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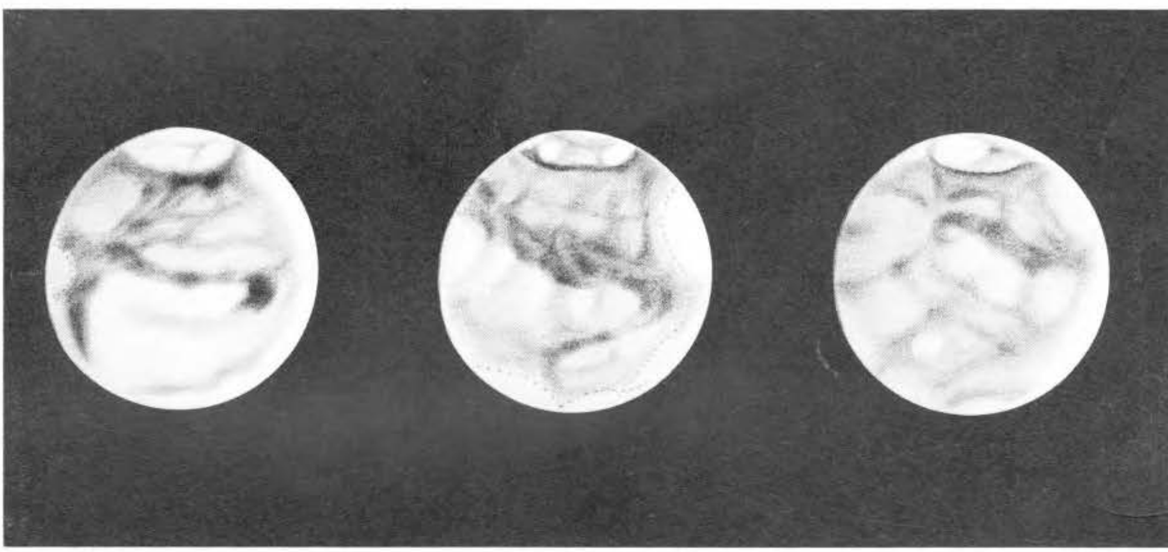

Drawings of Mars in 1971 showing a temporary darkening of the south polar cap. Made by Toshihiko Osawa, Nara, Japan, 8-inch reflector at 260X. Simply inverted view with south at top. Left drawing: June 28, south polar cap brilliant pure white. Center: July 13, temporary darkening of south cap. Right: July 18, apparent local differences in cap brightness. See Mr. Osawa's observational report and theoretical discussion on page 12 *et seq.*

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ALPO

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MARS 1971 APPARITION - MARTIAN POLAR HOODS - ALPO REPORT II

By: Charles F. Capen and Robert B. Rhoads, A.L.P.O. Mars Recorders

The polar regions of Mars were well observed by ALPO observers for over three-fourths of a Martian year from October, 1970 to March, 1972 (87^{o}-$358^{o}L_S$). The south polar region (SPR) was favorably tilted toward the Earth during most of the apparition from 1 March, 1971 onward, which included Martian mid-S. winter ($140^{o}L_S$) through S. spring ($180^{o}L_S$) to late S. summer ($358^{o}L_S$). The north polar region (NPR) was difficult to observe during this interval because of the south axial tilt. See Reference 1 and Reference 2, also the disk drawings and photos in Figures 1, 2, and 3. All 1970-71-72 photos, disk drawings, intensity estimates, and relevant tricolor data were studied and analyzed by the Mars Recorders for compilation of the results given in this present report.

The appearance of the polar hoods varies from a winter dull-gray to an early spring off-white. The exact day when the SPC makes its appearance from beneath the SPH (south polar hood) is not predictable, nor empirically well defined by the telescope. The polar hood becomes erratic, thins, and reforms several times during late winter and early spring before it dissipates completely. The aspects of the SPH and early spring SPC are shown in Figure 7 of Reference 1 and Figures 1 and 2 of this report. The behavior of the NPH is nicely summarized by B. Salmon in Reference 3.

The Observations

The SPH appeared to brighten (thin) during 3-5 May Terrestrial Date ($173^{o}L_S$); and C. Capen made micrometer measurements of it to obtain a maximum diameter of $97^{o} \pm 2^{o}$, which defines its edge at ≈42^{o}S. latitude. S. Miyamoto first saw a brilliant South Cap (SPC) around 9 May ($176^{o}L_S$). W. Haas and T. Jeffrey also reported the SPR to be brighter than the NPR on 10 May. A SPH was definitely seen again from 16-23 May TD by Helen Lines, E. Cross, J. Laird, B. Dischner, and Wm. Hartmann. Mrs. Lines noted a dark streak at about 240^{o} running parallel to the edge of the SPH on 16 May. The SPH dissipated again around 23-24 May ($185^{o}L_S$) because observations by Wm. Hartmann, R. Lines, C. Capen, J. Dragesco, and a photo taken on 26 May by M. Otis showed a bright, well-defined cap edge, dark rifts, bright patches within the SPC, and a narrow dark collar. Several morning and evening antarctic hazes were seen along the edge of the SPC in blue (Wratten Filter 38A) or violet (Wratten 47) light during this period by the above observers. The SPC remained bright through 1 June ($189^{o}L_S$), according to M. Mattei of Harvard, C. Scovil, Wm. Hartmann, J. Dragesco, F. Alpers, B. Dischner, and R. Rhoads. It became covered again on 2 June because it appeared dim in red and brighter in blue and violet light according to color filter intensity estimates by K. Delano, H. A. Smith, and J. Laird. The SPH was still suspected until 6 June ($192^{o}L_S$) by Wm. Hartmann, E. Cross, and J. Laird. On 6 June C. Capen recorded a bright, irregular edge on the SPC with a dark rift and two dull gray peripheral clouds. A small bright spot was noted on the SPC at about longitude 125^{o}, 70^{o}S. latitude by H. Lines using a 16-inch Newtonian. From 8-11 June the SPR brightened considerably as intensity estimates changed from 2 to 1 to 0 (scale: 0=brightest cap - 10=night sky) as obtained by S. Szczepanski, H. Smith, K. Delano, and N. Templin. These data and red-light photos by M. Otis and J. H-C. Liu, color photos by H. and R. Lines and C. Capen, and disk drawings by Wm. Hartmann, A. Haidai, P. Getz, R. Gordon, and W. N. Keyes showed a gradual brightening and improved definition of the SPC due to the permanent clearing of the SPH from 11-15 June. The planetocentric longitude was 195^{o}-$197^{o}L_S$, and the subsolar track (thermal equator) was $-7^{o}D_S$ areocentric latitude. An ill-defined, dull gray, and circular feature was noted concentric within the SPC by most observers from 21 June - 14 July (201^{o}-$215^{o}L_S$). This interesting feature is interpreted as a transient haze, which annually forms over the south pole of Mars, because of its shade, ill-defined boundary, extent, coverage of cap details, and seasonal behavior.*

Both polar hoods can be seen at the same time twice during a Martian year around the time of the two equinoxes. A SPH and a bright NPC were reported early in the apparition in October and November, 1970 (June Martian Date) by W. Haas and E. Cross. Temporary arctic hazes were noted in the vicinity of the small NPC by T. Cragg and C. Capen during March and early April, 1971 from 142^{o}-$158^{o}L_S$ (August MD). The NPH became dense and fairly constant by 10 April at $160^{o}L_S$ (September MD) according to W. Haas' observations. During April, May, and early June, 1971 both hoods were seen at times by T. Jeffrey, H. Lines, R. Rhoads, E. Cross, B. Dischner, J. Dragesco, R. Horiguchi, T. Osawa, C. Capen, J. Mitchell, Wm. Hartmann, M. Mattei, and others. The Martian S. spring equinox ($180^{o}L_S$) occurred on 15 May, 1971. The SPH was gone by 13-15 June, as reported above. The NPH was a dull gray and difficult object during late June, all of July, and early August, 1971. It was best seen in blue and violet light. The NPH was photographed during July and August by H. Verner, R. Horiguchi, J. Wiseman, N. Travnik, J. Dragesco, T. D. Ross, M. Otis, C. Capen, and H. Zeh. It brightened somewhat in August and was well observed by C. Michaux of JPL, B. G. Casseres at Curaçao, T. Osawa in Japan, and O. Henderson, D. Louderback, R. Gordon, J. Mitchell, P. Reddick, J. Prentice, R. Rhoads, J. West, and L. Carlino in the USA. According

*This feature and its interpretation are discussed by Toshihiko Osawa in his article beginning on page 12. See also front cover drawings.

Figure 1. ALPO 1971 observations of Mars. Identification: year, month, day, color filters, Universal Time, data, and remarks. See also "Key" on page 8.

1. 71 03 04 R,G,B 1315UT. 296°CM 142°L_s 61cm refr. 830X, C. Capen. Large SPH and early tenuous arctic haze over small NPC.
2. 71 03 13 I 0525UT. 95°CM 146°L_s 25cm Newt. J. Wiseman. Integrated (white) light photo. Note the large SPH and dark Solis L. NPC was too small to register.
3. 71 04 05 I 1305UT. 345°CM 158°L_s 15cm refr. 450X, T. Cragg, Mt. Wilson, CA. Both polar hoods are present.
4. 71 05 16 Y 1114UT. 284°CM 180°L_s 32cm Newt. 190X, E. Cross. Both polar hoods are present.
5. 71 05 25 I 0410UT. 94°CM 186°L_s 25cm Newt. 400X, J. Dragesco, Cameroun, Eq. Africa. Dull SPC with newly formed dark rifts. Probable antarctic haze present. NPH well defined.
6. 71 06 05 R,B 0615UT. 20°CM 192°L_s 15cm Newt. 210X, H. A. Smith. The SPC was bright with a dark collar. Intensity estimates (scale: 0=brightest; 10=night sky).
7. 71 06 06 I 1130UT. 88°CM 193°L_s 20cm refl. 360X, Wm. Hartmann, Tucson, AZ. Intensity estimates shown across disk (scale: 0=night sky; 10=bright cap). SPC bright with a dark collar. NPH was dull. Bright blue-white cloud (9.0) on terminator.
8. 71 06 06 R 1253UT. 107°CM 40cm Newt. 400X, Helen Lines, Mayer, AZ. Large SPC with a small bright spot. A medium dark polar cap collar.
9. 71 06 16 B,G,Y,O,R 1130UT. 353°CM 199°L_s 15cm Newt. 185 - 300X, R. Rhoads, Phoenix, AZ. A large, bright SPC. Extensive NPH and A.M. limb haze.
10. 71 06 21 I 1100UT. 300°CM 201°L_s 61cm refr. 810X, J. Inge, Flagstaff, AZ. Dark rift or haze on SPC. The NPH was bright white. Blue-white P.M. cloud was seen over Thoth-Utopia-Casius.
11. 71 06 25 B 0715UT. 208°CM 204°L_s 15cm refr. 290X, M. Mattei, Harvard Observatory, Mass. Excellent seeing conditions in broad blue light (W-38). A dark central patch was seen over SPC. The NPH was prominent.
12. 71 07 02 I 2255UT. 11°CM 208°L_s 25cm Newt. J. Dragesco's photo shows an extremely large and bright SPC with a dull central haze streak. The NPH is prominent.
13. 71 07 03 I 0805UT. 146°CM 209°L_s 15.6cm refl. E. Mayer, Baden, Austria. Large SPC with a central dark patch that is probably antarctic haze over a bright clear white cap. A narrow dark collar is present. The NPH is bright white.
14. 71 07 03 Y,B 1710UT. 278°CM 20cm Newt. 286X, T. Osawa, Nara, Japan. A bright SPC with a dull hazy streak was seen across the cap's diameter. The NPH extended into the A.M. limb haze.
15. 71 07 04 Y,B 0830UT. 142°CM 20cm refr. 250X, W. Wooten, Defuniak Springs, Fla. Bright SPC with dusky central streak and bright spot within the cap. A dark collar is present. A large NPH noted in blue and white light and not in yellow light.
16. 71 07 05 R,V,I 1112UT. 173°CM 210°L_s 40cm Newt. 400X, Helen Lines. Photovisual drawing. A dark central patch and a bright spot are noted in the SPC. The NPH was seen best in violet light.
17. 71 07 09 Y 0510UT. 48°CM 212°L_s 22.5cm Clark refr. D. Milon, Cambridge, MA. Four image composite photo shows the SPC central darkening (haze?). The NPR and A.M. limb appear bright. Note the enlarged Solis L.
18. 71 07 09 R,G,B 0700UT. 76°CM 31cm Newt. 300X. K. Delano provides intensity estimates for the above photo (scale: 0=night sky; 10=bright cap). The NPH was not seen in red light (0) and barely seen in yellow (5), but it was prominent in green and blue (7).
19. 71 07 13 I 2335UT. 282°CM 214°L_s 26cm Newt. 265X, J. Dragesco. SPC becoming clear of hazes and showing bright patches and early dark rifts. A large notable NPH was evident. Yellow clouds were present in the southern hemisphere.
20. 71 07 18 I 0830UT. 15°CM 218°L_s 31cm Newt. J. Prideaux's photo shows a weak and ill-defined SPC, and the contrasts of albedo features are low due to yellow cloud activity in the south.
21. 71 07 20 I 0830UT. 356°CM 219°L_s 20cm Newt. M. Otis, Aberden, S. Dak. Integrated light photo shows a bright SPC with a hazy evening (left) periphery. The NPH was a dull gray shade.

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to P. Kimball, C. Ricker, M. Fornarucci, and C. Haase, the NPH was again a dull gray shade in early September. Intensity estimates made by K. Delano on 20-22 September indicated that it was a wintery gray shade, and it was seen joined to an evening limb haze which stretched from pole to pole by B. Salmon and C. Capen.

Annual yellow storms are known to affect the polar regions (References 4 and 5). The Great Yellow Storm Cloud of 1971 was seen to reach the edge of the SPC on 24 September by R. Horiguchi. The NPH was seen large and bright on 25 September by J. Prideaux and C. Capen; but it was not noted on the next evening (26 September) by W. Haas, Salmon, J. Prideaux, Mattei, and Lankford, nor was it present on a photo by D. Milon. The disappearance of the NPH was confirmed on 27 September by J.R. Smith, Miyamato, Osawa, and Milon, and on the 28th by Salmon, Yajko, and C. Haase. The yellow storm's haze may have caused

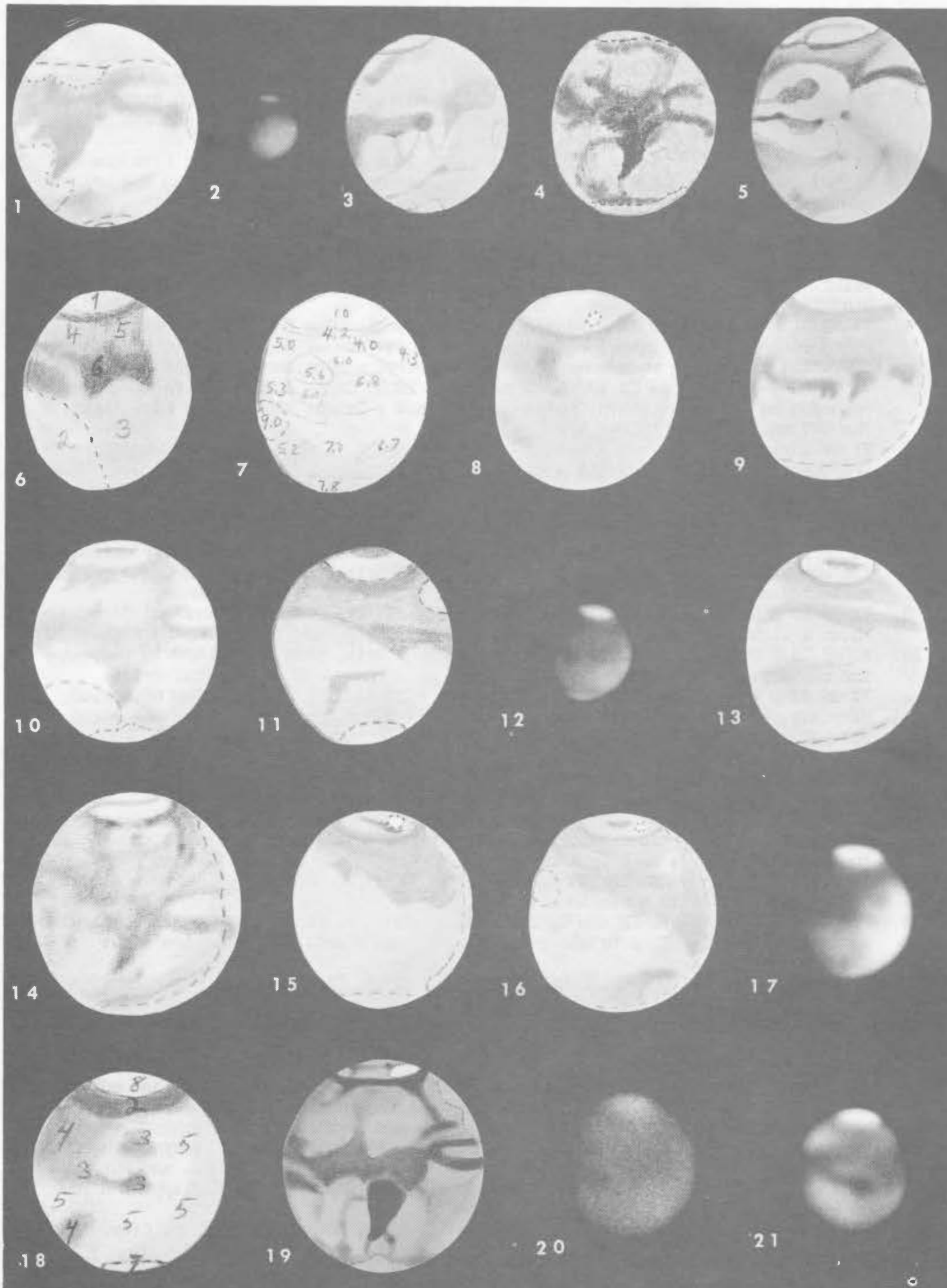

Figure 1. Selected drawings and photographs of Mars during its 1971 apparition by ALPO Mars Section observers. See explanatory material on page 2 and accompanying text.

