an error which he made in the last progress report.[1] While Mr. Huddleston did indeed observe +274+299 as indicated in the list of new domes, this dome has been well confirmed for years now and should not have appeared with the others given.

Observers with moderate to large apertures are cordially invited to search for, and report on, the domes listed in this article and the previous progress report. Negative observations, if made under the proper seeing and lighting conditions, are every bit as valuable as positive ones; for the actual existence of many of these domes is open to question.

A final word may be of interest to observers. Mr. Huddleston has recently noted that many domes appear to have white areas atop them which are often as large as their diameters. While many observers, including the writer, have noted this effect in the past, Mr. Huddleston is the first really to point out the importance of this and to publish a paper about it.[2] Many of the domes given above and in the first report show this effect, and observers are asked to note such white patches atop domes when they observe them. The white patches usually show up after the Sun has risen beyond the point where the dome is able to cast a detectable shadow; but many white patches show up before this time, and the writer would appreciate reports on this matter.

References

1. Jamieson, Harry D., "The Lunar Dome Survey: A Progress Report", Str. A., 23, Nos. 11-12, pgs. 212-215.

2. Huddleston, Marvin W., "Lunar Domes and White Patches: A Correlation Report", Proceedings of the Joint WAA-ALPO 1972 Convention, pgs. 120-121.

Additions to the A.L.P.O. Lunar Photograph Library: Contributions from Three Amateurs

(John E. Westfall)

Three A.L.P.O. members have recently contributed a total of 44 photographs to the A.L.P.O. Lunar Photograph Library. The contributors, Jean Dragesco, Roy Parish, and Richard Wessling, used, respectively, 10-, 8-, and 12½-inch reflectors, giving further evidence that useful lunar photographs may be made with amateur equipment; four of their photographs are reproduced with this report (Figures 17-20).

Other A.L.P.O. members are invited to participate in the photographic study of the Moon, and particularly to give attention to lunar domes, the A.L.P.O. Selected Areas, and the "Luna Incognita" region (see pg. 184 et seq.). Results, when of good quality, will be welcome as contributions to our Lunar Photograph Library.

All photographs described here are black-and-white enlargements, 8 X 10 inch format, except for those of M. Dragesco (which range from 6 X 9 to 10 X 12 inches). Further details are given in the list below. (Notes: (i) approximate scales are given as follows: 3.7M = 1/3.7 million, etc. (ii) JD = Jean Dragesco; P = Roy Parish; RW = Richard Wessling.)

Code No.	Area Covered	Date & Time (U.T.)	Colong.	Scale
JD-1	Whole Disk--1st Quarter	n.d. (no date)	circa .010°	12.3M
JD-2	Eratosthenes-Archimedes-Apennines	n.d.	circa .020°	3.7M
JD-3	Archimedes-Cassini-Eudoxus	1969 Jun. 6, 0420	161°.0	2.9M
JD-4	Alps-Caucasus Mts.	1969 Jun. 6, 0420	161°.0	3.0M
JD-5	Plato-Alps-Aristoteles	1969 Jun. 6, 0420	161°.0	3.1M

Figure 17. Sunset on Mare Crisium, as photographed by Jean Dragesco with a 10-inch reflector (photograph JD-20, Colong. 114.°0).
Note how the low lighting accentuates the low, concentric ridges of this mare, 400 km. in diameter, along with the radial valleys on its periphery.
South at top.
Original photograph can be borrowed from A.L.-P.O. Lunar Photograph Library.

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Code No.	Area Covered	Date & Time (U.T.)	Colong.	Scale
JD-6	Copernicus	n.d.	circa 191°	3.1M
JD-7	Clavius-Tycho-Stöfler	1969 Jun. 6, 0420	161.°0	3.3M
JD-8	Copernicus-Sinus Aestuum	1969 Nov. 18, 1840	022.°3	3.2M
JD-9	Sinus Iridum	1969 Nov. 19, 1940	035.°0	2.1M
JD-10	Copernicus-S. Iridum	1969 Nov. 19, 1940	035.°0	4.8M
JD-11	Whole Disk—Last Quarter	1969 Dec. 1, 0132	171.°5	12.9M
JD-12	Apennines-Archimedes-Plato	1969 Dec. 1, 0448	173.°1	4.2M
JD-13	M. Serenitatis-Frigoris	1970 Apr. 13, 1805	358.°6	4.9M
JD-14	Apennines-Archimedes-Plato	1970 Apr. 14, 1845	011.°2	4.1M
JD-15	Ptolemy-Deslandres	1970 Apr. 14, 1845	011.°2	3.9M

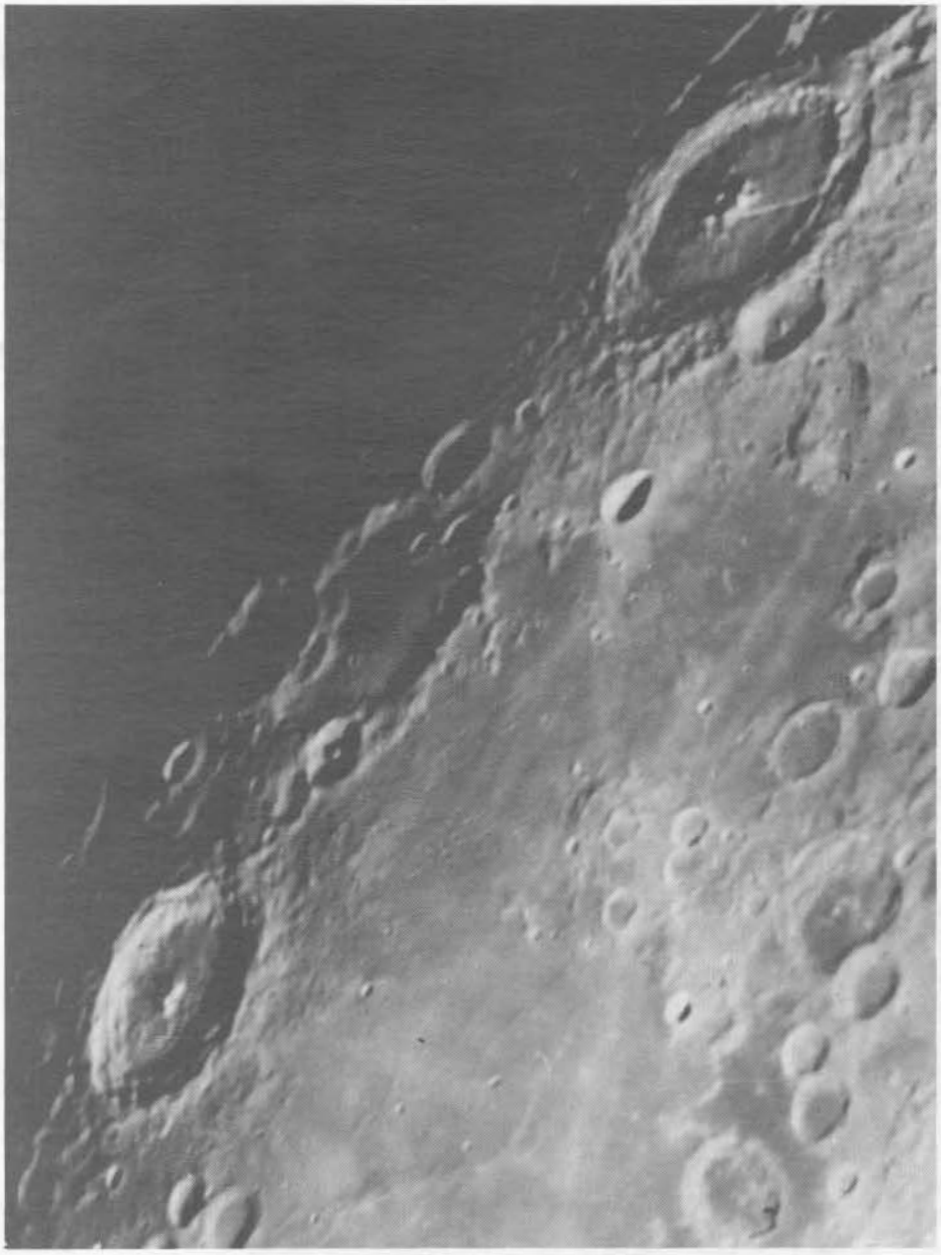

Figure 18. Eastern Mare Fecunditatis; another view by Jean Dragesco (photograph JD-21, Colong. 114°.0). The three large craters are Petavius (upper right, 175 km.), Vendelinus (center, 140 km.), and Langrenus (lower left, 130 km.). The setting Sun brings out considerable ejecta relief surrounding Langrenus. South at top. Original available for loan.