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the retreat of the NPH, or it may have covered the part of the hood seen from Earth. The SPC lost its brightness on 28 September, and it could not be seen on 30 September by B. Salmon and others. A bright yellow haze hood was noted over the SPR from 1-3 October by Capen, Horiguchi, and Salmon. On 2 October a brightening of the NPR was noted in blue and violet light; and by 3 October a definite NPH was again present as

Figure 2. ALPO 1971 observations of Mars. Identification: year, month, day, color filter, Universal Time, data, and remarks.See also "Key" on page 8.

1. 71 07 21 G 0645UT. 322°CM 219°L_S 15cm refr. 260X, M. Mattei, Harvard Observatory, Mass. The SPC has a marked rift and a dark collar. A dull afternoon haze covers its left portion. The NPH is a dull gray shade. Dotted outlines indicate bright areas.
2. 71 07 30 0 0850UT. 273°CM 225°L_S 30cm refr. 380X, Dr. J. Goodman at Lick Observatory, CA. saw a dusky rift in orange light around Novissima Thyle on the bright SPC. The NPH was faint in an orange filter.
3. 71 07 31 R 1613UT. 12°CM 226°L_S 25cm Newt. R. Horiguchi, Tokyo. A composite red photo of professional quality shows the dark rift (notch) indicating the location of Novissima Thyle on a bright clear SPC. A dark collar was evident on the original print. The NPH was dark in red light. Compare this image with the next companion blue light photo.
4. 71 07 31 B 1627UT. 15°CM 25cm Newt. R. Horiguchi. The SPC appears bright and sharp in broad blue-light. Photo sets like these are of high balue to the interpretation of Martian phenomena. The NPH appeared non-uniformly bright in blue.
5. 71 08 06 B 0010UT. 83°CM 230°L_S 20cm Newt. 240X, Capt. S.W. Bieda in Wiesbaden recorded an irregular,sharp, and bright SPC and a bright NPH in deep blue light. The NPH was not seen in red light.
6. 71 08 13 I,B 0330UT. 70°CM 234°L_S 15cm Newt. 180X, H.A. Smith. The shrinking SPC was seen clearly and with a dark rift and a bright spot. Intensity estimates indicated the SPC to be especially bright. The NPH was seen well in blue light.
7. 71 08 14 I 0450UT. 80°CM 235°L_S 51cm refr. K. Kamper's photo in white light shows a clear, bright SPC and very little of the NPH.
8. 71 08 14 I 0515UT. 86°CM 15cm Newt. 285X, R. Thomas provides intensity estimates for comparison with the above photo. The small bright oval on the SPC was estimated at intensity 10, the maximum. The NPH was a dull gray shade.
9. 71 08 19 B 0200UT. 355°CM 238°L_S 20cm Newt. 233X, B. Gomes Casseres of Curaçao shows a light blue disk with an irregular, shrinking, and clear SPC and a small NPH.
10. 71 08 19 R 0710UT. 71°CM 238°L_S 20cm Newt. M. Otis. The bright SPC is retreating rapidly. Just a hint of the dull NPH can be seen on the original print.
11. 71 08 27 R 0440UT. 323°CM 243°L_S 25cm Newt. 300X, Dr. J.H. Illescas of Mexico City saw the SPC clear with fine details. The NPH had brightened and was noted in red light.
12. 71 09 01 V 0330UT. 261°CM 246°L_S 15cm Newt. 300X, J. Mitchell, Cairo, GA. The small retreating SPC was seen clear of haze and with a narrow dark collar. The NPH was noted to be nearly as bright as the SPC in violet light.
13. 71 09 04 R,G,B,V 0210UT. 215°CM 248°L_S 10cm refr. 250X, C. Ricker. Intensity estimates (Scale: 0=night sky; 10=very bright cap) in integrated light showed the NPH (8.5) nearly as bright as the SPC (9). The NPH was not seen in red light.
14. 71 09 13 I 1315UT. 295°CM 254°L_S 25cm refl. 275X, R. Horiguchi, Tokyo. Almost a pure white SPC with Novus Mons vague.
15. 71 09 16 Y 0040UT. 83°CM 256°L_S 31cm Newt. 300X, K. Delano. Intensity estimates indicate a bright SPC, a bright evening limb, and a dull NPH in yellow light (Wratten 15).
16. 71 09 19 B 1940UT. 334°CM 258°L_S 20cm refl. 240X, Capt. S.W. Bieda, Wiesbaden. The SPC and NPH were bright in blue light.
17. 71 09 20 R,G,B,V 0345UT. 91°CM 258°L_S 61cm Clark refr. 810X, C. Capen, AZ. The evening limb haze connected with the haze caps at both poles. The SPC was seen through the antarctic haze.
18. 71 09 26 V 0350UT. 38°CM 262°L_S 20cm Newt. R. Parish, Fla. The SPC and enlarging NPH were bright in violet light (Wratten 47). Capen's Great Dust Storm (light band) covered much of the southern hemisphere and equatorial region.
19. 71 09 29 I 1115UT. 118°CM 264°L_S 25cm Newt. 384X, R. Horiguchi, Tokyo. The SPC was vaguely seen through the yellow haze of the storm. The Solis L. and Mare Sirenum were just at the edge of the bright yellow clouds. The NPH appeared to be missing.
20. 71 09 30 R 0250UT. 345°CM 264°L_S 31cm refl. 488X, B. Salmon, Oklahoma City. The SPC was covered by the dust storm. The NPH was very weak or non-existent.

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reported by L. Carlino, T. Osawa, C. Capen, and R. Yajko. A whitish type SPH appeared on 4 October to C. Haase, Yajko, Carlino, and Capen; it may have been the bright SPC shining through the dusty atmosphere or from an H_2O condensation on the dust nuclei as proposed by C. Capen in 1956 (Reference 6). The blue-white SPH was confirmed by R. Powaski, Delano, Dragesco, H. Smith, and Horiguchi on 5-7 October. Afterwards, a yellow-white SPH and a gray-white NPH were observed on the Martian disk from 5 October (268°L_S) until the end of the apparition on 12 March, 1972 (358°L_S). This period was equivalent to Martian N. winter and S. summer. See Figure 5 in Reference 1 for a season protractor.

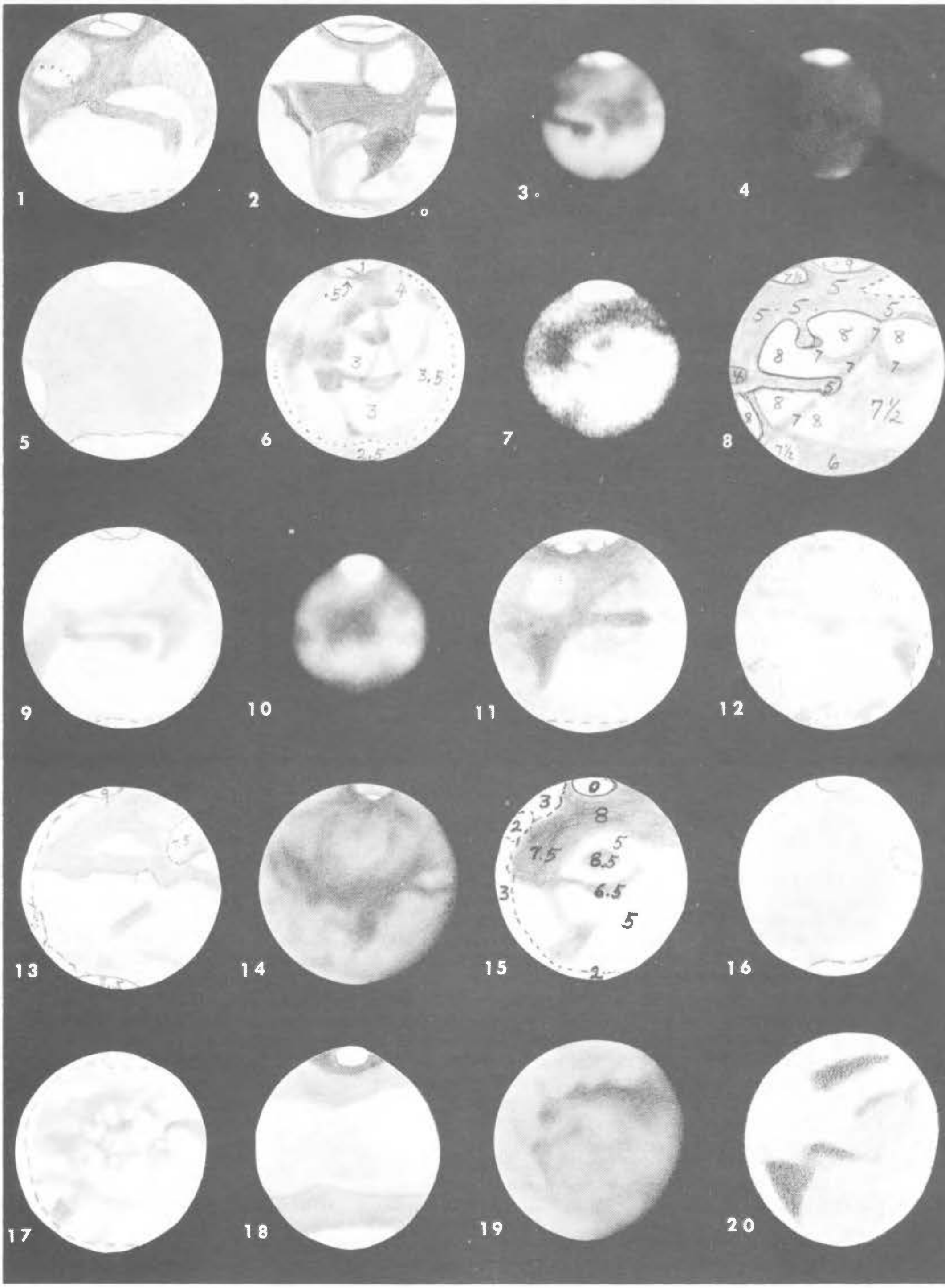

Figure 2. Selected drawings and photographs of Mars during its 1971 apparition by ALPO Mars Section observers. See explanatory material on page 4 and accompanying text.

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In Summary

The annual spring disintegration of the SPH began in early May, 1971 around $174^{\circ}L_s$ and ended about mid-June at $196^{\circ}L_s$; it thus required about 43 days or $23^{\circ}$of L_s for this

(text continued on page 8)

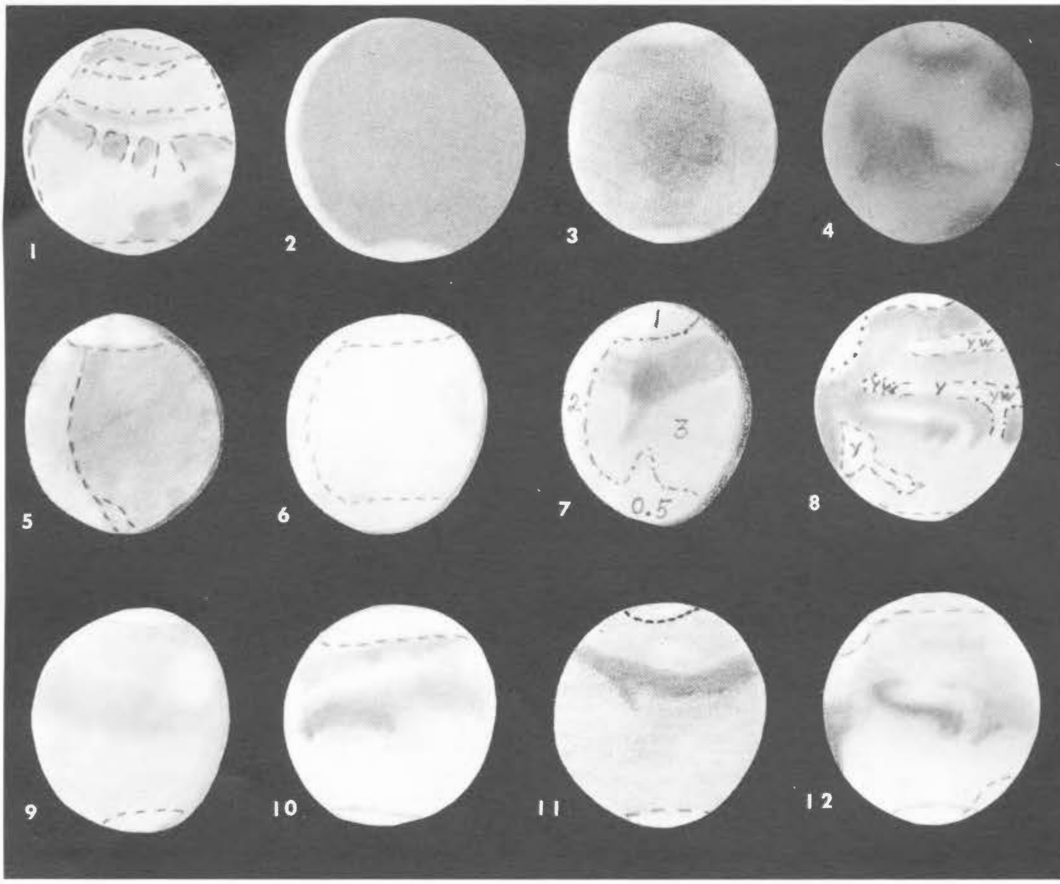

Figure 3. Selected drawings of Mars during its 1971-2 apparition by ALPO Mars Section observers. Identification: year, month, day, color filter, Universal Time, data, and remarks. See also "Key" on page 8.

1. 71 10 03 R,G,B,V 0520UT. 354°CM 266°L_S 61cm refr. 810X, C. Capen, AZ. The SPR was covered by a medium bright yellow-white hood. The NPH had a weak white appearance during this period of the dust storm.
2. 71 10 06 B 2010UT. 182°CM 269°L_S 31cm refl. 190X, A.W. Heath of Nottingham, England. The SPR was dull in blue light while the NPR was seen moderately well. The great dust storm was now in full progress.
3. 71 10 07 B 0130UT. 260°CM 269°L_S 15cm refl. 460X, M. Fornarucci, N.J. No SPC was found. The SPR was the lightest feature on the Martian disk in blue light. Perhaps this object was a polar hood created as a result of the planet-wide dust storm.
4. 71 10 07 I 1330UT. 75°CM 25cm Newt. 384X, R. Horiguchi. A bright patch was noted in the SPH at this longitude. The NPH was not located.
5. 71 11 05 G 0045UT. 332°CM 287°L_S 15cm Newt. 250X, M. Fornarucci. A bright SPH and an evening limb brightening were seen in green light. No NPH was found. Yellow dust storm at maximum.
6. 71 11 12 B,M 0210UT. 285°CM 291°L_S 15cm refl. 300X, C. Haase, TX. Both polar regions were bright in blue and magenta light.
7. 71 12 26 R,B 2310UT. 160°CM 318°L_S 15cm Newt. 180X, H.A. Smith, Conn. Large SPH appeared light in blue light. A large, bright NPH was present.
8. 72 01 14 R,G,B,V,M 0100UT. 10°CM 328°L_S 61cm refr. 810X, C. Capen. Hazy SPH best seen in blue and magenta light. The NPH was bright in green light and dull in red light.
9. 72 01 24 G 0140UT. 281°CM 333°L_S 35cm Newt. 500X, R. Rhoads, Phoenix, AZ. SPH seen weakly in green light, and NPH bright in green light.
10. 72 02 04 I,Y 0135UT. 171°CM 339°L_S 61cm refr. 610X, C. Capen. A large SPH was noted in white light. The NPR was dull and not well defined.
11. 72 02 18 Y,G,B 0235UT. 50°CM 347°L_S 10cm refr. 250X, R. Crausby, Provo, Utah. A large SPH was seen in green and blue light. The NPR was not bright.
12. 72 03 31 I 0210UT. 354°CM 08°L_S 61cm refr. 610X, C. Capen. The spring NPC was clear of artic hazes and bright. A large, dull autumn-winter SPH was present.

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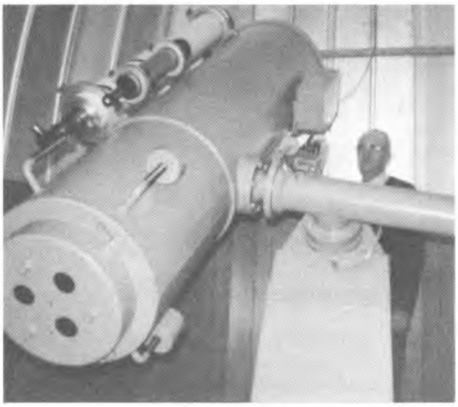
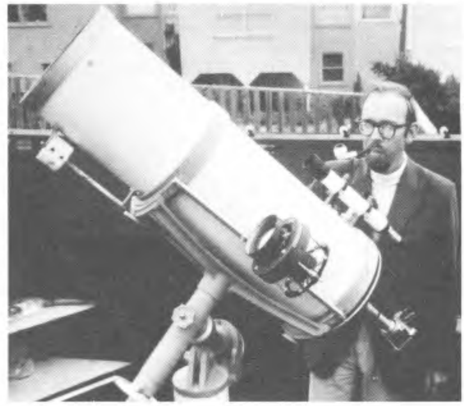
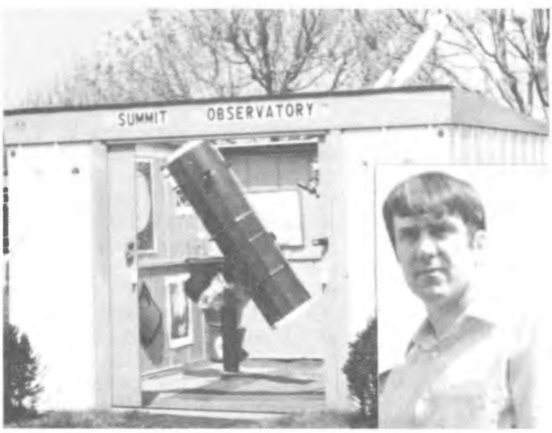
Figure 4 . ALPO Mars Section Observers and Their Telescopes



J. Russell Smith, ALPO Secretary & Book Review Editor with his 406mm Newtonian telescope at Waco, Texas.

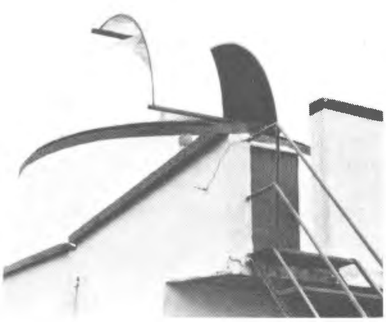


Dr. John Westfall, ALPO Lunar Recorder & Mars Section member with his 250mm Cassegrain telescope.



Robert A. Yajko & Observatory at Leechburg, Pa. has 250mm f/5 Newt. refl. and 106mm f/15 refr. that are used for systematic tricolor filter observations.

Raleigh Crausby of Salt Lake City & his 106mm f/15 refr. on Pump Ridge (7,300'), Utah. Raleigh uses yellow, green, & blue filters for Mars observation of clouds & white spots.



The OBSERVATORIO LAPLACE, Mexico City and the 250mm Newtonian reflector used by Dr. J. Hernandez Illescas for observing the Red Planet.

event to take place. The NPH made its first appearance as intermittent, thin arctic hazes in the vicinity of, or over, the small summer residual NPC in late Martian August around 142°L_S. During late northern summer, the hazes became more frequent and denser. The NPH became permanent close to the autumn equinox at 185°-195°L_S, and it continued to mature during northern autumn and winter. These polar phenomena are thought to be somewhat variable from one Martian year to another by experienced observers. Planet-wide summer dust storms drastically affect both polar regions. The global dust probably upsets the thermal balance of the Martian atmosphere. One wonders what effect this has upon the annual regression rate and on the final residual size of the summer SPC and the formation of the NPC and its maximum winter extent.

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Key to Notes on Figures 1, 2, and 3

Perhaps some readers would prefer a few more details on the notes on pages 2, 4, and 6. The date is there given in a year - month - day format; e.g., 71 10 03 is 3 October, 1971. Color filters used are identified by the first letter of the color name: I is integrated light (or white light), R is a red filter, B is blue, G is green, etc. The symbol U.T. is the Universal Time in hours and minutes, widely used in astronomical reports; it is the local mean solar time at Greenwich and is measured in a 24 - hour system from zero hours at midnight. Universal Time is five hours later than Eastern Standard Time, six hours later than Central Standard Time, etc. Item CM is the central meridian of longitude on Mars and tells us what features were presented to the Earth. For example, since the Solis Lacus is near longitude 90°, it can be observed when the CM is between, roughly, 40° and 140°, with axial tilt and phase naturally affecting the visibility of Solis Lacus. The quantity L_S is the areocentric longitude of the Sun measured from 0° at the vernal equinox of the northern hemisphere. Thus L_S measures the Martian season; the south hemisphere experiences its vernal equinox at 180° and its summer solstice at 270°. Telescope aperture and type, reflector or refractor, are given in the usual way; and some non-metric system readers may wish to recall that there are 2.54 cms. in an inch.

SOME SYSTEMATIC OBSERVATIONS OF SATURN DURING ITS 1974-75 APPARITION

By: Emilio Sassone-Corsi and Paolo Sassone-Corsi,
Neapolitan Astro-Amateur Group

The Saturn Section of the U.A.I. (Italian Astro-Amateur Union) organized, as usual, a program of visual and photographic observations of Saturn in 1974-75. There were about 30 participating observers, and on the average they used reflectors 8 inches in aperture. They obtained 178 visual observations for a total of 2081 estimations of intensity, 1337 of color, and 600 determinations of latitude.

For the estimating of intensity the scale adopted was 0 (for the brightest region of the planet) to 10 (for the sky background). No filters were used.

Apparition Data

Heliacal conjunction
June 30, 1974

Heliacal conjunction
July 15, 1975

Opposition January 6, 1975
polar diameter = 18".5
major axis of rings = 46".6

Description of the planet and its rings

Since the average Saturnicentric axial inclination was B = -24°, the rings almost totally hid the northern hemisphere of the globe, which was visible only from a latitude

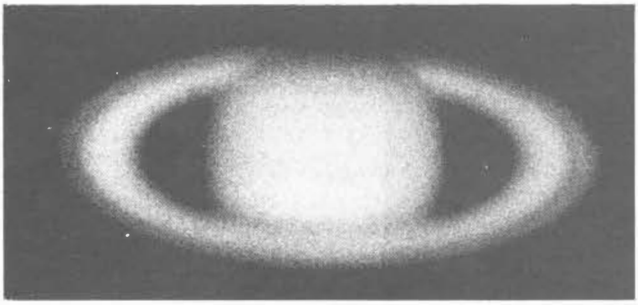

Figure 5. Photograph of Saturn with a 60-cm. reflector on January 15, 1975. Tri-X-Pan Kodak Film with W9 (yellow) filter. See also text.

of about + 8^{o} (southern limit where Ring C crossed the globe).

S.P.R. : On the average, it was brighter than in recent years but as wide as then. Greyish in color, it showed sometimes green nuances.

S.S.T.B. : It was visible only in the best conditions of observation. It was thinner than in past years and was less conspicuous than then. Its southern limit was sometimes confused with the border of the S.P.R.

S.S.T.Z. : The clear zone, between the SSTB and the SPR, was about the same intensity as the STZ.

S.T.B. : It was registered also on some photographs. Very thin but conspicuous enough. Indefinite color.

S.T.Z. : Yellowish with some pink nuances. Its northern limit has been appearing merged into the southern zone of the SEB.

S.E.B. : Clearly separated into two components (SEB_s and SEB_n) by a zone which was a little brighter (IZ) . The northern component of this system was much better delimited. More powerful instruments have shown a deep red color and some details, such as cumuli and spots, which were never well defined.

E.Z. : The brightest zone of the globe has sometimes shown a band which was scarcely notable but was wide enough: the EB. The color of this zone was persistently pink.

Ring A : The outermost ring was separated into two parts by Encke's Division (position 4.3 ± 0.6, assigning 0 to the external edge of Cassini's Division and 10 to the external edge of Ring A). Ring A's color sometimes tended to blue-green.

Cassini's Division : It was clearly visible, and only very rarely irregularities have been observed on its outer edge.

Ring B : Very bright in its external portion. Its two components, Ring B outer and Ring B inner, were clearly visible. The inner edge towards Ring C was not well defined.

Ring C : Easily visible. Its color was tending to violet.

The shadow of the rings on the globe was shaped like a meniscus, and has been visible through Ring C where crossing the globe.

The shadow of the globe on the rings has shown the usual variation in extent, being at its maximum at quadrature and at its minimum at opposition.

In the following table there are recorded the estimates of intensity made of the different parts of the planet (the number of estimates is in parentheses). For every set of estimates we have calculated the error of the mean by the statistical formula:

$$e = \frac{S}{\sqrt{n}}$$

where S is the root mean square and n is the number of estimates.

Feature	Intensity	Feature	Intensity
Ring A, outer	3.46 ± .09 (151)	S.P.R	4.30 ± .10 (158)
Encke's Division	6.07 ± .14 (18)	S.S.T.B	2.85 ± .16 (11)
Ring A, inner	3.03 ± .10 (148)	S.S.T.Z.	2.36 ± .09 (30)
Cassini's Division	8.03 ± .08 (155)	S.T.B.	3.37 ± .08 (38)
Ring B, outer	0.88 ± .03 (163)	S.T.Z.	2.33 ± .06 (130)
Ring B, inner	1.76 ± .08 (126)	S.E.B.s	4.01 ± .09 (162)
Ring C, off globe	6.35 ± .17 (123)	I.Z.	2.86 ± .24 (14)
Ring C, across globe	5.65 ± .15 (107)	S.E.B.n	4.00 ± .08 (162)
Shadow globe on rings	8.78 ± .09 (151)	E.Z.	1.47 ± .06 (133)
Shadow rings on globe	7.30 ± .11 (79)	E.B.	3.79 ± .15 (22)

Photographic Observations

Photographic observations have been made by the authors with a reflector having an aperture of 23.5 inches and an equivalent focal length of 40 meters at the Swedish Astro-

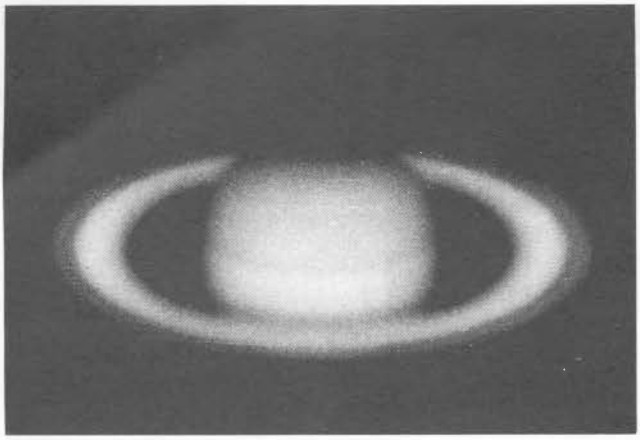

Figure 6 (above). Photograph of Saturn in yellow light with the technique of superimposed images. Figures 6, 7, & 8 were all secured by Emilio and Paolo Sassone Corsi on January 15, 1975 with a 23.5-inch Cassegrain at a focal length of 40 meters.

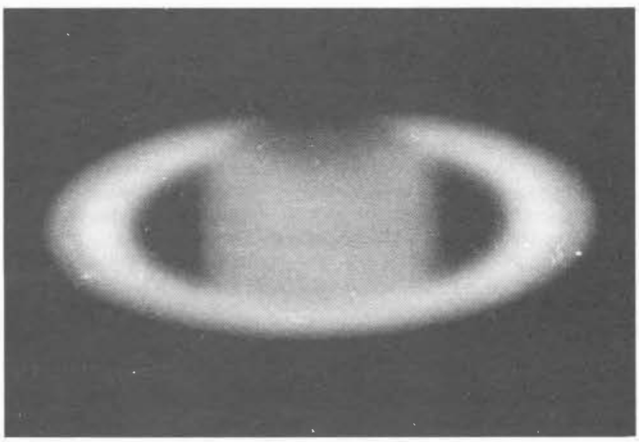

Figure 7 (above). Photograph of Saturn in violet light with the superimposition technique.

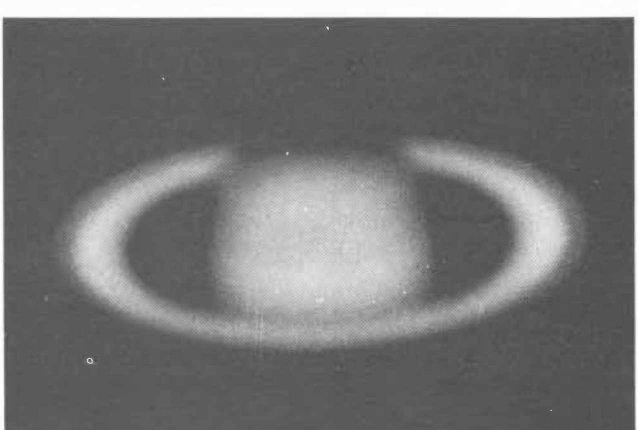

Figure 8 (above). Photograph of Saturn in infrared light with the superimposition technique.

physical Station of Anacapri (Naples). On the emulsion the length of the major axis of the rings was 1 cm. More than 400 photographs were secured in three different spectral zones: violet, yellow, and infrared. Pictures in the violet were made with a Tri-X-Pan Kodak film + Wratten 34 filter for a spectral range from λ = 3700 Å to 5000 Å (the lower limit is determined by the absorption of the interposed filter). Exposure time has usually been 10 seconds. Pictures in the yellow were made with a Tri-X-Pan Kodak film + Wratten 9 filter, for a spectral range going from λ= 4600 Å to 6700 Å. Exposure time has been about 2 seconds with very good results. Pictures in the infrared were made with a High Speed Infrared Kodak film + Wratten 89B filter for a spectral range going from λ = 6800 Å to 9500 Å, including the extreme red. Exposure time was about 10 seconds. All the films have been treated with a D19 Kodak developer 12 hours after the exposure, with continous agitation during development. The developing time has been 6.5 minutes for the Tri-X-Pan and 8 minutes for the High Speed Infrared, both at 20^{o} C.

In order to obtain better images, the superimposing technique was adopted, first blowing up the negatives to the ratio of 1 arcsec to the millimeter. For this purpose a Kodatone Kodak autopositive film was used (superimposing four images).

The resulting material was analyzed through the Joyce-Loebl microdensitometer of the International Instutute of Genetics and Biophysics in Naples, and the stop used was 31 x 70 microns.

In Table I on page 12 you can read the values of the Saturnicentric latitude of different features; they were obtained by calculating with Crommelin's formulae. The number of visual observations is given in parentheses. It will be noted in Table I that the photographic latitude of the S.P.R. appears to include even the SSTB.
As for the remaining features, the accordance is good enough.

With the microdensitometer we have obtained the photometric profiles of the major and minor axes of the rings. In order to obtain the characteristic curve

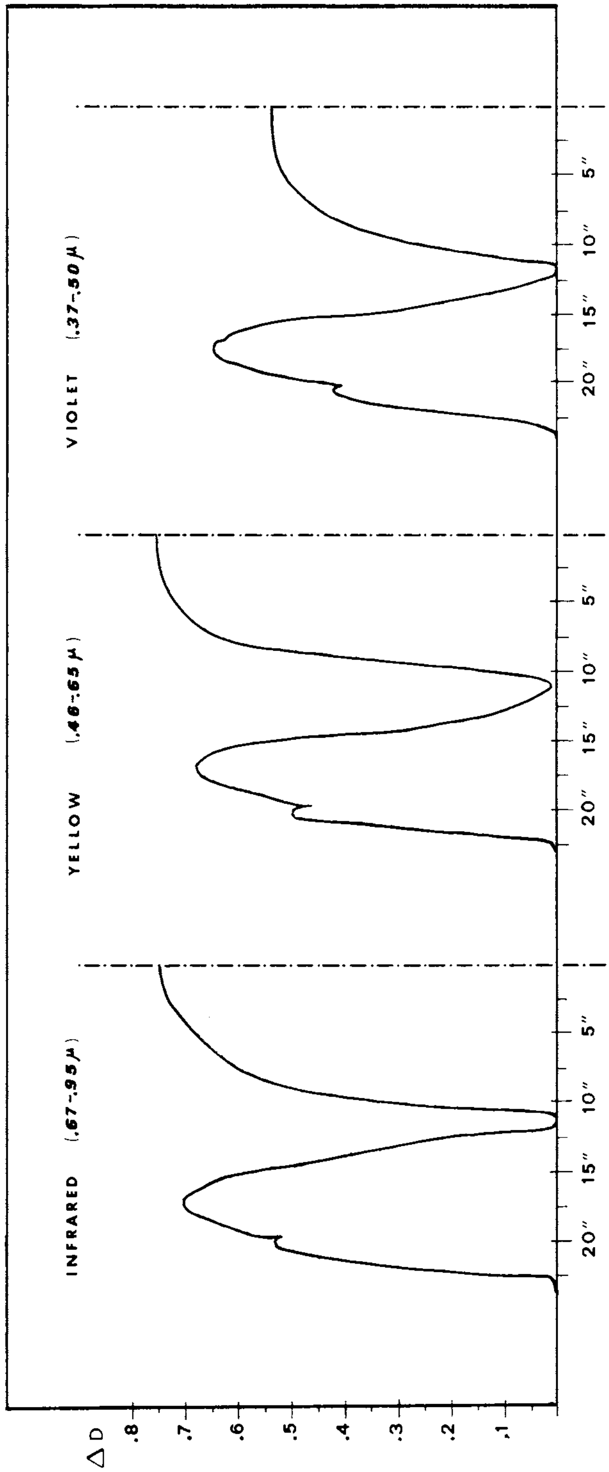

Figure 9. Photometric trace along the major axis of the rings of Saturn in three different spectral ranges. Intensity on horizontal scale; distance from center of disc in seconds of arc on vertical scales. See also text.

of the films we have analyzed a step filter, for which the difference of intensity (ΔD) between one step and another is known.

In Figure 9 you can see the corrected photometric profiles obtained through analytical traces along the major axis of the rings in the three different spectral ranges. On observing these curves some conclusions are easily reached. As we can see, the rings transmit rather regularly from λ = 3700 Å to 9500 Å (spectral zone covered by photographs); on the contrary, the globe transmits clearly less than the rings in the violet (3700 - 5000 Å); but in yellow and infrared light (4600 - 9500 Å) its transmission is nearly constant. Thus we can affirm that the discrepancies observed during 1973-74 were due to a different emission from the globe and not from the rings. (See "Some Systematic Observations of Saturn During Its 1973-74 Apparition", JALPO, Vol. 25, Nos. 9-10, pp. 207-211).

This emission can be explained only in two ways:
1) The chemical composition of Saturn's atmosphere is such that its emission is more intense in the yellow-infrared zone.
2) With a possible high temperature of the planet's atmosphere, the globe emits chiefly in the infrared.

In order to obtain more precise data, it would be useful to photograph Saturn with a series of narrow-band interference filters.

The Saturn Section of the U.A.I. is going to plan a program of further observations of the planet. Any interested person is invited to write to the authors at:
G.A.N., Via G. Malaterra n. 23, 80136, Naples, Italy.

Foreword by Editor. The article by Mr. Toshihiko Osawa which begins on page 12 can be profitably studied in connection with the Mars Report by Messrs. Capen and Rhoads on pages 1-8. Mr. Capen has read Mr. Osawa's manuscript and kindly made a number of helpful suggestions. Many of them were used in revising the text.