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Code No.	Area Covered	Date & Time (U.T.)	Colong.	Scale
JD-16	S. Medii-M. Vaporum	n.d.	c. 359°	4.4M
JD-17	Apennines-Archimedes-Alps	n.d.	c. 009°	3.9M
JD-18	Albategnius-Purbach	1971 Aug. 28, 1855	002°.2	3.0M
JD-19	Petavius-Stevinus	1971 Sep. 6, 2300	114°.0	2.3M
JD-20	M. Crisium	1971 Sep. 6, 2300	114°.0	3.9M

Code No.	Area Covered	Date & Time (U.T.)	Colong.	Scale
JD-21	Langrenus-Vendelinus-Petavius	1971 Sep. 6, 2300	114°.0	2.6M
JD-22	Langrenus-Petavius-Furnerius	1971 Sep. 6, 2300	114°.0	4.0M
JD-23	Langrenus-Vendelinus-Petavius	1971 Sep. 6, 2300	114°.0	3.9M
JD-24	Langrenus-Vendelinus-Petavius	1971 Sep. 6, 2300	114°.0	3.8M
JD-25	Aristarchus-Herodotus	1971 Oct. 1, 1900	057°.1	2.1M
JD-26	M. Humorum	n.d.	c. 050°	3.2M
JD-27	Kepler-Flamsteed	1971 Sep. 30, 1900	044°.9	3.0M
JD-28	Euler-S. Iridum-Harpalus	1971 Sep. 30, 1900	044°.9	3.8M
JD-29	Hercules-Atlas-Endymion	n.d.	c. 115°	4.3M
JD-30	Plato-W. M. Frigoris-Philolaus	1971 Sep. 30, 1915	045°.0	3.4M
JD-31	S. Aestuum-Eratosthenes-Timocharis	n.d.	c. 019°	3.6M
JD-32	Aristarchus-Herodotus	n.d.	c. 058°	2.1M
P104-20	M. Fecunditatis-Tranquillitatis	1971 Jun. 29, 0217	340°.6	3.7M
P106-4	M. Serenitatis-M. Frigoris	1972 May 21, 0253	006°.2	5.9M
P107-8	Theophililus-Walter-S. Medii	1972 May 21, 0259	006°.2	6.3M
P107-11	M. Nectaris-Arzachel-S. Limb	1972 May 21, 0304	006°.3	6.3M
RW-8	Pico-Piton-Spitzbergen (2 copies)	1971 Sep. 28, 0030	011°.2	1.7M
RW-9	M. Serenitatis-Tranquillitatis	1972 Feb. 21, 0014	347°.5	3.0M
RW-10	M. Serentitatis-Tranquillitatis	1972 Feb. 21, 0025	347°.6	4.1M
RW-11	M. Nectaris-Mts. Altai	1972 Feb. 21, 0029	347°.7	4.0M
RW-12	Menelaus-J. Caesar-Delambre	1972 Feb. 21, 0105	348°.0	2.7M
RW-13	S. Iridum-Delisle	1971 Sep. 30, 0026	035°.5	1.8M
RW-14	M. Humorum	1971 Oct. 2, 0254	073°.2	3.9M
RW-15	Zagut-Maurolycus-Hommel-Schomberger	1972 Feb. 21, 0032	347°.7	3.9M

LIST OF MATERIALS AND SERVICES SUPPLIED BY ALPO RECORDERS

By: J. Russell Smith

Foreword by Editor. The 1973 ALPO Business Meeting at Omaha strongly recommended that there be published in this Journal at intervals of approximately six months a complete listing of the goods and services furnished by the different Sections. Frequent updating of such material is necessary both because new readers are otherwise uninformed and also because the services and their prices necessarily change. We are glad to carry through on the recommendation. Mr. J. Russell Smith kindly collected the needed information by corresponding with all Section Recorders in October and November, 1973; and his efforts have made the following summary possible.

COMETS - Dennis Milon, 378 Broadway, Cambridge, Mass. 02139.
Observing Forms, 50 for $2.00 or duplicate your own. An announcement service for new discoveries and recent observations may be obtained by sending Mr. Milon a supply of self-addressed, stamped envelopes.

JUPITER - Paul K. Mackal, 7014 W. Mequon Rd., 112 North, Mequon, Wis. 53092.
Elmer Reese's 1964 Jupiter Handbook, 50¢ each. Advanced Observer's Handbook for Amateur Jupiter Observers, 1970 edition, $1.50, 1972 edition, $3.00.
Phillip W. Budine, R.D. 2, Box 245E, Unadilla, N.Y. 13849. Central Meridian Transit Forms - free. Strip Sketch Forms - 20 for $1.00.

LUNAR - John E. Westfall, San Francisco State College, 1600 Hollowway Ave., San Francisco, Calif. 94132.
ALPO Lunar Photograph Library Catalog, ALPO Lunar Eclipse Observation Form(3 pgs.), and ALPO Lunar Photograph Support Data (3 pages, deals with positional reductions), all available on request. Operates a loan library, comprising about 800 amateur, professional, and NASA lunar photographs, and a reference library of about 2650 large-format Orbiter lunar photographs. Can supply Luna Incognita observing schedule, Nix Olympica shadow/terminator projection ephemeris, and Saturn central meridian ephemeris.

Lunar Transient Phenomena - Winifred S. Cameron, NASA Goddard Space Flight Center, Code 641, Greenbelt, Md. 20771. Report Forms with observing instructions, including Elger's albedo scale - free.

Figure 19. This photograph, by Roy Parish, shows Maria Fecunditatis and Tranquillitatis under a morning Sun (photograph P104-20, 8-inch Rfl., Colong. 340°6). Theophilus is the large crater in the upper left; Langrenus is the bright crater in the lower left; the twin craters Messier and Pickering are above it and to the right. South at left, IAU west at top.

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Selected Areas Program - Christopher Vaucher, 6130 S.E. Reed College Pl., Portland, Oregon 97202. Observing Forms for each of the Six Selected Areas Program craters and peaks - free. Renders services personally and describes methods of observing, techni-

Figure 20. Mare Serenitatis (lower right) and Mare Tranquillitatis (top) are prominent in this photograph by Richard Wessling (photograph RW-10, 12½-inch Refl., Colong. 347°.6). This high-contrast enlargement shows considerable tonal variation in and between these two Maria; note the difference between the rim and the interior of Mare Serenitatis. South at top.

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ques of observing, etc., individually with each new observer, and thereafter.

Dark-Haloed Craters Program - Kenneth J. Delano, 22 Ingell St., Taunton, Mass.

02780. A two page introduction to the program outlining goals and procedures, a list of confirmed dark-haloed craters, a list of unconfirmed dark-haloed craters, and a supply of reporting forms. All free. A set of 16 finder charts for dark-haloed craters drawn by John Westfall for $2.00 postpaid. These charts are quite useful but not necessary.

Lunar Dome Survey Program - Harry D. Jamieson, Box 30163, Middleburg Heights, Ohio 44130. Copies of John Westfall's dome classification system at 25¢ each. A computerized list of 600 odd domes at 75¢ each. He also has a general copy service for anyone wanting reprints of pages from back issues of JALPO at 10¢ a page. His files go back to Vol. 13, Nos. 11-12.

Messier-Pickering Program - Roy C. Parish, 208 Birch St., Milton, Florida 32570. Report forms for shadow estimates and one for intensity estimates and/or drawings at 16¢ for postage.

LUNAR AND PLANETARY TRAINING PROGRAM - José Olivarez, Hutchinson Planetarium, 1300 N. Plum, Hutchinson, Kansas 67501. Novice Observer's Handbook available from Richard J. Wessling, 946 Deblin Dr., Milford, Ohio 45150, at $1.00. Mr. Olivarez will send the following free for a long, self-addressed envelope and 20¢ postage: 1. A list of outstanding articles on lunar and planetary methods from pages of the ALPO Journal. (Photocopies of the articles are available at 10¢ per page and 10¢ postage per article.) Two articles on how to figure the Moon's colongitude and Jupiter's central meridian. A copy of Dr. Joseph Ashbrook's "Dimensions of the Lunar Dome Kies 1".