Table I. Observed Saturnicentric Latitudes in 1973-74

Feature	Visual Observations	Yellow Photographs	Violet Photographs	Infrared Photographs
Nedge SPR	-69° 00'(98)	-57° 10'	-55°46'	-60°21'
center SSTB	-60 23(15)	-	-	-
center STB	-44 11(24)	-44 03	-	-
Sedge SEB_s	-29 33(107)	-28 09	-	-30 45
Nedge SEB_s	-25 20(74)	-24 35	-24 35	-25 08
Sedge SEB_n	-15 29(79)	-16 31	-18 12	-21 00
Nedge SEB_n	- 8 51(114)	- 7 39	-10 07	-11 41
center EB	+ 1 14(6)			+ 0 13
Sedge EB		- 2 28	-	
Nedge EB		+ 4 36	-	
Sedge Ring C projection*	+ 9 32(82)	+10 16	+ 5 19	+10 06

* The latitude of this feature varies with the changing axial tilt B of Saturn to the Earth.

ON A TEMPORARY DARKENING OF THE SOUTH POLAR CAP OF MARS

By: Toshihiko Osawa, Oriental Astronomical Association

From late June to mid-July, 1971, there occurred a conspicuous obscuration around the south pole of Mars, while the edges of the south polar cap remained very bright. The phenomenon may be explained by the latitudinal difference of insolation in the spring of the southern hemisphere of Mars.

General Description

After the south polar cap emerged from beneath the south polar hood from early May to the middle of June, 1971 (see the Capen-Rhoads article on page 1 et seq.) near the vernal equinox of the southern hemisphere, it was observed to thaw at a moderate rate until it was hidden by the Great Yellow Storm Cloud near the end of September. From June 21 to July 14 the south polar cap experienced a temporary darkening of its central portion, the outer edge remaining bright white. The writer observed the phenomenon from July 10 to 18, U. T. dates, with an 8-inch reflector usually employed at 286X. On July 16 to 18 the south cap was affected by yellow clouds. On July 28 the writer observed a pure white cap. It should be noted that L_s, the areocentric longitude of the Sun measured so as to be 180° at the vernal equinox of the southern hemisphere, varied from 201° on June 21 to 215° on July 14. The writer could not make personal observations in early July because of the rainy season in West Japan.

Examples of the transition of the normal bright cap to a duller one are shown in the drawings on the front cover of this issue. As far as the writer knows, the phenomenon is as striking as was the appearance of Rima Australis in early August, 1971, the latter a major seasonal change of the south polar cap.

A Possible Interpretation of the Phenomenon

It may be useful now to discuss the relation between the size of the thawing polar cap and latitudinal differences of insolation which the south polar cap receives.

Figure 10 represents the change in angular width of the south polar cap, first as determined by the writer's visual observations and second as determined by photographs taken by the Lunar and Planetary Laboratory and the International Planetary Patrol.[2] Dr. de Vaucouleurs' drawings[1] are also included. The visual and photographic melting curves were both obtained from a Least Squares approximation. As compared with the photographic melting curve on Figure 10, the writer has a systematic tendency to estimate the cap to be too small.

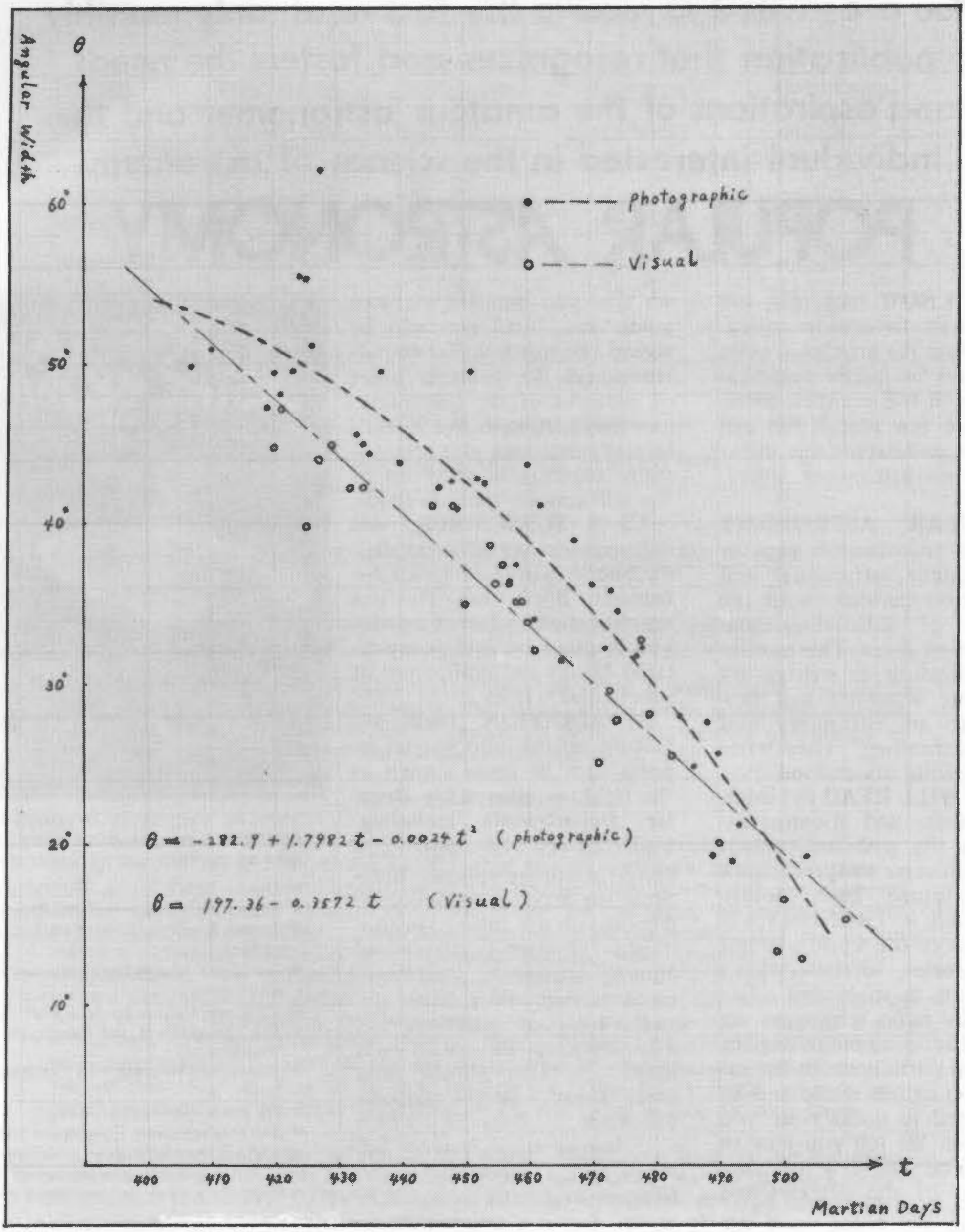

Figure 10. The observed thawing of the south polar cap of Mars in 1971. The angular width θ is plotted against the number of Martian days since the vernal equinox of the northern hemisphere of Mars for both photographic and visual measures. The computed least squares function is given for both kinds of observations. See also text on page 12.

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Figure 11 shows a combination of these curves with the old data plotted by E. C. Slipher[3] and with the average curve constructed by T. Saheki[4] from the reduction of 1937-56 observations by the Mars Section of the Oriental Astronomical Association. It may be concluded from these curves that the behavior of the south cap was rather normal during the 1971 apparition.

Insolation on Mars at Different Latitudes

The insolation Q at a given latitude is given by the following formula which makes no allowance for attenuation by the atmosphere of Mars.

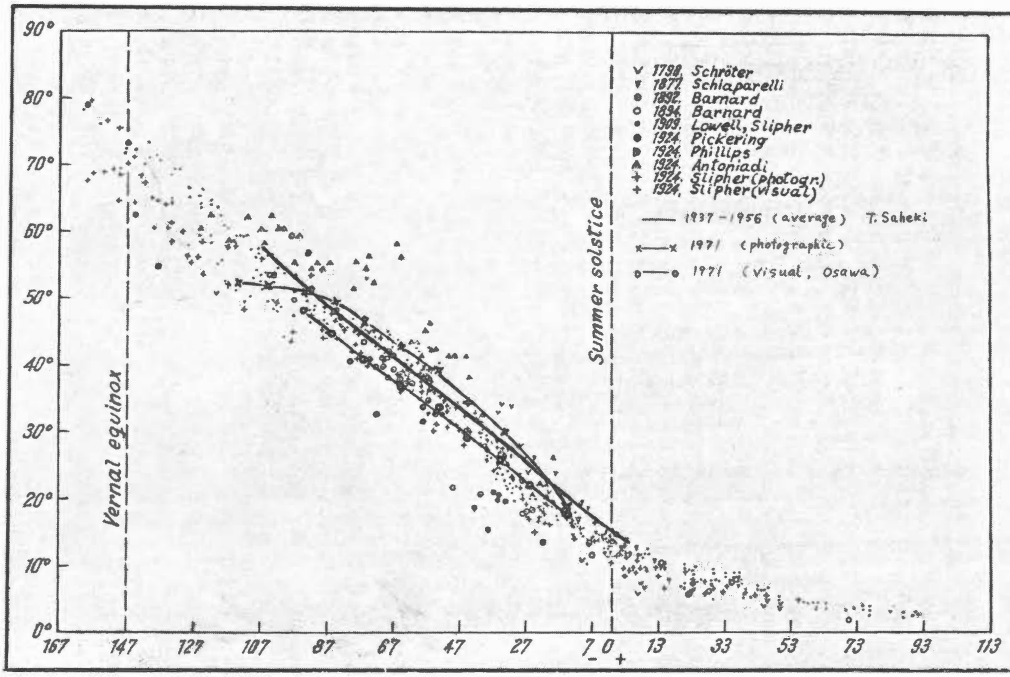

Figure 11. The observed thawing of the south polar cap of Mars according to the various sources in the key. The angular width is plotted against the number of Martian days before or after the summer solstice of the southern hemisphere of Mars. See also text.

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$$Q = \frac{2E}{R^2}\int_0^{T/2} (\sin\phi \sin D_s + \cos\phi \cos D_s \cos\omega t)\ dt.$$

Integration gives us:

$$Q = \frac{2E}{\omega R^2}\ (\theta_o \sin\phi \sin D_s + \cos\phi \cos D_s \sin\theta_o) \text{ if } \phi > -90° - Ds$$

and $Q = \frac{2E}{\omega R^2}\ \pi \sin\phi \sin D_s$ if $-90° \leqq \phi \leqq -90° - D_s$.

The symbols have these meanings:

Q, the insolation in calories per square cm. times Martian days.
ϕ, the latitude of a point on Mars, positive when north.
D_s, the areocentric declination of the Sun.
θ_o, the semi-diurnal arc of the Sun.
T, the duration of sunshine free from clouds.
ω, the angular velocity of rotation of Mars.
E, the solar constant = 1.94 cal/cm.^{2} minutes.
R, the distance of Mars from the Sun in Astronomical Units.

Pertinent relations among these quantities are:

$$\cos\theta_o = -\tan\phi \tan D_s$$

$$T = \frac{2\theta_o}{\omega}.$$

The results of the evaluation of Q from the above formula are graphically shown in Figure 12.

A Possible Interpretation of the Darkening of the South Polar Cap

There are plotted in Figure 12 the latitudes of the northern boundary of the south polar cap, really another expression of the "melting"curve of Figure 10.

In spite of the differences in the results given by the visual and photographic methods, the aspect of the decreasing south polar cap may be approximately profiled. The critical latitude ϕ_C of the terminator as computed from $\phi_C = -90° - D_S$ is also given. If a feature lies to the south of ϕ_C, the Sun is always above the horizon. Hence, the shaded area to the left of the ϕ_C curve in Figure 12 shows the zone which experiences day and night during a rotation of Mars, while the area to the right side shows the zone where the Sun never sets. Therefore, Figure 12 is useful in discussing the relations among the "melting" of the south polar cap, the insolation at different latitudes on Mars, and the existence of day and night at a given latitude.

Because the temporary darkening of the south polar cap occurred 427-434 Martian days after the vernal equinox of the northern hemisphere as observed by the writer, it is evident from the insolation curves in Figure 12 that it occurred when the insolation began to be greater at the south pole than at the north edge of the south polar cap and that the latitude where the insolation had its minimum value certainly lay between the south pole and the edge of the cap. Indeed, a unit area at the edge of the south cap then received more insolation per Martian day than a unit area at the south pole, but thawing near the edge of the south cap would apparently have been delayed by overnight sublimation from vapor to the solid phase. Such sublimation is assumed because of the nightly great decrease of temperature in the Martian atmosphere almost free of any "blanket effect". On the other hand, the increase in the insolation over the south polar area would accelerate thawing, as sublimation from the solid to the vapor phase, resulting in a temporary decline in the albedo of the area and causing the south polar cap darkening. When the darkening occurred in 1971, there was abnormal opacity in the atmosphere in the vicinity of the south pole so that other interpretations are possible. Nevertheless, the latitudinal effect of insolation may be considered to play an important role in the temporary darkening of the south polar cap.

References

1. Sky and Telescope. Vol. 42, No. 5. Front cover and pp. 260-263.

2. Sky and Telescope. Vol. 42, No. 3, pg. 134 and Vol. 43, No. 1, pg. 20.

3. E. C. Slipher. Mars, The Photographic Story, pg. 20.

4. Tsuneo Saheki. Mars and Its Observation (written in Japanese), pg. 160.

PROPOSAL FOR OBSERVATIONS OF THE CONTOUR OF VENUS

By: Richard Baum, Chester, England

VISUAL MAPPING of the apparent profile of Venus is here proposed as a possible method of identifying regions of high turbulence in its atmosphere. Such regions, it is suggested, may expose themselves as irregular contours at the cusps, along the terminator, or upon the limb of the planet. Effects of this kind were extensively observed by Schröter (1792-1796),[1] Trouvelot (1876-1892),[2] and Niesten and Stuyvaert (1903),[3] all of whom located the most conspicuous features in high southern latitudes, specifically in and around the vicinity of the cusp. Significantly, Bouquet de la Grye and Arago photographed a massive bulge in this region during the transit of December, 1882, the elevation of which they measured to be around 65 miles.[4] H. McEwen and F. Sargent independently reported a deep terminator indentation in 1913, notable for its longevity.[5] Indeed each apparition of the planet produces a fresh crop of such sightings, the earliest dating back to 1643.

Since it is hardly different from the effects of bad seeing, irradiation, or contrast, it is easy to understand why the contour anomaly has so long been ignored. Ultraviolet data obtained by F. E. Ross with the 60-inch Mt. Wilson reflector when Venus was favorably placed in the summer skies of 1927, coupled with more recent photographic work, sustain the earlier visual reports, however, and leave us with the impression of a phenomenon truly indigenous to the planet.

To many of the 18th and 19th century observers of Venus only one explanation could account for this want of symmetry: The surface of Venus is di-

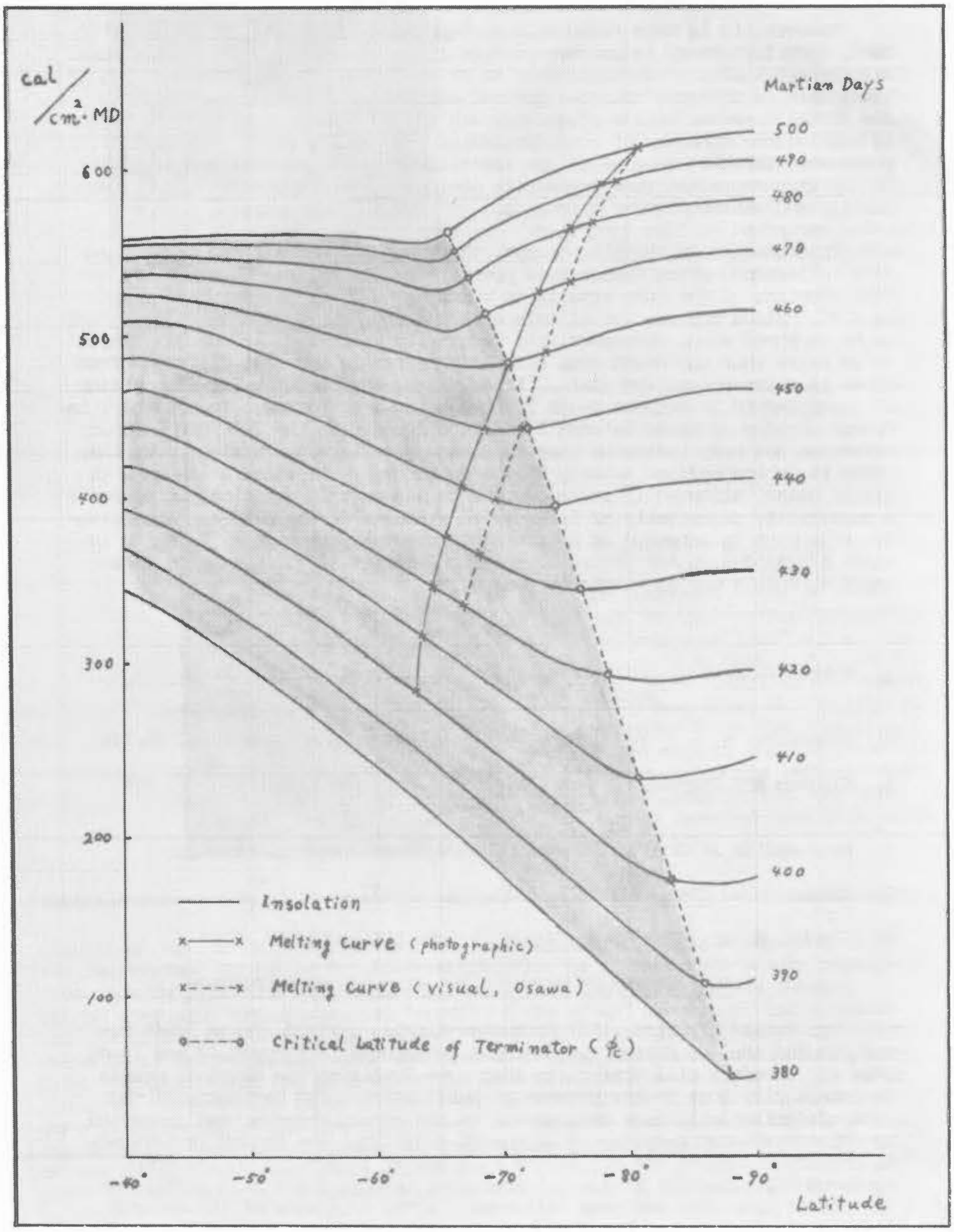

Figure 12. The insolation on Mars as a function of latitude for selected seasonal dates, which are expressed as Martian days after the vernal equinox of the northern hemisphere. In the shaded area the Sun rises and sets each Martian day. The latitudes considered are those covered by the south polar cap at its maximum extent. See also text of Mr. Osawa's article, pages 14-16.

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versified by immensely high mountain ranges. However, this idea is inconsistent with what is now known of the planet's cloud height, and has long since been abandoned. Even so, some radar and radiometric data have been adduced as evidence of mountains. Strictly speaking, it is regions of enhanced localized roughness which have been discovered, not features of the order hypothecated by our predecessors. Still, it is well to remember the startling disclosures of the Mariner missions to Mars before "the Himalayas of Venus" are finally dismissed.

However, it is more reasonable to suppose, as did Miss Ellen Clerke in 1893, that "....there is another possibility,....they may not be solid rock structure but cloud masses piled up to an enormous height."[6] And if this hypothesis is correct, then the contour anomaly in Venus may well provide the visual observer with a fresh approach to the difficult problem of trying to resolve the dynamics of its atmosphere. Especially would this be so if protracted scrutiny results in the identification of a definite periodicity of appearances, since this regularity would imply some permanent atmospheric anomaly and attract closer attention.

In connection with this concept, the south cusp is worth noting. Massive inflections often deform this point, the most notable being the recurrent blunting of the cusp itself, to which Schröter first called attention in 1789. Since the reality of this appearance is not in doubt, it is a fact to be reckoned with. Moreover, the regularity with which it emerges tempts us to infer that the south cusp has characteristics somewhat different from those in existence at the north. At any rate, the preferential disposition of irregularity in extreme south latitudes is worth noting. Importantly, infrared mapping of Venus between 8 and 14 microns with the 200-inch Palomar telescope not only indicates that the atmosphere is very restless, but that there is an unspecified anomaly at the south cusp. Is there a tie-up with visual data? Although it is impossible to answer this question, it presents a possibility conceivably of interest to students of the planet. Accordingly, this note is intended as a mere reconnaissance, the intent being to initiate a dialogue on the nature of the figure anomalies of Venus and to advance them in a way not hitherto considered.

References

1. Schröter, J. H., Phil. Trans., 1792, pp. 309-37. Aphrod. Frag., 1796.

2. Trouvelot, E. L., Bull. Soc. Astr. France. Vol. 6, 1892, pp. 61-147.

3. Niesten and Stuyvaert, Ann. Astr. Obs. Roy. de Belge. Vol. 8, new series, 1903.

4. Bouquest de la Grye and Arago, CR. Vol. 98, 1884, pp. 1406-11.

5. McEwen, H., JBAA. Vol. 23, 1913, pp. 325-27.

6. Clerke, E. M., The Planet Venus (circa 1893), pg. 37.

TWO JUPITER PHOTOGRAPHS AND A SUGGESTED COMPARISON

Mr. Ronald S. Price, 1622 Northview Circle, Garland, Texas 75040 has contributed the two Jupiter photographs reproduced as Figures 13 and 14 on page 19. Readers will appreciate that some detail on the original prints is necessarily lost in the process of publication. The darkening of the limb of Jupiter will look exaggerated to the visual observer and is caused by the overall red sensitivity of the SO-410 film. The reader is invited to compare Figure 13 and Mr. Budine's September 14 drawing on the front cover of Vol. 25, Nos. 11-12, our preceding issue. There is a difference in time of four days and some difference in the longitude of the central meridian in both System I and System II. The Red Spot and South Temperate Zone Oval BC are readily found on both the drawing and the photograph; so are the festoons and bright spots of South Equatorial Belt Distrubance No. 1. Compare also the large festoon across the Equatorial Zone near the longitude of the preceding end of the Red Spot. The interested reader may enjoy making his own study of similarities and differences.

THE A.L.P.O. MINOR PLANETS SECTION WITH NOTES ON THE 1976 APPARITION OF 1580 BETULIA

By: Derek N. Wallentine, A.L.P.O. Minor Planets Section

Until a decade or two ago, most astronomers simply ignored the asteroids or minor planets, relegating them to a couple of pages in the textbooks. Only

Figure 13. Photograph of Jupiter by Ronald S. Price on September 10, 1975 at 11^h5^m, U.T. 12-inch f/15.0 Cassegrain reflector at 1800" e.f.l. Exposure 6 seconds. Film SO-410. CM(I)=14°. CM(II)=57°. Seeing 9 (excellent). Transparency 6 (very clear). The Great Red Spot is the very dark oval in the upper left part of the disc. Simply inverted view with south at the top.

Figure 14. Photograph of Jupiter by Ronald S. Price on October 6, 1975 at 6^h40^m, U.T. 12-inch f/15.0 Cassegrain reflector at 1800" e.f.l. Exposure 5 seconds. Film SO-410. CM(I)=1°. CM(II)=208°. Seeing 9, transparency 6. Jupiter II (Europa) is on the limb at the south edge of the SEB_s; and its shadow is to its left, in the upper right part of the disc. Simply inverted view with south at the top.

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positional observations were made, the asteroids on the whole being treated as they were named (Greek asteroeides--starlike): as if they were merely featureless, moving points of light. Fortunately, this point of view has changed. Though they were once considered "vermin of the skies" because of their number and the difficulty of keeping track of them, the advent of electronic computers after WW-II has virtually ended the bane of orbital and perturbational computation. (There is not too much which can be done about the ubiquity of the minor planets. For example, about fifty to one hundred (!) objects near opposition show up on a single exposure of moderate length with the Palomar 122-cm. (48-in.) Big Schmidt. Only about fifteen of these would be previously known.[1]) The coming of the space program saw a dramatic increase in all Solar System studies, of which minor planets were no exception. Physical studies of all kinds are now being pursued.

In the history of the minor planets, amateur astronomers have been prominent. Dr. Heinrich Olbers (1758-1840), a German physician and famous amateur, discovered the second and fourth asteroids, Pallas and Vesta, in 1802 and 1807 respectively. Having discovered Pallas and finding it to have a high inclination and large eccentricity, Olbers originated the once-favored theory of asteroids as fragments of a broken planet. He is honored by a lunar crater and planet 1001 Olbersia. Thirty-eight years were to pass before the detection of the fifth minor planet, Astraea, by the man who must be the most dedicated asteroid hunter of all--German amateur Karl L. Hencke. He searched for fifteen years among the fainter stars near the ecliptic before finding Astraea in 1845; and two years later he discovered his second and last planet, 6 Hebe. For these he was given the then generous stipend of $300 per annum by the King of Prussia. Such were the rewards of amateur asteroiders.

Amateur observations in the recent past have been mainly casual observations of the Big Four (Ceres, Pallas, Juno, and Vesta) or of unusual objects such as Eros or Icarus at highly favorable apparitions. Except for a few individuals, no effort at serious studies was made.

More recently, Dr. J. U. Gunter's (see Fig. 15) articles, tracking charts, and newsletter (now known as Tonight's Asteroids[2]) did much to change this situation by encouraging positional observations of the brighter (11.5m_v or less) minor planets by interested amateurs. (An early note by Prof. Frederick Pilcher (Fig. 16) in Sky and Telescope also aroused interest.[3]) In June, 1973 the interest was considered great enough to establish the Minor Planets Section (MPS) as a part of the ALPO observing programs, with Richard G. Hodgson (Fig. 20) as Section Recorder. The raison d'etre of the MPS--that amateurs and smaller observatories can contribute significant work on minor planets--was doubted by many, and only six members were on the rolls initially. However, by the end of 1973 the number had grown to 24 members; and with favorable publicity it more than doubled to 54 in April of 1974. Currently (February, 1976), it stands at 96. The work and the growth of the MPS during this interval have proved its viability.

The work of this newest ALPO Section falls into two basic categories: (1) positional work, and (2) physical studies. Category 1 primarily involves positional observations to detect ephemeris errors, while physical studies include photometry and occultation work. The "almost inevitable" surface drawings which are a significant part of all other ALPO planetary programs are impossible with minor planets. Ceres (the largest of them) never has an apparent diameter larger than about 0".85, and Section member Dr. Clark R. Chapman of the Planetary Science Institute at Tucson has visually examined both Titan and Ceres under "truly superb seeing conditions"using the Mt. Wilson 152-cm. (60-in.) reflector.[4] No surface detail was seen on either object, though their disks were so clearly discernible that Dr. Chapman attempted to estimate their relative sizes, even though they were not in the same field of view. He concludes (and the present author concurs) that a much better way of studying "spots on an asteroid" is through their effect (or lack of it) on a lightcurve.

Perhaps a few notes on the minor planets themselves are in order.* The larger asteroids are now believed to be original accretions, some relatively intact, others with their collision-battered cores exposed, some fully chemically differentiated (as with the major planets), others only partly metamorphosed. The smaller objects are apparently collisional fragments, except for a few which may be extinct comet nuclei. The compositions of the minor planets fall into two principal groups: silicaceous, or stony-iron planets, which are reddish in color and have relatively high albedos, and carbonaceous, which are rather neutral in color and possess low albedos. Minor planet 3 Juno is an example of the former, and 324 Bamberga is an example of the latter. Some of the objects believed to be extinct comet nuclei may have vestiges of volatile ices on and near their surfaces. There may be as many as 100,000 asteroidal bodies larger than 1 kilometer in diameter.

The known asteroids range in size and mass from Ceres, with a diameter of 955 km. and approximately 1/5000 of the Earth's mass, to PL 6344, only about 120 meters in size and massing perhaps 2-3 million metric tons. It is comparable in size to the Waldorf-Astoria Hotel in New York City; and if spherical (highly improbable), four such bodies would fit in the Arecibo 305m dish with room to spare. Of the nearly two thousand objects whose orbits are well enough known to be numbered, 944 Hidalgo has the largest semimajor axis (5.82 Astronomical Units) and therefore the longest period (14.04 years). In its highly elliptical orbit (often described as cometary) it ranges out to the distance of Saturn at aphelion (9.64 AU). As is well known, the Apollo asteroid 1566 Icarus holds the record for the other extreme, approaching the Sun to within 28 million

*See References 5, 6, and 7 for recent articles on minor planets.

(text continued on page 21)

INDEX TO VOLUME 25 OF THE JOURNAL OF THE ASSOCIATION OF LUNAR AND PLANETARY OBSERVERS
(The Strolling Astronomer)

By: J. Russell Smith

(Published from September, 1974 to January, 1976)

Subject Index (references are to pages)

Author Index (references are to pages)

(text continued from page 20)

kilometers, and beats Hidalgo and all other known asteroids for the highest eccentricity, 0.82667. Icarus itself has (apparently) just lost the distinction of having the smallest semimajor axis (a) and shortest period, to 1976 AA, a remarkable object which is the first minor planet known to have a less than unity.*+ Its a is only 0.9675 AU, and its period is 0.95 years. With an eccentricity of 0.1848, perihelion is at 0.7888 AU and aphelion at 1.1463 AU. Thus, this object spends a large percentage of its time between the orbital distances of Venus and Earth.)

Positional observations are usually performed by visual comparison of the asteroid's location with field stars in a star atlas, though, if possible, photographic or micrometric measures are to be preferred. Any telescope can be used, though many more planets can be seen through larger apertures; and many of these are of especial scientific interest. Generally, positions are measured off the atlas grids and are compared to the computed positions (O-C) if the planet appears to have significant residuals (differences) from the published ephemeris. Among planets observed by Section members and discovered to have considerable residuals are 952 Caia, 67 Asia, and 568 Cheruskia.

Mark McConnell (Fig. 18), the Section's leading positional observer, uses a 15-cm. telescope and visually observes as many as six planets per hour using charts prepared with the Vehrenberg Photographic Star Atlas[8] and the Leningrad Ephemerides of Minor Planets[9]. To date (in about three years of observing), he has made over 1000 observations of about 200 different asteroids!

One area where more effort could be evinced is with planets on the Critical List, a roster of poorly-observed planets (usually 70-80) included in the annual Leningrad Ephemerides which have been seen at less than four oppositions or have been unobserved for ten years or more. Also listed here are numbered planets which are hopelessly lost (e.g., 330 Adalberta and 719 Albert). Residuals can be considerable, and many of these bodies are faint objects; but a number of them are in the range of photographically sophisticated and well-equipped amateurs. A recovery can be important and also quite a feather in the observer's cap.

Searching for new planets is viewed as too involved for most members of the Section and is best left to the large observatories.

Physical observations are those which reveal information about the body itself, considered separately from orbital information (which does have a bearing on the origin and constitution of the minor planets). Photometry of asteroids is one of the major areas being pursued here. The most obvious observations are lightcurves (i.e., rotationally induced variations of light) such as have been obtained with Eros, which has the large amplitude (at certain apparitions) of 1 1/2 magnitudes. Professionally, these studies have gone on for many years; within the last two years, the MPS has started a program to monitor the brighter ($12.7m_v$ or less) planets for light variation. Many of these planets have never been studied for variation. Passages across AAVSO variable star fields are now predicted for good opportunities to conduct visual photometry. Variations have definitely been reported with 233 Asterope and 270 Anahita in 1975, and papers concerning observations of these planets have been submitted for publication. One of the early Section accomplishments was the photoelectric redetermination of 18 Melpomene's period.[10] This work was done with 14 hours of observation by three Section members in August, 1974, using a 36-cm. (14-in.) Celestron equipped with an IP21 photo-tube. The period was revised from 14 hrs., 12 mins. (based on eight hours of observation in 1958) to 11 hrs., 50 mins. -- exactly five-sixths of the older value. This result was found photoelectrically, but 233 Asterope and 270 Anahita were observed with visual methods. All three planets reveal the importance of a series of intensive observations, especially those extending over several successive nights, for period determination.

*Based on preliminary values.
+Robert S. Richardson, who (along with Seth B. Nicholson) computed the initial orbit for Icarus, has written that the big moment of that discovery to him occurred when his computing machine came up with the value of 0.95869 for Icarus' semimajor axis (later revised upwards but still the smallest known value by a good margin at that time). This parallels the case of 1975 YA, whose preliminary elements gave a = 0.8294. This value has been changed in the light of new information to a = 1.22. Minor planet 1976 AA still appears to have a $<$ 1.0.

Figure 15. Dr. J. U. Gunter (right) of Durham, North Carolina, seen talking with Vic Shelburne, president of the Duke University Astronomy Club after delivering a lecture on asteroids. Dr. Gunter is a Durham pathologist and asteroid-tracking enthusiast who is largely responsible for the recent surge of amateur interest in minor planets. He puts out the popular newsletter, Tonight's Asteroids, which includes tracking charts of bright, currently observable asteroids and comets, interesting historical tidbits and anecdotes on these objects, and letters from corresponding observers around the world. This unique bimonthly is available free from Dr. Gunter for a self-addressed, stamped envelope. When not busy with his profession or popularizing astronomy, he observes minor planets and comets with a 6-inch altazimuthally-mounted Newtonian reflector. (Photo by Will Sagen.)

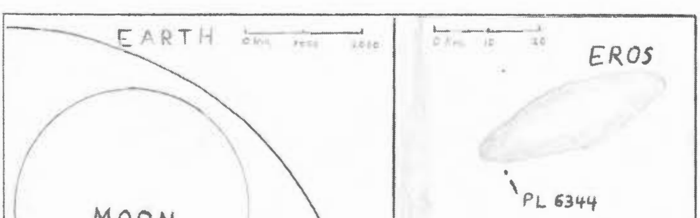

Figure 17. The relative sizes of some asteroids. In the first box, Ceres and Eros are compared to the Earth and the Moon. Eros is only a dot here. Enlarged approximately 100 times in the right drawing, Eros' elongated shape is delineated, its place in this drawing being taken up by the mote of PL 6344. In the final lower right drawing (10X larger than the previous), the now discernible PL 6344 is seen below a small portion of Eros' surface. The volume of all of the larger asteroids is approximately the same as that of the Earth's oceans. Charts prepared by Derek Wallentine.

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Also of importance are refinements of values for the asteroids' absolute magnitudes. Other possibilities with photometry are measuring the color and polarization of an asteroid's light, and phase effects. Much can be learned about them through these observations, including albedo (and therefore a value for the diameter), compositional type, and an indication as to the degree of roughness of the surface. Some work of this sort has been performed on Asterope.

Figure 16. Prof. Frederick Pilcher with the 25-cm. (10-in.) f/15.4 Celestron of the Balcke Observatory in Jacksonville, Illinois. He is a leading member of the Minor Planets Section and has contributed many papers to the Section's Minor Planets Bulletin. Using Hans Vehrenberg's photographic star atlases, he has observed more minor planets visually (almost 500) than anyone else now alive. He started observing them in 1968 using the 25-cm. and currently uses a 36-cm. Celestron, enabling him to reach planets as faint as fourteenth magnitude. Balcke Observatory is named for the late Walter H. Balcke, who donated the 36-cm. to Illinois College (where Prof. Pilcher is Associate Professor of Physics) in 1973. Both instruments are permanently mounted on the roof of Crispin Science Hall at the college and are protected by shelters mounted on rails. With these instruments and the Vehrenberg charts, Prof. Pilcher can usually find and identify an asteroid within a few minutes. (Photo by Don Dalton.)