MARS - Chas. F. Capen, 223 W. Silver Spruce, Flagstaff, Arizona 86001. Mars Observing Kit - Chuck full of useful materials including maps of Mars, reprints of articles, filter techniques, official Mars chart for nomenclature, etc. at $3.00. ALPO Mars observing report forms are 20 for $1.00, U.S. currency only.

MERCURY - Rev. Richard G. Hodgson, Dordt College, Sioux Center, Iowa 51250. Observing Forms, set of 20 postpaid, $1.00 and An Observer's Guide to the Planet Mercury at $2.00.

MINOR PLANETS - Rev. Richard G. Hodgson, Dordt College, Sioux Center, Iowa 51250. Minor Planet Bulletin, $2.00 for a volume of four issues. Subscription includes interim circulars called Minor Planet Memo and Minor Planet Alert postpaid, overseas airmail $1.00 extra.

REMOTE PLANETS - James W. Young, Table Mountain Observatory, Box 367, Wrightwood, Calif. 92397. No special materials or services. Requests interested observers to send their observations for publication in the Journal ALPO.

SATURN - Julius Benton, c/o Thornwell Home and School for Children, Bryan-Miller-McNeil-McLees Cottage, P.O. Drawer 60, Clinton, South Carolina 29325. An Amateur's Guide to Visual Observations of the Planet Saturn ($4.50). This book replaces the current Saturn Handbook (still available for $3.00) as of Jan. 1, 1974. A complete set of observing forms will be furnished free with the book. Saturn Observing Forms otherwise per set $2.00. The Saturn News Letter (bimonthly) is $4.00 per year.

VENUS - Julius Benton, c/o Thornwell Home and School for Children, Bryan-Miller-McNeil-McLees Cottage, P.O. Drawer 60, Clinton, South Carolina 29325. An Introduction to Observing the Planet Venus at $2.50. A complete set of observing forms will be furnished free with the purchase of the booklet. Venus Observing Forms are ordinarily $2.00 per set.

PERIODIC COMET GIACOBINI-ZINNER 1972d

By: Charles S. Morris, A.L.P.O. Comets Section

Periodic Comet Giacobini-Zinner 1972d has the distinction of being one of the most thoroughly observed periodic comets in the history of the ALPO Comets Section. In all, a total of thirty-three visual observations and three photographic observations were received from the following observers:

John Bortle, Stormville, N.Y.
Albert Jones, Nelson, New Zealand
Charles Morris, Stormville, N.Y.
Leonard Farrar, Onyx Peak, Calif.
Thomas Kleine, Stade, West Germany
David Sutherland, Pen Hook, Va.

Michael Seslar, Oakdale, Conn. (July 5), and Rockledge, Fla. (Aug. 19)

The observations cover the period from June 8, 1972 to November 16, 1972.

The Comet's Appearance

Throughout the period that P/Giacobini-Zinner was under observation the coma's degree of condensation was always considered to be small. Never was the degree of condensation recorded as being greater than 5 on a scale of 0 to 9, where 9 is stellar. However, this was about the only aspect of 1972d which did not show a large amount of variation.

The fact that this comet was very active can be seen from the large variation in coma size. In general, the coma was usually described as being between one and two minutes of arc in diameter. This value corresponds to a coma diameter of 25,000 to 50,000 miles. However, in August both Seslar (Aug. 19.37 U.T.) and Bortle (Aug. 20.35) observed the coma to be over 80,000 miles in diameter. The large variation in coma size was matched by an equally large range of coma shapes. Descriptions by observers included almost everything from circular to fan-shaped. In a couple of instances, observers even called the coma tear-drop-shaped.

Throughout most of the comet's apparition a central condensation or nucleus was noted. However, even this aspect of the comet's appearance changed drastically over short periods of time as can be seen from the two following descriptions by John Bortle:

1972, September 5.37 U.T.: "The coma has a strong central condensation at its center. The diameter is possibly 10"-20", and its magnitude 11.5 (11.3 and 11.8 R Mon comparison stars). It is centrally located, and there is no stellar nucleus evident at 146x."

1972, September 6.37 U.T.: "The central condensation is less intense (strikingly) than on September 5 and slightly more diffuse. At 146x there is possibly a stellar nucleus of magnitude 13-13½."

P/Giacobini-Zinner had a short tail during most of its apparition. Most of the time the tail was observed to be three minutes of arc or less in length. However, on August 21.32, 1972 Bortle recorded a tail of seven minutes of arc or 210,000 miles in length. This value was the maximum tail length observed. The tail itself was usually described as being broad or fan-shaped during most of the comet's apparition. Toward the end of the apparition (October) the tail was described as being narrow. In all cases, the tail was recorded as being straight.

The position angle of the tail varied from 265 degrees in June to 300 degrees at the beginning of September and then back to 275 degrees in October. The predicted position angle for a tail pointing directly away from the Sun varied from 253 degrees in June to 277 degrees in October. Thus, the tail of P/Giacobini-Zinner deviated by as much as 34 degrees from the expected position angle.

Total or Coma Magnitude

Values of r (Sun-comet distance in Astronomical Units) and delta (Earth-comet distance in A.U.) were calculated by the author (employing an ephemeris program written by M. McCants), using the following orbital elements (Marsden, IAU Circular 2372):

T 1972, August 4.9867	ω = 171°9094
e = 0.715093	Ω = 195°1314
q = 0.993982 A.U.	i = 31°7091

These values of r and delta were used in the reduction of 31 visual magnitude estimates (see Table I).

The first step in the reduction was to correct for the changing distance between the Earth and the comet. This was done using the following formula:

$$H_{\Delta} = H - 5 \log (\Delta)$$

H_{Δ} = heliocentric magnitude
H = observed magnitude

This formula was applied to each of the magnitude estimates.

Table I. P/Giacobini-Zinner 1972d Visual Magnitude Estimates

Date (UT)	Observer	Instrument	Observed Magnitude
1972, June 8.30	Bortle	6" refl.	10.2 a
11.30	Bortle	6" refl.	10.2 a
July 5.31	Seslar	6" refl.	9.5 a
20.83	Kleine	4½" refl.	9.4 a
26.30	Bortle	6" refl.	9.7 b
Aug. 5.33	Bortle	6" refl.	9.5 b, c
10.33	Bortle	6" refl.	9.6 a
19.37	Seslar	6" refl.	9.3 a
20.35	Bortle	6" refl.	9.7 a
21.32	Bortle	6" refl.	9.7 a
Sept. 5.37	Morris	12½" refl.	10.4 a
5.37	Bortle	12½" refl.	9.9 a
6.37	Morris	12½" refl.	10.6 a
6.37	Bortle	6" refl.	10.0 a
10.73	Jones	12½" refl.	11.4 a
11.71	Jones	12½" refl.	11.4 a
12.71	Jones	12½" refl.	11.4 a
15.36	Bortle	12½" refl.	11.2 a
17.72	Jones	12½" refl.	11.6 a
18.36	Bortle	12½" refl.	11.3 a
19.70	Jones	12½" refl.	11.5 a
20.72	Jones	12½" refl.	11.5 a
29.69	Jones	12½" refl.	12.0 a
Oct. 3.40	Bortle	12½" refl.	11.4 a
4.69	Jones	12½" refl.	11.9 a
9.38	Bortle	12½" refl.	11.7 a
10.38	Bortle	12½" refl.	11.7 a
14.68	Jones	12½" refl.	11.9 a
17.67	Jones	12½" refl.	12.1 a
18.39	Bortle	12½" refl.	11.8 a
Nov. 16.39	Bortle	12½" refl.	13.1 a

a. AAVSO and New Zealand charts.
b. USNO P. E. P. Catalog.
c. SAO Star Catalog.

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The second step in the reduction was to correct for the aperture effect. This was done by using the aperture correction for reflectors determined by this author (Publications of the Astronomical Society of the Pacific, Vol. 85, No. 506, pp. 470-473, 1973 and Journal ALPO, Vol. 24, Nos. 7-8, pp. 150-156, 1973. This aperture correction states that for each inch of aperture used a given comet will appear 0.048 stellar magnitudes fainter on the average. Using this aperture correction, all the heliocentric magnitudes were corrected to a standard aperture of 2.67 inches.

The resulting aperture-corrected, heliocentric magnitudes were then used to obtain the best straight line fit using the formula:

$$H_{\Delta} = H_o + 2.5n \log r, \text{ where}$$

H_{Δ} = heliocentric magnitude,
H_o = absolute magnitude,
and n = a number which represents how the comet's brightness varies with heliocentric distance ($n = 2$ represents the inverse square law).