Figure 18. Mark McConnell (right) of Horseheads, New York, with his homemade 15-cm. (6-in.) f/7.3 Newtonian reflector. He is the leading positional observer in the Minor Planets Section. In the last General Report of Observations, his observations totaled 529 positions of 107 planets: these were obtained during late 1973 and 1974. He uses a 56-power eyepiece with prepared charts to find and to plot an asteroid, whose position is measured afterwards. He has observed as many as 27 planets in one night by this method. Presently a high-school senior, he plans to make astronomy his career. At left is Mr. McConnell's father; and at the middle is Dr. Martin Green, a fellow amateur.

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Occultations are a largely untapped area of observation, but are the most accurate means of determining the very important quantity of asteroid diameters. Only one stellar event (the much-celebrated Eros-Kappa Geminorum occultation) and a lunar occultation or two have been observed with useable results. Up to five hundred events a year involving 14th magnitude or brighter stars and twelfth magnitude or brighter planets should be observable from the North American continent. At this time, predictions of such events even for brighter planets and brighter stars are greatly hampered by the lack of precision ephemerides for the majority of the minor planets; therefore, the observation of virtually all occultations will depend on vigilance and luck by a network of observers. The organization of such a network is one of the major goals of the MPS. A rather ingenious suggestion has been put forward by Recorder Hodgson to observe close passes by minor planets of some of the brighter open, or galactic, star clusters, enabling a network to observe the pass and thus to have a reasonable chance of seeing an occultation. This idea deserves, and will receive, more attention in the future.

Observers for a worldwide network -- both for occultations and 24-hour photometry work (similar to the Mars Planetary Patrol) are needed on all continents and Oceania too. Potential observers are invited to join the Section and to make their interest known.

Members join the Section by subscribing to its publication, the Minor Planet Bulletin (MPB). This periodical is edited by Recorder Hodgson and includes much useful information on observing and studying the minor planets, along with interesting historical notes. Recent issues have featured such articles as "Interpolating Minor Planet or Comet Positions Between Ephemeris Dates", by Prof. Frederick Pilcher; "The Names of the Asteroids, Part 1", by June LoGuirato; and "Some Conjunctions of Minor Planets in 1976", by Jean Meeus. In each quarterly issue is "News Notes", relating Section news and late information on new planets, observations, etc., and "Visual Photometry Opportunities", a list of predicted passages of AAVSO star fields by selected planets, compiled by the author of this article and Alain Porter (Fig. 19). Annually, there are the general reports on Section members' observations, and Prof. Pilcher's very helpful list of planets at highly favorable oppositions -- screening the 1300 or so planets in the Ephemerides for those best placed for observations. Subscription is currently $4.00 (in U.S. funds) a year for North Americans and $5.50 (airmail service) for overseas subscribers, and includes the occasional interim publications, Minor Planet Memo and Minor Planet Alert. Write to Prof. Richard G. Hodgson, ALPO Minor Planets Recorder, Dordt College, Sioux Center, Iowa U.S.A. 51250.

To promote subscription (which would put the MPB on a very sound financial footing and cover increased costs of offset printing and postage), special group rates are now available to persons in Canada, Mexico, and the U.S., provided that the mailing is to a single address and that a minimum of five subscriptions is entered at the same time. For five to nine copies the rate is $2.50 U.S. a year per subscription. For 10 or more subscriptions the rate is only $2.00 U.S. each--a real bargain (bon marche!) at today's prices! For groups overseas, write to Editor Hodgson at the above address as to rates, etc. These rates, of course, may change.

Minor Planets Section Materials and Services

MPB, MPM, and MPA. Described above.

Minor Planets Section Report Forms: Single copies for replication supplied occasionally with the MPB; available in packets of 20 for $1.00 U.S., or 100 for $3.00 from Recorder Hodgson.

Minor Planets Section Photometry Report Forms: Available free for a self-addressed stamped envelope (large brown variety) from Alain Porter, 10 Sea Lea Drive, Narragansett, Rhode Island, U.S.A. 02882.

The 1976 Apparition of 1580 Betulia

The minor planet 1580 Betulia will come to a highly favorable opposition on May 22, 1976, approaching the Earth to within 0.130 Astronomical Units on this date and brightening to 11th magnitude. Discovered as a fast-moving object on

Figure 19. Alain Porter, Photometry Coördinator in the Minor Planets Section in his observatory. He is an active member of the MPS and currently is working on the Section's photometry program to monitor all planets of the 12th magnitude or brighter. He uses a 10-cm. Unitron and a 15-cm. Newtonian reflector in his 10'X10'X6' backyard observatory. The roof of the plywood and 2x4 structure slides on rails off to the north; and the south gable folds down to permit the entire sky to be seen with the refractor, though the fifteen-centimeter reflector is more frequently used with asteroids because of its greater magnitude reach. Mr. Porter is also MPS Occultation Coördinator for the New England region.

Figure 20. Minor Planets Section Recorder Richard G. Hodgson, here pictured with his Cave 41-cm. f/7 Newtonian reflector in the larger of his two observatories. With this instrument (equipped with a piggy-back RFT 20-cm. f/4.5) he can observe many of the fainter minor planets. He is Editor of the Section's Minor Planet Bulletin and is located in Sioux Center, Iowa, where he teaches at Dordt College. He is also ALPO Mercury Section Recorder.

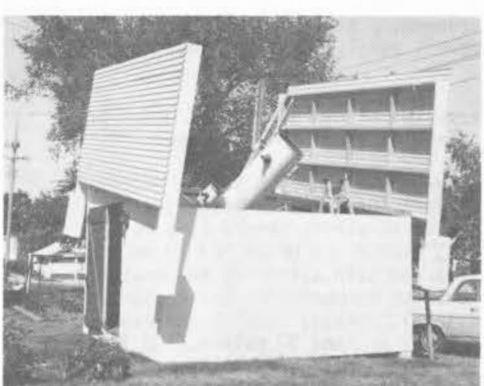

Figure 21. Reverend Hodgson's larger observatory from the outside. The counter-weighted roof-halves swing open to allow viewing with the 41-cm. reflector. The ladder is needed to reach the eyepiece of the instrument. He also has a smaller observatory with a 32-cm. (12-in.) f/6 Cave, which--since this photo was taken--has been re-located about six feet away from the main structure. The site has also been landscaped; and the elm tree in the background has died and has been removed, permitting a little more open sky.

May 22, 1950 by E. L. Johnson at the Union Observatory in Johannesburg, it is an asteroid of the Amor Group; i.e., its perihelion point is just outside the radius of the Earth's orbit. The discoverer's third find (he eventually discovered 10), the body was named at the request of Dr. Samuel J. Herrick (1911-1974, well-known UCLA astrodynamicist) in honor of his South American wife. It is the fifth of this group (excepting the lost 719 Albert) to be numbered.

Close approaches occur at thirteen-year intervals on a 13/4 commensurability, 13 revolutions of the Earth very nearly equalling 4 of Betulia. Previous appearances of this sort were the discovery apparition and the one in 1963. Both the eccentricity and the inclination to the ecliptic (0.48997 and 52°041) are large--no other numbered planet has a higher inclination.

Physically, little is known about the object. A reasonable (though not necessarily correct) assumption about this planet's albedo gives a diameter of 3.4 kms. Its orbit suggests a possible cometary origin; physical observations at this apparition with the sophisticated tools of modern astronomy--including radar--may help to settle this problem and other questions.

The conditions of this appearance are generally quite good. The Moon is full on the 14th of May, and Last Quarter is on the 21st--out of the way at the time the asteroid is closest to the Earth. Delta min. (minimum distance from the Earth) occurs when the asteroid is just south of the celestial equator and consequently fairly high in the sky for both northern and southern hemisphere observers. Telescopes as small as three inches in aperture should have no difficulty picking up this planet at its maximum magnitude of about 10.9 visual.

Besides having a singular sighting of a rapidly-moving Earth-grazer, an amateur can make some worthwhile observations of Betulia. These include watching for occultations and photometry for light variations and for determining its absolute magnitude.

Table I gives predicted positions of the planet, based on the Leningrad <u>Ephemerides</u>. For the 12 days when Betulia is brighter than 13.0m_{pg}, positions are given at half-daily intervals. Also given are the distances from the Earth (Δ) and the Sun (r), as well as the predicted photographic magnitudes (m_v equals m_{pg}-0.8). Note the rapid motion, amounting to more than 7 deg./day to the SSW on the 22nd. This motion is rapid enough to aid the observer in locating the planet by the "bird-in-the-bush effect", i.e., its movement among a field of stars will be evident within a minute or two.

Table II presents predictions of appulses of AAVSO variable star fields. Readers are urged to view the planet and to make magnitude estimates during the times when Betulia is crossing these fields. Estimates should be made every few minutes for several hours or more and the time (at least to the nearest minute) must be noted. The chart codes are given; order them from the American Association of Variable Star Observers, 187 Concord Ave., Cambridge, Mass. U.S.A. 02138 by identifying them by these codes and the small letter subscript of the desired charts. Remit $0.25 (U.S.) for each chart ordered; U.S. postage stamps are accepted for small amounts. Please report any photometric observations to Alain Porter at the previously mentioned address.

In Table III there are given selected appulses of stars, most of which are bright enough to be plotted on the Skalnate Pleso Atlas of the Heavens.

Table IV† gives preliminary data on appulse-occultations, which are potential occultations from somewhere on the Earth; observers are asked to watch the planet closely at these times and to be prepared to time an event, should it occur. Due to the preliminary nature of these predictions, events are given out to an indicated geocentric separation of 180". Events marked with asterisks are exceptionally likely. Observations of occultations should be communicated to the author* with duration (measured as accurately as possible), precise time of the event, and exact location of the observer to within 1" of arc and 30 meters (100 feet) altitude on the Earth's surface. Sky conditions (seeing, scintillation, obscuration) should also be noted, along with any remarks thought to be relevant. In

*The address is Derek Wallentine, 3131 Quincy NE, Albuquerque, NM 87110.

†The information in this paragraph has been supplemented, and in part superseded, by "Further Notes on Table IV" on page 33.

view of the probable brevity of occultations by Betulia, timings with photoelectric equipment with high time resolution are highly desirable.

Acknowledgments

I would like to thank June LoGuirato for helping with information on Betulia's discovery and naming, and Prof. Frederick Pilcher for late information on 1975 YA and 1976 AA. Appreciation also goes to Alain Porter, Mark McConnell, Rev. Hodgson, and Prof. Pilcher for prompt responses to my request for photographs (Figures 15-21).

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TABLE 1. Ephemeris for 1580 Betulia (1950)

UT		R.A. h m	Dec. ° '	r (AU)	Δ (AU)	m_{pg}
1976, April	30	18 39.6	+47 34	1.119	0.389	15.3
May	2	18 33.5	+46 33	1.119	0.360	15.1
	4	18 26.3	+45 18	1.119	0.331	14.9
	6	18 17.9	+43 45	1.119	0.302	14.7
	8	18 08.0	+41 47	1.120	0.274	14.5
	10	17 56.5	+39 15	1.121	0.246	14.2
May	12	17 43.0	+35 57	1.123	0.220	13.9
	13	17 35.4	+33 55	1.124	0.207	13.7
	14	17 27.2	+31 34	1.125	0.194	13.5
	15	17 18.4	+28 51	1.126	0.183	13.3
	16	17 08.9	+25 43	1.128	0.172	13.1

Table I. Ephemeris for 1580 Betulia (cont.)
(1950)

UT		R.A. h m	Dec. ° '	r (AU)	(AU)	m_{pg}
1976,May	17	16 58.6	+22 06	1.129	0.161	12.9
	17.5	16 53.2	+20 06			
	18	16 47.6	+17 58	1.131	0.152	12.7
	18.5	16 41.8	+15 42			
	19	16 35.8	+13 17	1.132	0.144	12.4
	19.5	16 29.7	+10 43			
	20	16 23.4	+ 8 02	1.134	0.138	12.2
	20.5	16 16.9	+ 5 15			
	21	16 10.2	+ 2 20	1.136	0.133	12.0
	21.5	16 03.3	- 0 40			
	22	15 56.3	- 3 44	1.138	0.131	11.9
	22.5	15 49.2	- 6 50			
	23	15 41.9	- 9 57	1.140	0.130	11.7
	23.5	15 34.5	-13 03			
	24	15 27.0	-16 06	1.142	0.131	11.7
	24.5	15 19.4	-19 04			
	25	15 11.8	-21 57	1.145	0.135	11.9
	25.5	15 04.1	-24 44			
	26	14 56.4	-27 22	1.147	0.140	12.1
	26.5	14 48.7	-29 51			
	27	14 41.0	-32 12	1.150	0.147	12.3
	27.5	14 33.3	-34 24			
	28	14 25.7	-36 27	1.152	0.156	12.5
	28.5	14 18.2	-38 21			
	29	14 10.8	-40 06	1.155	0.165	12.7
	29.5	14 03.5	-41 43			
May	30	13 56.3	-43 13	1.158	0.176	13.0
	31	13 42.4	-45 51	1.161	0.188	13.2
June	1	13 29.1	-48 04	1.164	0.200	13.4
	2	13 16.6	-49 56	1.167	0.213	13.6
	3	13 04.8	-51 31	1.170	0.226	13.7
	4	12 53.8	-52 50	1.174	0.240	13.9
	5	12 43.5	-53 57	1.177	0.254	14.1
	6	12 34.0	-54 54	1.180	0.268	14.2
	7	12 25.2	-55 43	1.184	0.283	14.4
	8	12 17.1	-56 25	1.188	0.297	14.5
	9	12 09.6	-57 01	1.192	0.312	14.6
	10	12 02.7	-57 32	1.195	0.327	14.8
	11	11 56.4	-57 59	1.199	0.342	14.9

TABLE II. AAVSO Variable Star Appulses by 1580 Betulia
c marks the minimum separation of planet and star

Variable Desig.	Chart(s)	Betulia's m_v	UT,(1976)	Separation	PA
1657+22 SY HER	c	12.1	May 16.6	79'	37°
			16.7	53'	39
			16.8	27'	45
			16.896	6'c	123
	Full Moon May 14		16.9	6'	133
			17.0	29'	201
			17.1	56'	207
			17.2	84'	209
1527-14 RU LIB	b45,d	10.9	May 23.6	96'	22°
			23.7	54'	16
			23.8	17'	335
			23.82	14'c	301
	Last Quarter May 21		23.9	36'	234
			24.0	76'	222

Table II. AAVSO Variable Star Appulses by 1580 Betulia (cont.)

Variable Desig.	Chart(s)	Betulia's m_V	UT,(1976)	Separation	PA
1515-20 S LIB	b,d,e	11.1	May 24.5	70'	11°
			24.6	35'	346
			24.66	25'c	301
	Last Quarter May 21		24.7	30'	268
			24.8	62'	235
1228-54 U CEN	d	13.4	June 5.8	49'	114°
			6.0	42'	137
			6.08	41'c	147
	First Quarter June 6		6.2	43'	163

TABLE III. Selected Appulses by 1580 Betulia

c indicates the minimum separation
GC followed by a number indicates no. in Boss General Catalogue
SAO followed by a number indicates no. in Smithsonian Astrophysical Observatory Catalogue

Star	1950 Position h m	° '	m_V	Betulia m_V	UT(1976)	Separation	PA
GC 24936	18 14.1	+42 08	5.4	13.7	May 6.6	65'	10°
					7.0	42'	345
					7.29	36'c	313
					7.6	44'	276
SAO 47246	18 06.5	+40 54	7.0	13.7	May 7.8	72'	23
					8.2	39'	7
					8.55	22'c	311
					8.8	33'	263
					9.2	68'	240
SAO 66487	17 54.5	+39 27	8.1	13.4	May 9.4	75'	59
					9.8	37'	82
					10.05	25'c	129
					10.4	48'	188
GC 24183	17 46.2	+36 34	6.7	13.1	May 11.5	18'	15
					11.62	7'c	309
					11.8	26'	235
GC 24098	17 43.1	+35 14	6.8	13.1	May 12.1	33'	343
					12.23	27'c	308
					12.4	37'	264
GC 23736	17 29.0	+31 12	5.8	12.7	May 13.7	67'	7
					13.9	39'	341
					14.02	31'c	305
					14.2	46'	259
					14.4	79'	239
GC 23393	17 16.8	+28 52	5.8	12.5	May 14.7	75'	48
					14.9	36'	64
					15.05	18'c	123
					15.2	37'	186
					15.4	79'	201
62 Herculis	17 06.5	+24 33	6.8	12.3	May 16.1	53'	21
					16.31	11'c	303
					16.5	50'	226
GC 22948	16 58.9	+22 42	5.7	12.1	May 16.7	51'	51
					16.88	16'c	122
					17.0	36'	186

Table III. Selected Appulses by 1580 Betulia (cont.)

Star	1950 Position h m	°	'	m_v	Betulia m_v	UT(1976)	Separation	PA
GC 22802	16 52.8	+21	02	5.5	12.1	May 17.2 17.35 17.5	55' 36'c 57'	72° 122 174
54 Herculis	16 53.2	+18	31	5.6	11.9	May 17.6 17.77 17.9	72' 50'c 63'	348 302 264
GC 22553	16 43.1	+15	50	5.8	11.9	May 18.3 18.45 18.6	50' 12'c 52'	17 301 225
29 Herculis	16 30.3	+11	36	4.9	11.6	May 19.2 19.37 19.5	61' 19'c 53'	48 120 189
GC 22233	16 29.5	+ 9	31	6.7	11.4	May 19.5 19.67 19.8	72' 34'c 58'	2 300 246
21 Herculis	16 21.7	+ 7	04	5.7	11.4	May 20.0 20.17 20.4	63' 8'c 92'	23 300 215
GC 21844	16 11.9	+ 2	46	7.1	11.2	May 20.8 20.91 21.1	47' 8'c 77'	20 301 216
SAO 140913	16 00.2	- 0	16	7.6	11.1	May 21.3 21.51 21.7	102' 53'c 97'	61 120 177
GC 21526	15 59.1	- 3	38	6.8	11.1	May 21.8 21.94 22.1	68' 33'c 76'	1 300 235
SAO 140854	15 54.5	- 5	15	7.8	11.1	May 22.1 22.22 22.4	55' 21'c 82'	6 300 225
GC 21221	15 44.9	- 9	20	6.9	10.9	May 22.7 22.87 23.1	77' 20'c 100'	15 301 222
GC 21124	15 40.4	-10	46	7.3	10.9	May 23.0 23.13 23.3	54' 5'c 76'	25 300 214
Gamma Librarum	15 32.7	-14	37	4.0	10.9	May 23.5 23.72 23.9	98' 26'c 80'	15 301 229
34 Librarum	15 27.8	-16	26	5.9	10.9	May 23.9 24.03 24.2	57' 20'c 76'	9 301 227
32 Librarum	15 25.4	-16	33	5.9	10.9	May 23.9 24.08 24.2	77' 6'c 50'	35 120 205
SAO 159175	15 17.0	-19	22	7.7	11.1	May 24.4 24.58 24.7	78' 20'c 52'	47 121 189

Table III. Selected Appulses by 1580 Betulia (cont.)

Star	1950 Position			m_v	Betulia	UT(1976)	Separation	PA
	h m	°	'		m_v			
GC 20522	15 13.5	-22	13	5.7	11.1	May 24.8	87'	13°
					very near c----	25.0	28'	304
						25.2	84'	232
GC 20383	15 06.9	-23	48	6.8	11.1	May 25.1	90'	31
						25.33	2'c	303
						25.5	68'	214
Sigma Librarum	15 01.1	-25	05	3.4	11.3	May 25.4	82'	49
					very near c----	25.6	22'	120
						25.8	78'	197
59 Hydrae	14 55.7	-27	27	5.7	11.3	May 25.8	85'	37
						26.03	5'c	124
						26.2	63'	209
GC 20103	14 54.2	-28	57	6.2	11.3	May 26.1	65'	7
						26.26	30'c	304
						26.4	58'	245
GC 19780	14 38.9	-30	43	6.5	11.5	May 26.7	87'	94
						26.83	74'c	125
						27.0	93'	163
Psi Centauri	14 17.5	-37	39	4.2	11.7	May 28.2	67'	67
					very near c----	28.4	32'	127
						28.6	64'	188
GC 19220	14 12.2	-39	52	7.6	11.9	May 28.7	60'	36
						28.92	3'c	310
						29.1	47'	224
Chi Centauri	14 03.0	-40	56	4.5	11.9	May 29.2	56'	79
						29.37	35'c	131
						29.6	66'	189
Phi Centauri	13 55.2	-41	51	4.1	12.2	May 29.5	93'	85
						29.78	64'c	132
						30.1	99'	182
GC 18333	13 31.4	-48	01	6.4	12.6	May 31.7	38'	25
					very near c----	31.9	14'	312
						June 1.1	39'	247
GC 18170	13 24.1	-48	53	6.3	12.6	June 1.0	70'	46
						1.2	35'	44
						1.41	2'c	318
						1.6	32'	231
GC 17890	13 10.4	-50	26	6.0	12.8	June 2.2	37'	75
						2.42	16'c	139
						2.6	31'	198
						3.0	83'	219
GC 17461	12 49.5	-53	33	6.3	13.1	June 4.0	58'	42
						4.2	35'	34
						4.48	12'c	324
						4.6	18'	275
						5.0	58'	246
GC 16856	12 19.2	-56	06	6.0	13.7	June 7.4	23'	77
						7.68	7'c	148
						8.0	26'	223

Table III. Selected Appulses by 1580 Betulia (cont.)

Star	1950 position h m	° '	m_V	Betulia m_V	UT(1976)	Separation	PA
Non-stellar (extended objects)							
NGC 6070	16 07.4	+ 0 50	12.3pg	11.2	May 21.1	58'	22°
Galaxy					21.24	8'c	300
Sc 3'.2 x 1'.8					21.3	26'	228
NGC 5897	15 14.5	-20 50	10.9v	11.1	May 24.6	86'	34
Globular					24.81	3'c	122
7'.3					25.0	77'	209
NGC 5365	13 54.8	-43 42	13.0pg	12.2	May 29.9	56'	35
Galaxy					30.14	7'c	312
					30.3	36'	234
Omega Centauri	13 23.8	-47 03	3.7v	12.6	June 1.0	81'	41
Globular					-		
23'					-		
NGC 5156	13 25.7	-48 39	12.9pg	12.6	June 1.0	49'	44
Galaxy					1.28	3'c	317
S 1'.5 x 1'.5					1.6	53'	230

Observers are reminded of these lunar phases by UT dates:
New Moon on May 29, 1976; First Quarter on May 7 and June 5; Full Moon on May 13; and Last Quarter on May 20.

Table IV. Geocentric Appulse Data for 1580 Betulia

SAO# Star	UT(May)1976	Distance	PA	Delta	P" parallax	t duration	m_V 1580	m_V SAO
47594	2.4295	4".5	316°.0	0.35375	24".859	$0^s.3$	14.3	8.8
47207	8.7105	31.2	130.75	0.264225	33.282	0.3	13.7	9.1
66473	10.4329	10.8	129.0	0.24058	36.553	0.2	13.4	8.0
84999	15.1903	43.3	304.25	0.18057	48.701	0.2	12.5	8.2
84860	16.3151	46.6	303.25	0.16837	52.232	0.2	12.3	8.2
102229	19.4535	44.2	120.0	0.141395	62.1945	0.1	11.6	8.6
121607	19.9182	65.5	300.0	0.13842	63.529	0.1	11.6	8.8
140757	22.8120	74.0	300.0	0.12997	67.664	0.1	11.1	8.9
159447	23.1704	26.75	120.0	0.13008	67.603	0.1	10.9	9.2
159446	23.1712	35.0	120.0	0.13008	67.603	0.1	10.9	9.0
183363	24.7252	45.5	121.75	0.13378	65.737	0.1	10.9	9.2

SAO#	SAO Position R.A.	Dec.	Sub-Appulse Point Long.	Lat.	d	Uncertainty T	d	LT (0) h m
47594	$18^h 31^m.99$	+46° 19'.1	97°.077W	+46°.318	1160km	0.002d	1540km	4 18
47207	18 04.07	+40 58.8	148.592E	+40.980	7700	0.001	1150	8 03
66473	17 53.72	+38 37.8	115.748W	+38.630	1910	0.0008	1050	4 23
84999	17 16.62	+28 18.2	42.385W	+28.303	6970	0.0005	785	21 34 14th
84860	17 05.69	+24 38.8	91.154W	+24.647	7020	0.0004	732	21 34 15th
102229	16 30.17	+10 59.7	152.953W	+10.995	5030	0.0003	615	5 53
121607	16 24.41	+08 30.1	37.857E	+ 8.502	-	0.0003	602	-
140757	15 44.63	-08 45.8	63.293E	- 8.763	-	0.0002	565	-
159447	15 39.28	-10 58.7	67.423W	-10.978	2590	0.0002	565	1 05†
159446	15 39.26	-10 58.9	67.717W	-10.982	3460	0.0002	565	1 06†
183363	15 15.86	-20 21.2	85.463E	-20.353	4870	0.0002	582	5 24 25th

Table IV. Geocentric Appulse Data for 1580 Betulia (cont.)

Approximate Areas of Occultation

47594: From Arctic Ocean, Greenland, Canada, Hudson's Bay, Saskatchewan*, Alberta, British Columbia, Washington, Pacific Ocean.
47207: Southeast Pacific, near farthest point from land.
66473: From New England to Pennsylvania, Arkansas, area near the Texas-Mexico border*, Mexico, Pacific Ocean.
84999: North-Northwest Canada.
84860: N.W. Canada, S.E. Alaska, North Pacific*.
102229: Northwest South America, Southeast Pacific*.
121607: Near occultation. Possibly North Atlantic, Greenland, N.E. Canada.
140757: Near occultation. Possibly Western Europe.
159447: Mid-Atlantic, S.E. Brazil*, Patagonia, S.E. Pacific.
159446: Same as 159447, but more to the southeast.
183363: Pacific Ocean, New Zealand, S.E. Australia, Southern Indian Ocean*.

† This pair is a double. 46-47, 23.″1 in PA 51.°4

Further Notes on Table IV. This table is potentially the most important of all since it indicates opportunities to observe possible occultations of stars by 1580 Betulia. The table is based on an updated ephemeris by Dr. Brian G. Marsden and was ready on April 1, 1976. Later improvements in the needed data are certainly possible. Table IV gives the estimated duration of occultation t in seconds of time and the geocentric parallax p of the minor planet in seconds of arc. The sub-appulse point on the Earth's surface is the position where the star is in the zenith at the time of closest appulse. The item d is the distance along the Earth's surface from the sub-appulse point to the point of occultation at the time of closest geocentric appulse. Estimated uncertainties in time and distance are given (distance on the plane of the sky at the Earth as seen from Betulia), along with the local time of occultation at the time of closest appulse. Finally, an asterisk(*) marks the expected geographical area of occultation at the time of closest appulse.

I shall make every personal effort to observe the possible occultations of SAO 47594 and 66473 from Albuquerque, New Mexico and heartily invite readers to join in this effort -- correspondence will be most welcome.

DRAWINGS AND PHOTOGRAPHS OF COMET WEST (1975n)

A number of readers have written to express their enjoyment of the beautiful spectacle of Comet West in the spring morning skies. The selected drawings and photographs on pages 34-36 will hopefully be of some interest. Comets Recorder Dennis Milon will be glad to receive observational reports of Comet West; they should be sent on the ALPO Comets Section photographic form or on the visual report form. The ephemeris given on pages 33, 35, and 36 should help those who wish to follow the receding comet. This ephemeris was prepared by Charles S. Morris of Purdue University from orbital elements given on an IAU Circular by Brian G. Marsden. The right ascension and declination of the comet are for 0^h, U.T. Delta is the Earth-Comet distance in Astronomical Units; R is the Sun-Comet distance in the same units. CES is the Comet-Earth-Sun angle in degrees. TL is the tail length as millions of miles per degree. PA is the position angle of the tail. ALT is the altitude of the comet when the Sun is 102° from the zenith (nautical twilight), and Time is the local time of beginning of nautical twilight for an observer at latitude 40° north. The corresponding civil time (e.g., Eastern Daylight Saving Time) will require correcting for the longitude of the observer. The columns involving logs are used to calculate the predicted magnitude of the comet.

MAY 1976	R	A	DEC		DELTA	R	CES	TL	MAG	5LOGD	LOGR	P A	ALT	TIME
1	20	7.88	17	25.1	1.249	1.620	91.1	3.3	9.5	.49	.209	254.0	59.2	3 54
2	20	6.05	17	30.2	1.251	1.638	92.3	3.3	9.6	.49	.214	253.2	59.8	3 53
3	20	4.18	17	35.0	1.254	1.655	93.5	3.3	9.6	.49	.219	252.5	60.5	3 51
4	20	2.28	17	39.5	1.256	1.673	94.6	3.4	9.7	.49	.223	251.8	61.2	3 50
5	20	.34	17	43.8	1.258	1.691	95.8	3.4	9.7	.50	.228	251.0	61.8	3 48
6	19	58.36	17	47.7	1.261	1.708	97.0	3.5	9.8	.50	.233	250.2	62.5	3 47
7	19	56.35	17	51.4	1.263	1.726	98.2	3.5	9.8	.51	.237	249.4	63.1	3 45
8	19	54.31	17	54.7	1.266	1.743	99.4	3.6	9.9	.51	.241	248.6	63.7	3 44
9	19	52.23	17	57.7	1.269	1.760	100.6	3.7	9.9	.52	.246	247.8	64.3	3 43
10	19	50.12	18	.4	1.271	1.778	101.8	3.7	10.0	.52	.250	247.0	64.8	3 41
11	19	47.97	18	2.8	1.274	1.795	103.0	3.8	10.0	.53	.254	246.1	65.3	3 40
12	19	45.80	18	4.8	1.277	1.812	104.2	3.8	10.1	.53	.258	245.3	65.8	3 39
13	19	43.60	18	6.4	1.280	1.829	105.4	3.9	10.1	.54	.262	244.4	66.3	3 37
14	19	41.36	18	7.6	1.283	1.846	106.6	4.0	10.2	.54	.266	243.5	66.7	3 36
15	19	39.10	18	8.5	1.286	1.863	107.8	4.0	10.2	.55	.270	242.6	67.1	3 35
16	19	36.81	18	9.0	1.289	1.880	109.0	4.1	10.3	.55	.274	241.6	67.4	3 34
17	19	34.50	18	9.1	1.293	1.896	110.2	4.2	10.3	.56	.278	240.7	67.6	3 33
18	19	32.16	18	8.8	1.297	1.913	111.4	4.3	10.3	.56	.282	239.7	67.8	3 31
19	19	29.80	18	8.1	1.300	1.930	112.6	4.4	10.4	.57	.285	238.7	68.0	3 30

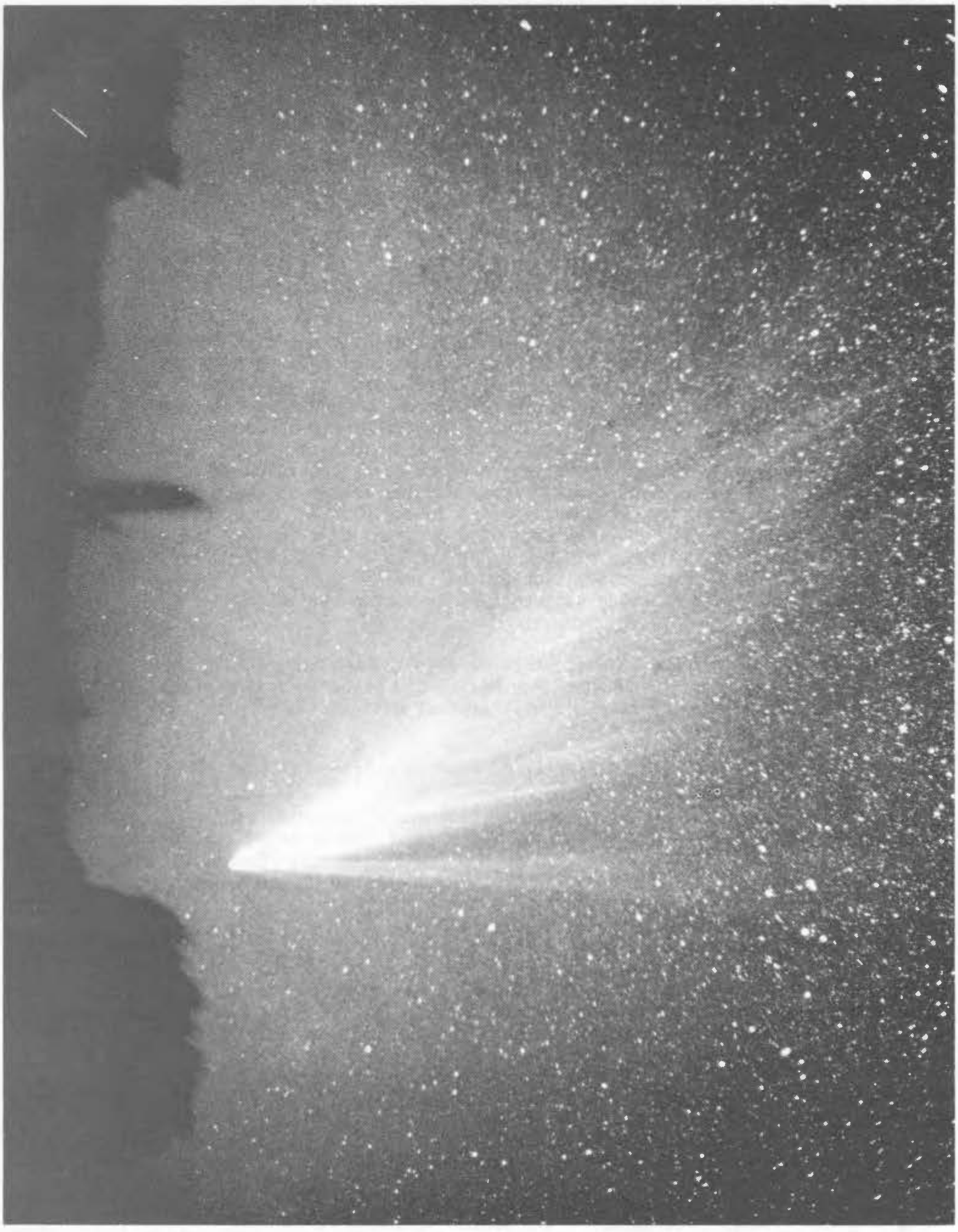

FIGURE 22. Photograph of Comet West (1975n) by Marvin J. Mayo and George Carlisle at Montezuma Valley, California (near Palomar Mountain) on March 7, 1976, 12^h20^m-12^h25^m, Universal Time. Clear sky. Exposure 5 minutes. Camera of 50 mms. aperture, focal ratio 1.8.Tri-X film, Acufine developer. Guiding with Cave 8-inch reflector. Tail 25° or more long, estimated visual magnitude 1.4. Contributed by Marvin Mayo.