The results for P/Giacobini-Zinner are given below:

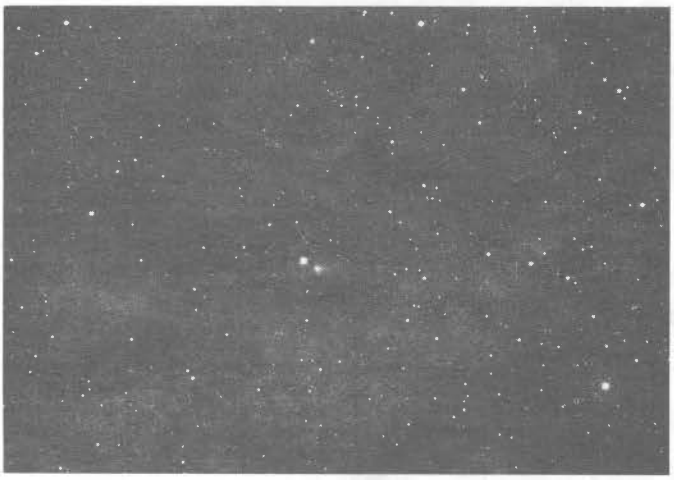

Figure 21. In this photograph of Periodic Comet Giacobini-Zinner 1972d taken on July 22, 1972, the comet is about 2½ minutes of arc southwest of a 5.6-magnitude star located in Perseus at $3^h25^m.0$, +33° 38'. It was taken by Rainer Pauls, Hamburg, West Germany with a 360/420/625 -mm. Schmidt Camera on Adox 17 panchromatic film, exposure three minutes. The comet's visual magnitude on July 20.8 was 9.4 according to Thomas Kleine, who contributed this print. A short tail extends westward. N. at top.

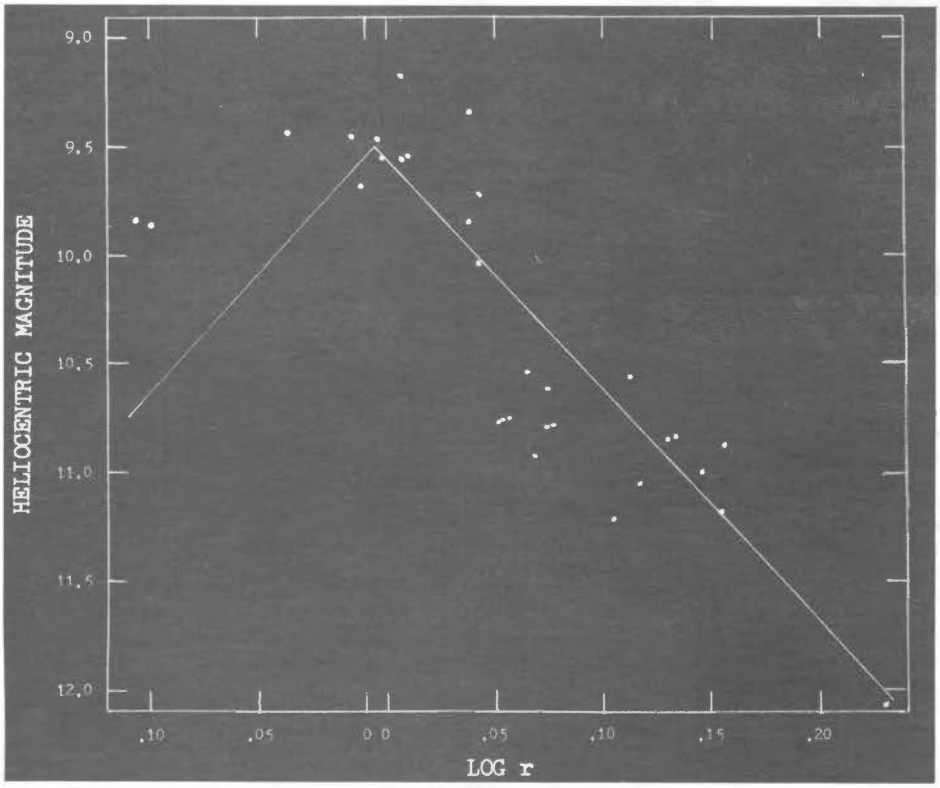

Figure 22. Graph by Charles S. Morris of the light curve of P/Giacobini-Zinner 1972d. The straight line represents the equation $H_\Delta = 9.57 + 10.55 \log r$. Note the apparent asymmetry of the light curve. See also discussion in text.

Figure 23. Charles S. Morris at the photoelectric photometer of the University of Michigan's 24-inch Cassegrain reflector. Mr. Morris has been analyzing ALPO data on comet magnitudes, and is now a graduate student at Purdue University, address 1128-O Graduate House West, West Lafayette, Indiana 47906.

$H_0 = 9.57 \pm .08$ $n = 4.22 \pm .37$ (probable errors)
(Variation in r: 1.284-.994-1.701)

The results indicate that this comet was intrinsically faint. The absolute magnitude of a comet with an average intrinsic brightness would be about six.

The value of n obtained for this comet is somewhat misleading due to the fact that this comet's light curve was asymmetric. Although the post-perihelion observations are represented fairly well by the calculated value of n, it is obvious from the light curve (see Figure 22) that the preperihelion observations require a smaller value of n. Unfortunately, there were not enough observations to determine a preperihelion magnitude formula. It appears, however, that the value of n may have been as small as two. On the other hand, the value of n for this comet is very close to the average, which is between three and four.

This comet is a good example of a periodic comet which has not shown any "decay" since it was discovered. (Decay is used here to mean an increase in the value of the absolute magnitude on successive returns. The idea is that as the comet loses material, its intrinsic brightness will decrease; and thus the absolute magnitude will increase to a higher number.) A preliminary analysis of the ALPO data for the 1959 apparition of this comet indicates that the absolute magnitude at the 1972 apparition was about half a magnitude brighter than the absolute magnitude recorded 13 years earlier! Thus, P/Giacobini-Zinner shows no evidence of decay. However, it should be pointed out that variations in absolute magnitude are probably not very good indicators of cometary decay (due to solar cycle, etc.) unless many apparitions of the comet are used. As a result, the findings given in this paper concerning "decay" of P/Giacobini-Zinner should be considered very preliminary.

If the data in the present study are used to obtain H_{10} (assuming n = 4) using the

reduction procedure of Vsekhsvyatskii (i.e., no aperture correction), one finds that the comet was brighter at this apparition than when it was first discovered. See Vsekhsvyatskii's book Physical Characteristics of Comets and "Periodic Comet Faye, 1843III = 1969a" by John E. Bortle (The Strolling Astronomer, Vol. 24, Nos. 1-2, pp. 22-25) for further information concerning the decay of periodic comets. Also, see David D. Meisel's paper "On the secular brightness decrease of periodic comets" in PASP, Vol. 81, Feb., 1969, where ALPO estimates of Periodic Comet Tempel 2 are analyzed.

BOOK REVIEWS

1974 Yearbook of Astronomy, edited by Patrick Moore, W. W. Norton and Co., 500 Fifth Avenue, New York, N.Y. 1973. 191 pages. $6.50.

Reviewed by J. Russell Smith

On page 7 in the Editorial, Patrick Moore states that this Yearbook has now been published for thirteen years. As Book Review Editor of the Journal of the A.L.P.O. for about thirteen years, this is the first copy that I have seen. I'm pleased that it has come our way.

The Yearbook is divided into four parts. In Part One: Events for 1974, one finds simple monthly star charts suitable for the beginner. This section is followed by about 70 pages of Monthly Notes which give information relating to the Moon and planets. There are also a few pages devoted to information on eclipses, occultations, comets, meteors, and minor planets in 1974 as well as a page on some events in 1975. Part Two is an Article Section containing seven interesting articles on astronomy, which apparently have been added to give the book volume. Part Three: For Stellar Observers is a discussion of Unpredictable Stars followed by a listing on each of the following: telescopic variables, double stars, clusters, and nebulae. Part Four lists four recent books on astronomy and gives biographical notes on the contributors to the Yearbook.

The 1974 Yearbook of Astronomy is a useful book to have in your collection, but those past the novice stage will also need a good atlas such as Norton's Star Atlas as well as the Observer's Handbook of the Royal Astronomical Society of Canada or the Handbook of the British Astronomical Association.

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The Astronomical Revolution, by Alexandre Koyré. Cornell University Press, N.Y., 1973. 531 pages. Price $17.50.