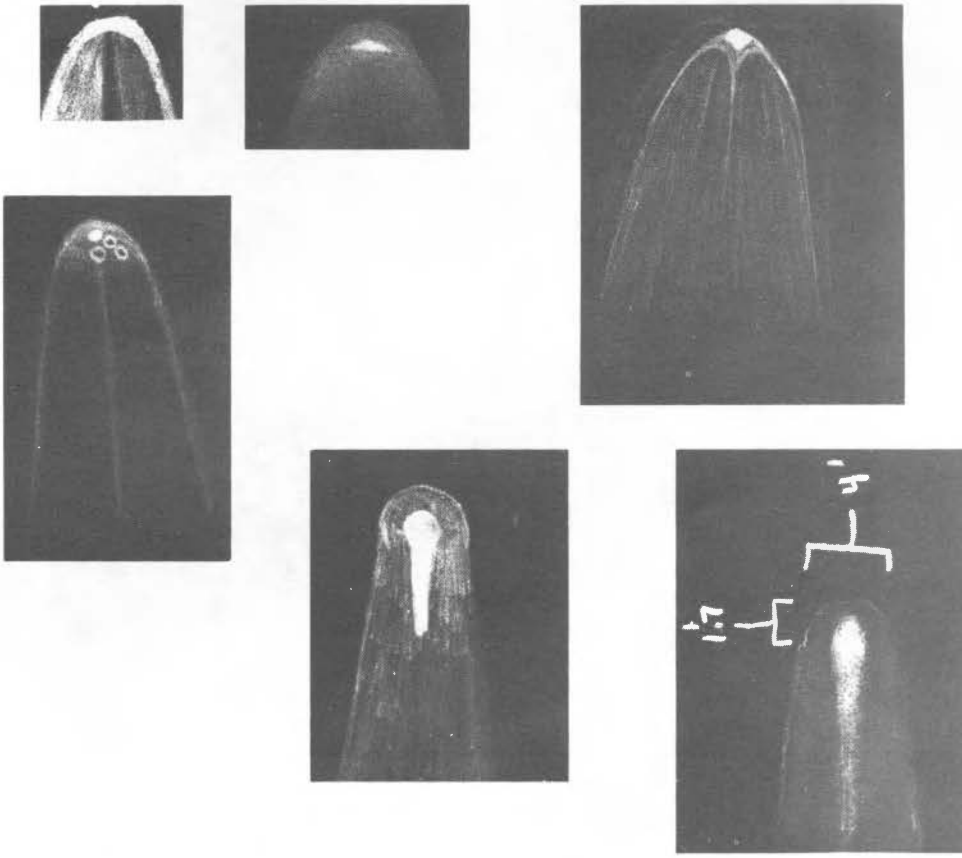

FIGURE 23. Drawings of the Head of Comet West (1975n) by observers in the ALPO Comets Section. Contributed by Dennis Milon, ALPO Comets Recorder. Top Left: Wolfgang Muehle, March 2, 1976, 5^h, U.T., at Stuttgart, West Germany. 12-inch refractor, 450X. Note the dark shadow behind the nucleus. Top Center: R. B. Minton, March 5, 12^h35^m, U.T., Tucson, Arizona. 6-inch reflector. A bright inner coma was measured to be 5 by 7 seconds of arc. Top Right: John Laborde, March 9, Santee, California. A bright spine has now appeared following the nucleus. Left Center: Helen Lines, March 14, 12^h55^m, U.T., Mayer, Arizona. Lines Observatory 16-inch, f/8 Newtonian reflector. Note a stellar nucleus and three condensations. Bottom Center: Leonard Matuszewski, March 26, 8^h55^m, U.T., Paramus, New Jersey. 4-1/4-inch telescope. He drew a coma 10' in diameter with a bluish bright central spine 25'-30' long. Bottom Right: R. B. Minton, March 31, 12^h U.T. 6-inch reflector. The diameter of the head was measured to be 4', with an elongated section 1'.7 (as drawn). The total magnitude of the head was estimated to be 4.6 in 7 x 50 binoculars, two magnitudes brighter than the original prediction.

May	R	A	DEC		DELTA	R	CES	TL	MAG	5LOGD	LOGR	P A	ALT	TIME
20	19	27.41	18	7.0	1.304	1.946	113.7	4.4	10.4	.58	.289	237.7	68.1	3 29
21	19	25.01	18	5.4	1.308	1.963	114.9	4.5	10.5	.58	.293	236.6	68.1	3 28
22	19	22.58	18	3.4	1.313	1.979	116.1	4.6	10.5	.59	.296	235.5	68.1	3 23
23	19	20.14	18	1.0	1.317	1.996	117.3	4.7	10.6	.60	.300	234.4	68.0	3 17
24	19	17.69	17	58.2	1.322	2.012	118.4	4.8	10.6	.61	.304	233.3	68.0	3 10
25	19	15.22	17	54.9	1.327	2.028	119.6	5.0	10.7	.61	.307	232.1	67.9	3 4
26	19	12.74	17	51.2	1.332	2.044	120.7	5.1	10.7	.62	.311	230.9	67.9	2 58
27	19	10.25	17	47.0	1.337	2.060	121.9	5.2	10.7	.63	.314	229.7	67.8	2 51
28	19	7.75	17	42.4	1.343	2.077	123.0	5.3	10.8	.64	.317	228.4	67.7	2 45
29	19	5.25	17	37.4	1.349	2.093	124.1	5.5	10.8	.65	.321	227.1	67.6	2 38
30	19	2.75	17	31.9	1.355	2.109	125.2	5.6	10.9	.66	.324	225.8	67.5	2 32
31	19	.24	17	25.9	1.361	2.125	126.3	5.7	10.9	.67	.327	224.4	67.4	2 25

FIGURE 24. Photograph of Comet West (1975n) by Richard J. Wessling, March 10, 1976, 10^h20^m-10^h37^m, U.T. 200-mm. lens at f/4.5. Tri-X film. Transparency 4 (limiting stellar magnitude). Contributed by Dennis Milon.

JUNE 1976

	R	A	DEC		DELTA	R	CES	TL	MAG	5LOGD	LOGR	P A	ALT	TIME
1	18	57.74	17	19.6	1.368	2.140	127.3	5.9	11.0	.68	.330	223.0	67.3	2 19
2	18	55.23	17	12.8	1.374	2.156	128.4	6.0	11.0	.69	.334	221.5	67.2	2 12
3	18	52.74	17	5.6	1.382	2.172	129.4	6.2	11.0	.70	.337	220.0	67.1	2 6
4	18	50.25	16	57.9	1.389	2.188	130.4	6.4	11.1	.71	.340	218.5	67.0	2 0
5	18	47.77	16	49.9	1.397	2.203	131.4	6.6	11.1	.73	.343	216.9	66.8	1 53
6	18	45.30	16	41.4	1.405	2.219	132.4	6.7	11.2	.74	.346	215.3	66.7	1 47
7	18	42.84	16	32.6	1.413	2.235	133.3	6.9	11.2	.75	.349	213.6	66.5	1 40
8	18	40.40	16	23.4	1.422	2.250	134.2	7.1	11.3	.76	.352	211.9	66.4	1 34
9	18	37.98	16	13.8	1.431	2.266	135.1	7.3	11.3	.78	.355	210.1	66.2	1 28
10	18	35.58	16	3.8	1.440	2.281	135.9	7.5	11.3	.79	.358	208.3	66.1	1 21
11	18	33.20	15	53.5	1.449	2.296	136.7	7.8	11.4	.81	.361	206.4	65.9	1 15
12	18	30.84	15	42.9	1.459	2.312	137.5	8.0	11.4	.82	.364	204.5	65.7	1 9
13	18	28.51	15	31.9	1.469	2.327	138.2	8.2	11.5	.84	.367	202.5	65.5	1 2
14	18	26.20	15	20.6	1.480	2.342	138.9	8.4	11.5	.85	.370	200.5	65.3	0 56
15	18	23.92	15	9.1	1.490	2.357	139.5	8.7	11.6	.87	.372	198.4	65.2	0 50
16	18	21.67	14	57.2	1.502	2.373	140.2	8.9	11.6	.88	.375	196.3	65.0	0 44
17	18	19.44	14	45.1	1.513	2.388	140.7	9.1	11.6	.90	.378	194.1	64.8	0 38
18	18	17.25	14	32.7	1.525	2.403	141.2	9.3	11.7	.92	.381	191.9	64.5	0 31

NEW BOOKS RECEIVED

By: J. Russell Smith, A.L.P.O. Book Review Editor

COPERNICUS - Yesterday and Today, Vistas in Astronomy, Volume 17, edited by Arthur Beer and K. Aa. Strand. Pergamon Press Ltd., Headington Hill Hall, Oxford OX3 OBW, England. 1975. 225 pages. Price $50.00.

This book is the publication of the proceedings of a conference held in December, 1972. The conference was co-sponsored by the U.S. Naval Observatory, the National Graduate University of Washington, D. C., and the American Association for the Advancement of Science. It was held in Washington, D. C. to commemorate the 500th anniversary of the birth of Nicolaus Copernicus in Poland on February 19, 1473.

Forty-five outstanding scholars from the United States, Europe, and Canada were in attendance and participated. The book is beautifully bound, and it has a suitable index.

Pulsating Stars, edited by B. V. Kukarkin. John Wiley and Sons, New York, N.Y. 1975. 320 pages. Price $37.50.

This book is the first in a series of five books known as "Nonstationary Stars and Methods for Studying Them". The chapters in this first of the series are as follows: "Theory of Stellar Pulsations", "Classical Cepheids", "Cepheids of Spherical Component", "RV Tauri Stars", "RR Lyrae Stars", "Delta Scuti Variable Stars", "Dwarf Cepheids", "Beta Cephei Stars", "Long-Period Variables of the Mira Ceti Type", and "Semiregular and Irregular Variable Stars".

One will find this volume to be the most reliable up-to-date information available on this subject.

Atlas of Optical Transformers, by G. Harburn, C. A. Taylor, and T. R. Welberry. Cornell University Press, Ithaca, N.Y. 1975. 33 pages plus 32 pairs of plates. Price $15.00.

This unique book is a visual guide to a wide range of objects and their optical analogues. Quoting from the jacket: "The atlas was produced to aid researchers in the interpretation of X-ray diffraction patterns." The English text is repeated in French.

The Observer's Handbook, John R. Percy, Editor. Royal Astronomical Society of Canada, 252 College Street, Toronto, Ontario M5T 1R7, Canada. 116 pages. Price $3.00, paperbound.

This 1976 volume is the sixty-eighth edition of a handbook which is an essential aid for amateur astronomers. The Handbook no longer carries advertisements, thus making more space for additional astronomical information for the observer.

The Copernican Achievement, edited by Robert S. Westman. University of California Press, Berkeley, California, 1975. 421 pages. Price $14.50.

This book is No. 7 in the list of contributions of the U.C.L.A. Center for Medieval and Renaissance Studies. In November, 1973, a number of outstanding scientists and natural philosophers held a symposium at the University of California at Los Angeles to honor the 500th birthday of Nicholas Copernicus. The papers in the book are the published results of the four sessions of this conference.

BOOK REVIEWS

Astronomical Calendar 1976, by Guy Ottewell, Department of Physics, Furman University, Greenville, South Carolina, 1975. 55 pages, paperbound. Price $4.95.

Reviewed by Phillip W. Budine

In coöperation with the Astronomical League, Mr. Ottewell has performed a splendid service in assembling a complete and comprehensive calendar and guide for the amateur. This book is the most complete calendar and guide for celestial events the reviewer has ever seen.

Some of the good monthly features are the large star chart, meteor shower radiants, position of the Moon at First Quarter and Full, the bright planets and their movements during the month, the Milky Way, the coördinate system, the prominent variables, and deep sky objects. Opposite each monthly chart is a detailed description of the events for that month.

Upon reading the book carefully, I have found it to be unusually free from omissions and errors. On page 25, for the month of September on Wednesday, the 22nd, under the Fall or Autumnal Equinox, it is stated: "the days and nights are equal except at the poles where the sun skims the horizon, neither rising or setting. The sun begins to rise and set south of east and west, and in the Northern Hemisphere the days become longer than the nights." This last sentence should instead indicate that the nights become longer than the days.

The book is packed with astonomical information, and the Glossary is quite complete. The type is unusually small, and the reviewer found it difficult to read with the large amount of information on some of the pages.

This is an excellent book for astronomy clubs because the author offers group rates: 25 or more copies are $3.30 each, and 50 or more copies are $2.97 each.

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THE PLANETS: Some Myths and Realities, by Richard Baum. John Wiley and Sons, Inc., 605 Third Avenue, New York, N.Y. 10016, 1973. 200 pages. Price $8.95 hardback.

Reviewed by Charles F. Capen

The observational record of astronomy abounds with unusual and intriguing observations which have not been confirmed to date. Many of these old reports, and their interesting observational methods, have become forgotten in the pages of time. THE PLANETS: Some Myths and Realities brings to light the case histories of eight such episodes for the modern reader. The author, Richard Baum, is himself a well known astronomical observer of many years experience and a contributor of planetary data to the BAA and ALPO observing sections. Over the years the reviewer has exchanged historical data and references with Mr. Baum, which he has used in his various literary researches concerning the history of Solar System observations.

In his book Mr. Baum describes in a most readable style the historic details of each exciting observational incident. Each chapter episode is written as a mystery, with the "who done it" or final enigma saved until the last. In his "Introduction" and "Contents," he proposes such questions of the reader as: Has our Moon a satellite? Have towering peaks been observed in the past or today on the surface of Venus? What was the unexplained observation made by the renowned observer Barnard? Why did so many experienced observers of unquestioned integrity report seeing rings around the outer planets Uranus and Neptune? And finally, what are the observational circumstances behind two lost planets in our Solar System? To reveal here in detail the important events surrounding each of the eight astronomical episodes would destroy the excitement of discovery and the mystery of events that are so charmingly presented to the reader by the author. It is sufficient to list here the name of each chapter episode, and leave the conclusion to the reader: (1) "The Search for a Satellite of the Moon," (2) "The Himalayas of Venus," (3) "An Unexplained Observation," (4) "A Strange Celestial Visitor," (5) "William Herschel and the Ring of Uranus," (6) "Neptune 1846-47," (7) "Strange Interlude," and (8) "The Lost Planets of 1831 and 1835."

Richard Baum's skill and patience as an astronomical historian show throughout the entire volume. His literature researches have been thorough and accurate, and it is evident that much time-consuming correspondence was necessary before the text of his book could be initiated. Some of the material presented has never been published, while the remainder can only be found with difficulty. As with any proper historical work, Mr. Baum has listed by chapter all his notes and references, and has given us a good bibliography. An adequate index completes the book.

To this reviewer, the story about the young Edward Barnard (1857-1923) and the observational evidence concerning the rings around Uranus and Neptune were fascinating and well worth the modest price of the book. I am confident that THE PLANETS: Some Myths and Realities will appeal to laymen, historians, and astronomers.

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Man and Cosmos, edited by James Cornell and E. Nelson Hayes. W. W. Norton and Co., New York, N.Y., 1975. 192 pages. Price $8.95.

Reviewed by Bruce M. Frank

In the past few years, Man's knowledge of the bodies comprising the Solar System has increased tremendously. The success of unmanned space probes, such as Mariner 9 and Pioneer 10, has not only provided professional scientists with large amounts of new data about the Sun, Moon, and planets; but it has also enhanced the layman's interest in the import of these findings. The material on the Solar System contained in Man and Cosmos is presented in a nonmathematical format to bring the informed layman and amateur astronomer up to date on what is currently known about our neighbors in space. The book is a compendium of nine Guggenheim lectures on the Solar System sponsored by the Smithsonian Institution in early 1974. The contributors include--among other notable astronomers--Carl Sagan, Brian Marsden, Fred Whipple, and A. G. W. Cameron.

A brief rundown of the book's contents will give some idea of the multitude of topics covered therein. Each chapter corresponds to one lecture in the series. In Chapter One, Dr. Cameron summarizes the various theories on the formation of the Solar System and presents his own solar nebula model in some detail. Owen Gingerich (Chapter Two) recounts some of the history of astronomical research on the Sun from Copernicus through the first Skylab mission. Chapters Three (John Ward), Four and Five (Carl Sagan), Six (S. I. Rasool), Seven (Myron Lecar), and Eight (Brian Mardsen) discuss what we currently know about the observable features and composition of the Moon, terrestrial planets, outer planets, the asteroids, and comets respectively. In the final chapter, Fred Whipple highlights the most surprising information obtained on the Solar System such as moonquakes, evidence of probable water erosion on Mars, and the modulation of Jupiter's radio noise by one of its innermost satellites--Io.

The editors of Man and Cosmos are to be commended for their fine job in establishing good continuity out of material provided by manny different authors. The narrative is concise, clearly written, and highly descriptive. The text is further enhanced through the many drawings, photographs, and charts appended to each chapter. The only fault one can find with the book is that the material is not totally up to date. Because the lectures were held in early 1974, information obtained from subsequent space probes is not included in the main text. Instead, the introduction to the book by Thornton Page recapitulates some of these additional discoveries, particularly in regards to Mercury by Mariner 10. Photographs from the Mariner 10 mission have also been included.

In sum, Man and Cosmos is an excellently written and well-illustrated book. It should prove enjoyable reading for anyone desiring a concise overview of what we currently know, or hypothesize, about the Solar System as described by some of the most emminent astronomers of our time.

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Increase in Subscription Rates. The ALPO Business Meetings in 1972 and 1973 already recommended increases in our present dues. The Editor has been personally very reluctant to raise them, but this step can no longer be avoided. Frequent increases in postal rates, higher costs for secretarial services, in truth higher everything--force us to increase. We regret also that for the first time we must charge more for subscriptions in most foreign countries; the extra postal charge on one issue of this journal is now 17 cents. Effective July 1, 1976, our new rates are:

1 volume (6 issues), U.S.A., Canada, and Mexico	$ 8.00
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League-ALPO Convention in August, 1976. We are meeting this year with the Astronomical League at its National Convention at Kutztown State College in Eastern Pennsylvania. The dates are Thursday, August 19, to Sunday, August 22. Pre-registration checks should be mailed to George Maurer, Astronomical League Bicentennial Convention, R. D. 3, Box 140, Cooperburg, PA 18036; the cost of registration is four dollars for individuals and five dollars for families. The total cost of registration, housing for four days, the banquet, and meals for the three highlight days of the meeting will be approximately forty-five dollars--remarkably low in this period of unending inflation and ever-higher prices.

An ALPO Exhibit is being assembled by Phillip W. Budine, Box 68A, R.D. 3, Walton, NY 13856. Readers are invited to send selected drawings and photographs of planets, comets, and lunar regions to Mr. Budine, such items being ordinarily the best for display. We have also responded to the Astronomical League's invitation to conduct a number of seminars or workshops on selected ALPO projects (e.g., our observational studies of the planet Jupiter). J. Russell Smith, our Secretary, is organizing this effort; and at the moment (April 25) it is expected that a number of our Section Recorders and leading observers will attend and will lead workshops.

The Strolling Astronomer

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