Reviewed by Bruce M. Frank

In reviewing the lives of three eminent astronomers - Copernicus, Kepler, and Borelli - a noted historian of science examine the revolution, occurring in the sixteenth and seventeenth centuries, which radically changed Man's perception of the world around him. The book is divided into three sections, one devoted to each astronomer. First, Koyré traces the development of the key points in Copernicus' heliocentric model of the Universe. Then he turns to an examination of Kepler's laws of celestial motion. Finally, Koyré shows Borelli completing the revolution by applying the new principle of dynamics to astronomy. Little space is devoted to giving background information on each astronomer since the author's primary concern is to analyze in depth the major accomplishments for each man. Where possible, Koyré allows Copernicus, Kepler, and Borelli to speak for themselves by quoting key passages from their own writings. Many of these passages have never before been translated into English. The thoughtful inclusion of these passages at relevant points in the text recaptures some of the intellectual and spiritual atmosphere of this crucial period in the advancement of scientific thought.

Koyré does an excellent job of tying together the translated scripts with detailed, to-the-point commentary describing the impact of these writings. The voluminous notes attached to each section of the book should be of special interest to history of science enthusiasts. In fact, there are as many pages of notes as there are of main text! The notes do provide detailed supplemental information. However, I have two criticisms about the note section. One drawback with putting all the notes at the end of each section is that the reader must continually thumb back and forth in the book to tie all the information together well. It also appears that some of the data contained therein could have been incorporated into the text, in turn reducing the amount of cross referencing. Another key feature of the book is the excellent use of diagrams. All of the diagrams are

directly related to the text, facilitating the explanation of spatial concepts and helping to clarify sections potentially confusing if the reader had only the written descriptions to go on. One word of caution - some of the diagrams are necessarilly elaborate and require close scrutiny to be fully understood.

In sum, The Astronomical Revolution is an excellently written, well documented book. Although the cost of the book is rather high, the wealth of previously untranslated passages it contains and the extensive commentary by the author make it a good investment. Koyré's work should appeal to anyone who desires a detailed, nonmathematical examination of the evolution of the theories of three important men in the history of astronomy.

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Astronomy, by Donald H. Menzel. Random House, New York, 1970. 320 pages, 50 color photographs, 160 black and white photographs, 85 drawings, and 24 sky maps. Price $17.50.

Reviewed by Jack C. Royals

The oepning chapters of this book present a thoughtful review of the gropings of the early astronomers by tracing astronomy from its very beginnings.

After a chapter on the Earth, the author considers the Moon; and the text here is enhanced with a number of photographs from several Lunar Orbiters. The text proper discusses earthshine, lunar rotation, and the maria. Dr. Menzel suggests that the pear-shaped depressions on the Moon could be a type of artesian lake from which water, lava, volcanic ash, subsurface ice, or permafrost flowed outward and downward through the rills.

There follows an informative and generalized chapter on the Sun, and in "Eclipses" the author suggests the use of welder's goggles when viewing a solar eclipse.

Excellent textual material is given on the planets. Dr. Menzel describes Mars in terms of the results of Mariner IV, VI, and VII. He also mentions the discovery of the 14th magnitude Saturnian satellite, Janus, discovered in 1966 by Audouin Dollfus when the rings appeared edge-on. Charts of the planets are given which show the equatorial radius, volume, mass, density, surface gravity, escape velocity, rotation period, and the inclination of the equator to the orbit. Elements of the orbit, such as mean distance from the Sun, sidereal period, synodic period, inclination to the ecliptic, and eccentricity are also given. These charts make a good reference to have handy.

A chapter on asteroids, meteors, and comets suggests that the most convincing theory of comet origin is one proposed by Jan Oort of Holland. Oort suggests that a vast cloud of at least 100 billion comets extending 100,000 Astronomical Units into interstellar space completely surrounds the Solar System. The gravitational pull of passing stars causes deflections which can send individual comets toward the Sun.

In a chapter entitled "The Origin of the Solar System" the statement is made that the Universe is running down and will continue to do so until some unpredictable force "winds" it up again. Other interesting chapters discuss stars, nebulae, and evolution of the stars as well as galaxies and the Universe. These chapters supply basic information on these subjects.

On page 261 a photo of NGC 4594 (M 104, Sombrero Nebula) is labeled incorrectly as M 81. On page 264 a photo of NGC 4565 in Coma Berenices is incorrectly labeled as NGC 4594 (M 104, Sombrero Nebula). On page 267 a photo of M 81 in Ursa Major is incorrectly labeled as NGC 4565 in Coma Bernices. I'm sure that these errors in labeling must be on the part of the publisher and not the author.

The Appendix contains a list of selected open star clusters, globular star clusters, diffuse gaseous nebulae, planetary nebulae, and galaxies.

This book is, in my opinion, suitable for a text. The material is clear, concise, and to the point. I would recommend it for the good general knowledge and for the many excellent photographs.

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"An Observer's Guide to the Planet Mercury" by Rev. Richard G. Hodgson. Available from Rev. Hodgson, A.L.P.O., Mercury Recorder and Director of Dordt College Observatory,

Sioux Center, Iowa 51250. Price: $2.00.

Reviewed by Clark R. Chapman, Planetary Science Institute, Tucson

By the time you read this review of Rev. Hodgson's excellent guide to amateur observations of Mercury, Mariner 10 will have "done its thing". If it is successful in its fly-by examination of Venus and Mercury, our knowledge about both planets will be greatly increased. Our understanding of Mercury, in particular, will be revolutionized because today we know virtually nothing about the planet, except for certain orbital and physical parameters which are outlined for us in the first 8 pages of the 32-page pamphlet reviewed here. That elusive, twinkling, evening (or morning) star will be transformed by Mariner into an immense geological world and geophysical laboratory.

This change in our conception of Mercury may be difficult for long-time Mercury observers to take. Those of us who specialize in trying to make sense out of the smallest, most-difficult-to-observe bodies in the Solar System (satellites, asteroids, Uranus, Neptune, Pluto, and — of course — Mercury) particularly enjoy the challenge of trying to learn from the small quivering images absolutely all there is to be learned about them. Mars and Jupiter seem pretty complex by comparison, and the Moon — whether seen through a backyard telescope or studied from atlases of Lunar Orbiter pictures — is completely overwhelming in its geological complexity. After decades of straining to see the markings on Mercury's pinkish disk, we have relatively little to show for our effort. But after modern radar helped us around that century-long April Fool's trick Mercury's rotation had been playing on us, we were able to construct the best maps possible. It has taken a major NASA effort to do better than what we did with our small telescopes, and we need feel no shame.

Indeed, the Mariner mission will have photographed only one side of what we now know is truly a two-sided planet. We will soon know (by comparison with Mariner "truth") how accurately telescopic drawings and photographs can map the coarsest features on Mercury's surface. But even if the comparison is disappointing, we can forge ahead to do our best at mapping that other side — for we know that if we do not map it, it will be many years before another spacecraft does a better job.

I have dwelled a little long on mapping, mainly because Rev. Hodgson rather downplays that facet of Mercury-observing. I shouldn't blame him, particularly in view of our track record; but it might have been helpful if he had defined the 0° longitude meridian (which is the longitude facing the Sun at alternate perihelion passages — a definition differing by 136 degrees from the temporary one I employed in my own Mercury map and in the article I co-authored with Dale Cruikshank in the July, 1967 issue of Sky and Telescope). In any case, Hodgson does include a description of the central meridian ephemeris printed at New Mexico State University.

After describing briefly the facts and figures of Mercury, Rev. Hodgson leads us through a description of the six different circumstances under which Mercury may be observed (ranging from broad daylight to nighttime to solar transit). Always cautioning against the dangers of the nearby Sun, Hodgson describes the inevitable compromises an observer must make between seeing conditions and sky brightness. Methods of finding Mercury are detailed and some standard observing programs are outlined. Particular emphasis is given to the search for small natural satellites of Mercury. Although Mercury may well possess no significant satellite, Hodgson is certainly correct that it only remains for an enterprising amateur Mercury observer to demonstrate that supposition.

This plastic-ring-bound pamphlet includes an excellent and up-to-date annotated bibliography. A sample Mercury observing form is also included.

Since I tend to be critical, I cannot avoid pointing out several half-truths and minor omissions I noticed. But before I do so, I must hasten to add that even small errors are surprisingly few. Thermal inertia might be defined, at the top of page 6, as the square root of the product of the conductivity, density, and specific heat of the surface layer. I think Rev. Hodgson was susceptible to a little "lunar-chauvinism" when he wrote that probably "the brighter areas are scarred with many craters"; I see no reason why the dark areas shouldn't be similarly scarred, though Mariner may have answered that question by the time you read this. Mercury's density is similar to that of the Earth, as written on page 6; but it is not pointed out that Mercury's "uncompressed density" is greater than the Earth's, implying that Mercury has a higher proportion of iron than does the Earth. This is an important fact in understanding the conditions under which the early solar nebula condensed and accreted to form the planets.

On page 13 we are told to "experiment with a variety of color filters" to bring out faint detail. I would suggest that experimentation begin and end with yellow, orange, and red filters for daylight and twilight observations — they will serve to darken the blue background sky which has an important effect on contrast perception. Unfortunately, some of the discussions of observing Mercury during the long solar eclipse of 1973, June 30 and observing the transit of 1973, November 10 are dated. No more solar transits will be observed from the United States until November, 1999. I might also add that I am a bit dubious of the value of photographing the position of Mercury in the sky, as suggested on page 18, at least in comparison with the other projects suggested. If observers attempt to observe colors on Mercury, as suggested on page 21, they should bear in mind the unavoidable colors due to atmospheric refraction when Mercury is low in the sky. The spurious colors are pretty but have little to do with Mercury.

My minor quibbling in the last two paragraphs should not distract all you Mercury observers out there from putting your two dollars in an envelope and mailing them off to Dick Hodgson. He has put together a fine observer's guide. And, in at least one sense, he has done far better than Dale Cruikshank and I have done with the Mercury chapter of the A.L.P.O. Observing Manual which we wrote about a decade ago: he has gotten it published! (If you would like an independent guide to Mercury — but, I must confess, no better than Hodgson's — just tell your friendly local publisher that there is a wonderful Observing Manual still waiting to meet him.)

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Astrology: Fact or Fiction?, by Reverend Kenneth J. Delano. Our Sunday Visitor, Inc., Huntington, Indiana 46750, 1973. 127 pages. Price: $2.50.

Reviewed by Bruce M. Frank

The author of this work, a well known member of ALPO, presents a rather broad though interesting inquiry in attempting to answer the following questions: first, can astrology legitimately claim a scientific basis for itself; and, secondly, what is the role played by astrology in today's society? In answer to these questions Rev. Delano makes it quite clear from the start that he regards astrology as unscientific, anti-intellectual superstition attempting to legitimize its existence through claiming close association with the science of astronomy. Chapters 1 and 2 contain a brief history tracing the origins of astrology and astronomy from the Chaldean Empire in 3,000 B.C. through ancient Greece and Rome. From the start he attempts to separate the development of the two by pointing out their different evolutionary paths. In chapter 3, "Christian Era Astrology", Rev. Delano puts forth the view that the development of empirical science during the eighteenth century led to the initial triumph by astronomy over astrology. He attributes this triumph to the discovery of the planet Uranus, a planet unknown to astrologers, by William Herschel. The discovery of further new planets and other heavenly bodies is a source of embarrassment to the astrologers, who have to take these previously unknown celestial bodies into account in their predictions. The last three chapters in the book discuss the role played by astrology in the present day based on science, rationality, and religion. In all three perspectives he finds reasons to reject the astrologer's claims of special powers and knowledge of future events. It is evident throughout the book that he is quite disturbed about the recent resurgence in the popularity of astrology and lists several reasons for its popularity as, for example, preying on those people who desperately need certainty in life. Astrology is therefore rejected on the grounds of its "latent determinism, overt hedonism, and disgraceful irrationalism" (p. 126).

On the whole the book presents a well written probing account of the origin and history of astrology and offers evidence which can be leveled against its claims, although somewhat brief due to the work's shortness and lack of a bibliography. Aside from these two minor criticisms, Astrology: Fact or Fiction? should prove worthwhile reading to anyone interested in a concise history of astrology as well as in its impact on contemporary society.

ANNOUNCEMENTS

Sustaining Members and Sponsors. The persons in these special classes of membership as of January 5, 1974 are listed below. Sponsors pay $25 per year; Sustaining Members, $10 per year. The balance above the normal rate is employed to assist the ALPO in suitable ways. We thank all these colleagues for their generous help.

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New Address for Julius Benton. Beginning at once, the Recorder of our Saturn and Venus Sections has the following mailing address:

Dr. Julius L. Benton, Jr.
c/o Thornwell Home and School for Children
Bryan-Miller-McNeil-McLees Cottage
P. O. Drawer 60
Clinton, South Carolina 29325

Our colleague has just accepted a position on the staff of the Physics-Astronomy Department of the Presbyterian College in Clinton, a private institution with some 3,500 students. ALPO members are invited to visit the campus; there are 16-inch and 20-inch Cassegrains at two nearby observatory stations.

Errors in Vol. 24, Nos. 7-8 of Journal ALPO. Mr. Charles Capen has called attention to some minor errors in his published article "Color Filter Techniques for Bright Comets". On pg. 149 the third sentence in the third paragraph ought to read: "The coma usually appears small in red (W-23A and W-25) or orange (W-21) light, and larger in UV (W-18A photo), violet (W-47A), and blue (W-38) light due to the most often present violet CN and blue C_2 emission bands". The fourth following sentence after that one ought to read: "The presence of dust shows strongest in yellow (W-4), yellow-green (W-11 and W-57), orange (W-21), and red (W-23A and W-25) light."

On pg. 159 the ephemeris of Comet Kohoutek 1973f is for 1950 astronomical coördinates. The epoch does not appear to be explicitly stated in the accompanying text.

Correction to Article in Vol. 24, Nos. 3-4 of Journal ALPO. Mr. Charles S. Morris calls attention to a desired change in his article "Comet Magnitude Analysis: Toba 1971a". On page 69 of the issue cited one should read $H_0 = 5.39 \pm 0.13$ and $n = 8.37 \pm 0.37$ instead of $H_0 = 5.39 \pm 0.19$ and $n = 8.37 \pm 0.55$. The reason for the change is that Mr. Morris wants to use probable errors rather than the standard deviations originally published. He has chosen probable errors in order to make the results of magnitude analyses on all comets he reduces comparable with each other and with other published results.

New Assistant Mars Recorder. The large quantities of Mars observational data accrued by the ALPO Mars Section during the 1971 and 1973 apparitions have imposed a large if pleasant workload upon our two Mars Recorders. After some discussion, the ALPO Director has thought it best to appoint a new Assistant Mars Recorder. Tom Cave has served well in this capacity, but the demands of his business severely limit his time for other activities. We thank him for his most helpful efforts and wish him well in continuing his well-known, long-time studies of the Red Planet.

The new ALPO Assistant Mars Recorder is Mr. Robert B. Rhoads, 8637 E. Palo Verde Ave., Scottsdale, Arizona 85253. He is an experienced and active observer of Mars with a 14.5-inch Newtonian reflector and a past president of the Phoenix Observatory Association. He has already helped Mars Recorder Capen with certain reductions of 1969 data. Moreover, he visits Flagstaff several times a year to observe at the Lowell Observatory, and these personal contacts between the two Recorders will greatly help the work of the Mars Section.

New Address for Mrs. Cameron. Our Lunar Recorder in charge of Lunar Transient Phenomena now has the following address: Winifred S. Cameron, NASA, Goddard Space Flight Center, Code 601, Greenbelt, Maryland 20771.

Observation Acknowledgement Cards? Mr. Dennis Milon has been acknowledging the flood of observations of Comet Kohoutek by sending each contributing observer a postcard form. He fills in the name of the comet, the date of the contributed observation, and any desirable comments. One card may serve to acknowledge observations on more than one date. While Comet Kohoutek observational coverage has been unusual, the Director wonders whether other ALPO Recorders might not profitably use similar cards to acknowledge observations. The cost would be small, and the observer might feel rewarded. Complaints by observers that Recorders do not acknowledge their contributions have been frequent at times in the past. Promptness in acknowledging observations may indeed be more important than a much delayed detailed discussion of the observation, a discussion which can become an impossible load on the Recorder's time. It is now entirely up to each staff member to act on this suggestion as he thinks proper - the cards might help show our observers that their volunteer efforts are appreciated.

WAA-ALPO 1974 Convention. Readers are reminded of the joint meeting of the Western Amateur Astronomers and the Association of Lunar and Planetary Observers on the UCLA campus in Los Angeles. Tentative dates are August 15, 16, and 17, 1974. These dates and other details are to be discussed at the mid-winter meeting of the WAA Board in Fresno, California in late January. Mr. Thomas Cragg, the President of the Western Amateurs, has agreed to inform us of plans made for the meeting; and we shall carry such information in our next issue, which will probably be published near the beginning of April. Tom has been a long-time active contributor to the ALPO and served as a Saturn Recorder for many years. Readers will appreciate that the energy crisis and the gasoline shortage complicate plans for astronomy gatherings.

1974 Riverside Telescope Maker's Conference. The sixth annual Riverside Telescope Maker's Conference will be held at ISOMATA, the University of Southern California's Conference Center in the beautiful mountain resort of Idyllwild, California. The dates are May 25, 26, and 27, 1974. Speakers and exhibits are needed, and persons wishing to give a talk or supply an exhibit are warmly invited to do so. Further information about this meeting may be obtained from Mr. Donald Minger, P.O. Box 4063, Riverside, CA 92504. These Telescope Maker's Conferences have been highly successful and enjoyable in recent years.

OBSERVATIONS AND COMMENTS

Note on Comet Kohoutek 1973f. On December 13, 1973 Mr. Charles S. Morris communicated what was then the following current news on this comet:

"The following results were obtained from a reduction of 107 observations made between September 29th and November 27th, 1973.

Observed magnitude = $5.23 + 5 \log \Delta + 7.11 \log r$
$H_o = 5.23 \pm 0.04$ $n = 2.84 \pm 0.10$ (probable errors)

"This formula is for a standard aperture of 2.67 inches. All reflector observations were corrected to this standard aperture by using the Morris aperture correction, and all refractor observations were corrected to this standard aperture by using the Bobrovnikoff aperture correction. See JALPO, Vol. 24, Nos. 7-8, pp. 150-156.

"The following predictions are for 2-inch binoculars.

Date (U.T.)	Magnitude
1974, Jan. 3, 0 hrs.	1.0
13	3.0
23	4.2
Feb. 2	5.4
12	6.4
22	7.2
Mar. 4	7.9
14	8.6
24	9.1

"It is quite possible that the observed magnitude after perihelion will differ (possibly by a large amount) from these predictions. [Indeed, my personal observations would indicate that Kohoutek was one and one-half to two and one-half magnitudes dimmer than these predictions during the first two weeks of January. --Editor.]

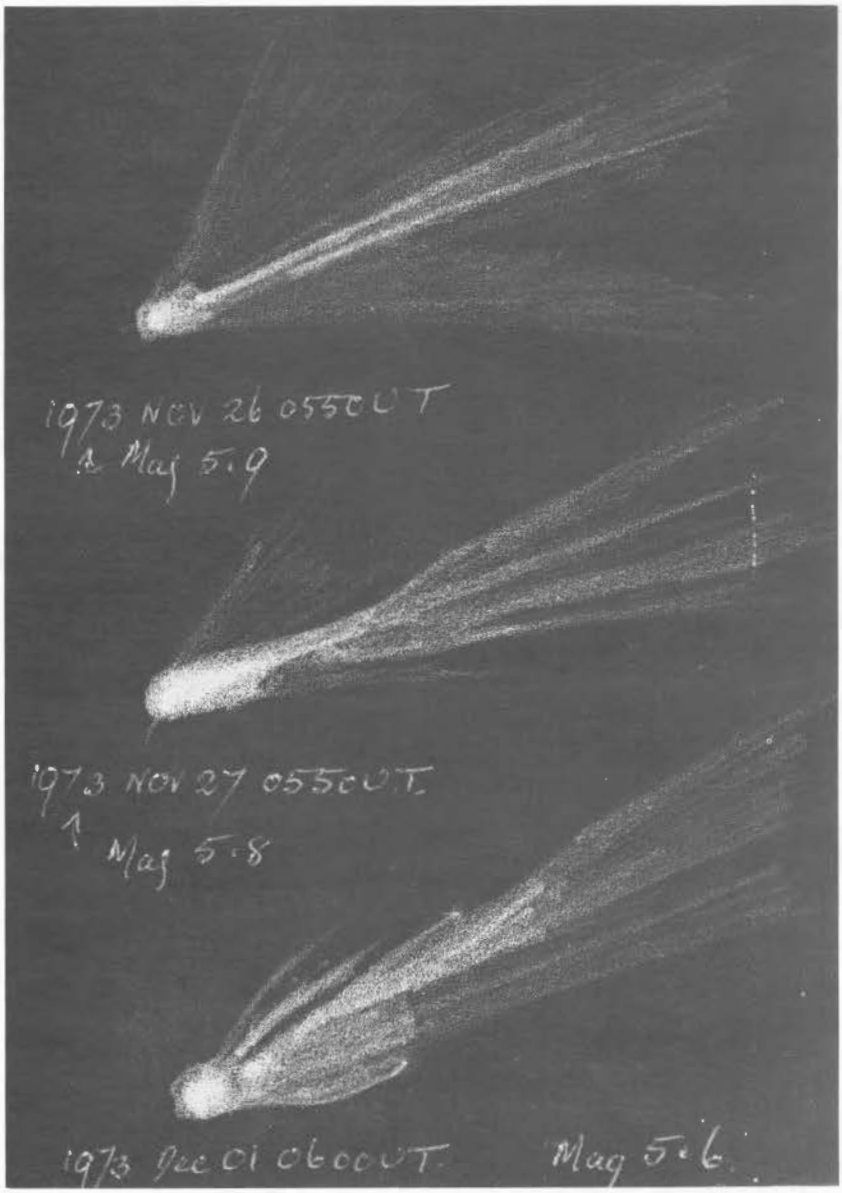

Figure 24. These drawings of Comet Kohoutek 1973f show a changed appearance in the tail on each of three mornings: Nov. 26, Nov. 27, and Dec. 1, 1973. They were made by the well-known comet and nova discoverer, G. E. D. Alcock of Peterborough, England, using 25 X 105 binoculars. His visual magnitude estimates are noted also. Drawings contributed by Dennis Milon, ALPO Comets Recorder.

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Photographs of Comet Kohoutek. By this time, perhaps, our readers will feel that they have seen a surfeit of photographs of this well-advertised comet. Nevertheless, we invite attention to two more Kohoutek pictures: by Mr. John Laborde on the front cover and by the Mauna Kea Observatory on page 210. The captions should be self-explanatory.

Sketches of Kohoutek Tail. Figure 24 should be of considerable interest to all read-

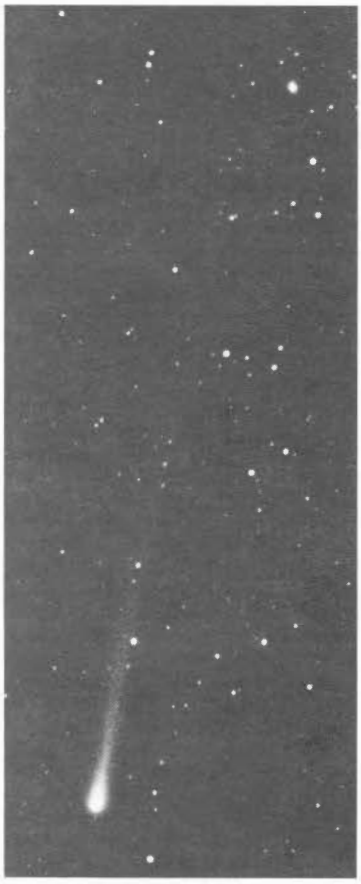

Figure 25. Photograph of Comet Kohoutek 1973f at Mauna Kea Observatory in Hawaii on December 6, 1973, 15^h32^m, U.T. 4-minute exposure, Kodak IIa-O plate, 305 mms. focal length lens at f/2.5. Contributed by Dr. Dale P. Cruikshank. At this time the comet was 190,000,000 kms. from the Earth and 110,000,000 kms. from the Sun.

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ers who were observing this comet in the morning sky in late November, 1973. Mr. Alcock's original sketches had negative shading; Mr. Milon reversed this shading when he made photographic copies of the sketches. It is evident that 25 x 105 binoculars are a really powerful instrument for many phases of comet research; the Editor's views of the tail of Kohoutek with 7 x 35 binoculars in late November were greatly inferior to Mr. Alcock's three sketches. Presumably our colleague uses his binoculars on a permanent and rigid mount.

It appears worhtwhile to point out that Mr. Alcock's middle sketch in Figure 24 was made a little more than six hours before Mr. John Laborde's front cover photograph of Comet Kohoutek. It will be apparent at once that the appearance of a comet varies tremendously with the instrumentation employed, and on photographs with the exposure and film processing.

Photograph of Saturn by ALPO Member. The attention of both Saturn observers and astronomical photographers is invited to Figure 26. The original print contributed by Mr. Zeh clearly shows the South Equatorial Belt near the middle of the globe, the brighter Equatorial Zone, the shadow of the ball on the rings along the right edge of the ball, the marked difference in brightness between Ring A and Ring B, the Crape Band upon the ball above the projected rings, and a pronounced South Polar Region shading. The last-named feature reminds the Editor strongly of its aspect to him at a similar tilt of the rings in 1944 and 1945. Our colleague's address is 3125 Cambridge St., Toledo, Ohio 43610.

Annular Solar Eclipse on December 24, 1973. We would like to share a slightly edited note upon his observation of this event from Mr. Lawrence B. Nadeau, 32 Shelby St., Apt. #3, East Boston, Mass. 02128, as follows: "I went with Dr. David Dunham (from Austin, Texas) to Puerto Escondido, Mexico to observe the sunrise annulus. It was very clear. Annularity lasted for 4 minutes, and the Sun was 4° high at mid-annularity. Joan Dunham was successful in recording a Baily's Beads sequence. The beads were seen especially well at third contact. Some atmospheric boiling also caused considerable 'black drop' effects. A search was made for Comet Kohoutek 1973f about 10° from the Sun, but it was not found. [It would presumably be very difficult to estimate how faint an object could have been detected at the position of the comet. -Editor.] With an unfiltered view one could just tell that something was obscuring the center of the Sun. There was some leveling off of the twilight brightness before sunrise, but after sunrise the sky color appeared normal."

A Hong Kong Lunar and Planetary Photographer. Those who met Mr. Joseph Hing-Chai Liu at the Astronomical League - A.L.P.O. Convention at Omaha last year will especially enjoy seeing on page 211 our colleague at his observatory and a sample of his photographic results. Several other lunar and planetary photographs by our colleague are of excellent quality. Mr. Liu would be glad to correspond with ALPO members skilled in photographic techniques. His address is Mandarin Court B-9, 142 Argyle St., Kowloon, Hong Kong. He is an education officer at Queen's College, Hong Kong, an advisor of the Queen's

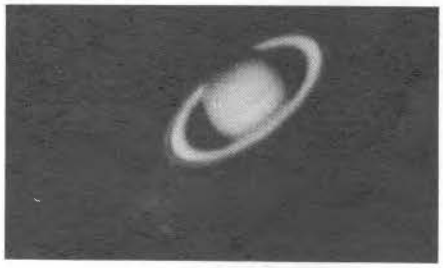

Figure 26. Photograph of Saturn by Howard F. Zeh on January 24, 1973. 8-inch reflector, f 133. Exposure 2 seconds. Plus -X film. Simply inverted image with south at top.

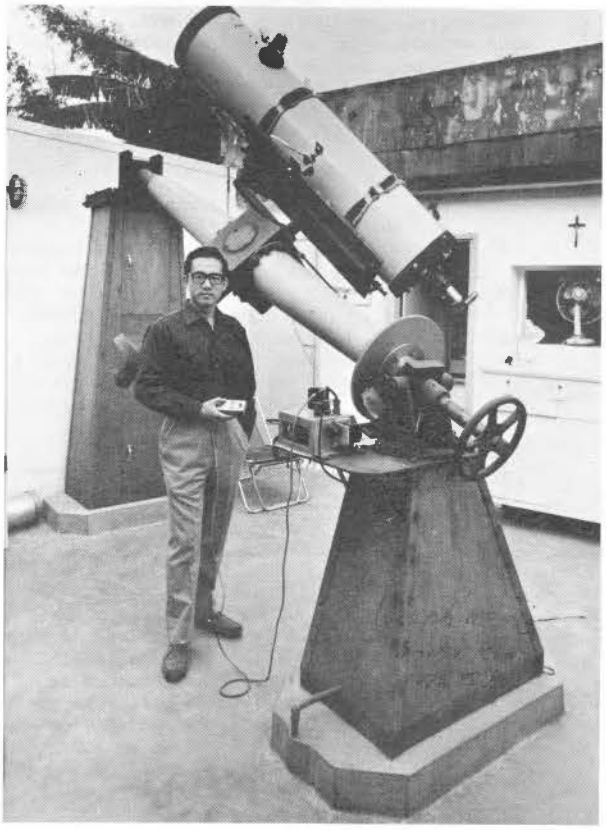

Figure 27. Mr. Joseph Hing-Chai Liu at his private observatory in Hong Kong. The 12.5-inch reflector shown took the photograph of Jupiter published as Figure 28. It is a Newtonian-Cassegrainian (f/5-f/19).

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College Astronomers' Club, and a tutor in astronomy in the Department of Extra-Mural Studies, University of Hong Kong.

Optical Effects During Solar Transit of Mercury on November 10, 1973. While a later report on ALPO studies of this phenomenon is tentatively planned, we should here like to note some results communicated by Richard M. Baum, 25 Whitchurch Road, Chester CH3 5QA, England. Mr. Baum chiefly looked for possible anomalous phenomena with a 115-mm., f/12 refractor at chiefly 186X, using the projection method. Clouds and rain did not allow observations to begin until 13^h0^m, U.T. At 13^h9^m, with the solar granulation distinguished with great clarity, Mercury, 50"

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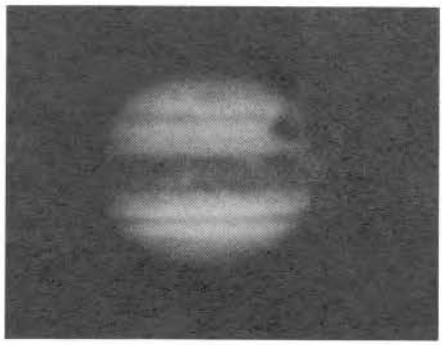

Figure 28. Photograph of Jupiter on June 3, 1972 at 19^h7^m, U.T. by Joseph H. C. Liu. Blue light (Wratten 38A filter). 8-second exposure. 12.5-inch reflector at f/183. A 12.5-mm. Orthoscopic eyepiece was used to project a 10-mm. image of Jupiter on to the 35-mm. Tri-X film. $CM_1 = 161°$. $CM_2 = 312°$. The Great Red Spot is a prominent dark oval in the South Tropical Zone.

inside the limb, was found to be surrounded by a pale dusky halo about half as wide as the diameter of the planet (outer diameter of halo about 18"). The halo was darkest adjacent to the planet and faded toward its external edge. Mercury itself was apparently darkest at its center. After an interval of passing clouds, Mercury at 13^h14^m, U.T. on the dimmed solar limb was surrounded by a bright halo having the shape of the former dark halo but being narrower (outer diameter 13" or so). As the planet egressed from the solar disc, the portion still projected against the Sun continued to be surrounded by the bright halo.

Our British contributor considers that the explanation of these appearances must be sought among the less familiar effects of diffraction. He is puzzled, however, as to what mechanics can explain the transformation from the dark halo to the bright halo. Perhaps well-planned experiments can yield the answer. A few others in Great Britain, he writes, remarked the dusky halo but not the bright one.

Mr. Baum observed third contact to occur at $13^h15^m45^s$, U.T.; but this result is inferior because of bad seeing. The planet was last positively seen at 13^h17^m, but this may not be the true fourth contact. The program chosen for the transit was adopted because of the experiments of Graham Hewick on artificial discs in simulation of transit phenomena.

The Strolling Astronomer

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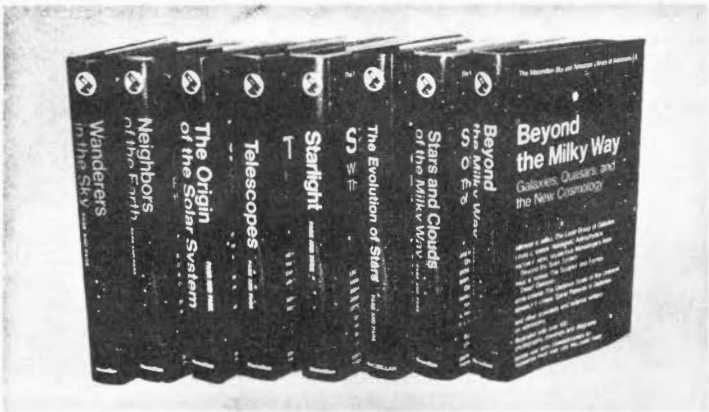

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