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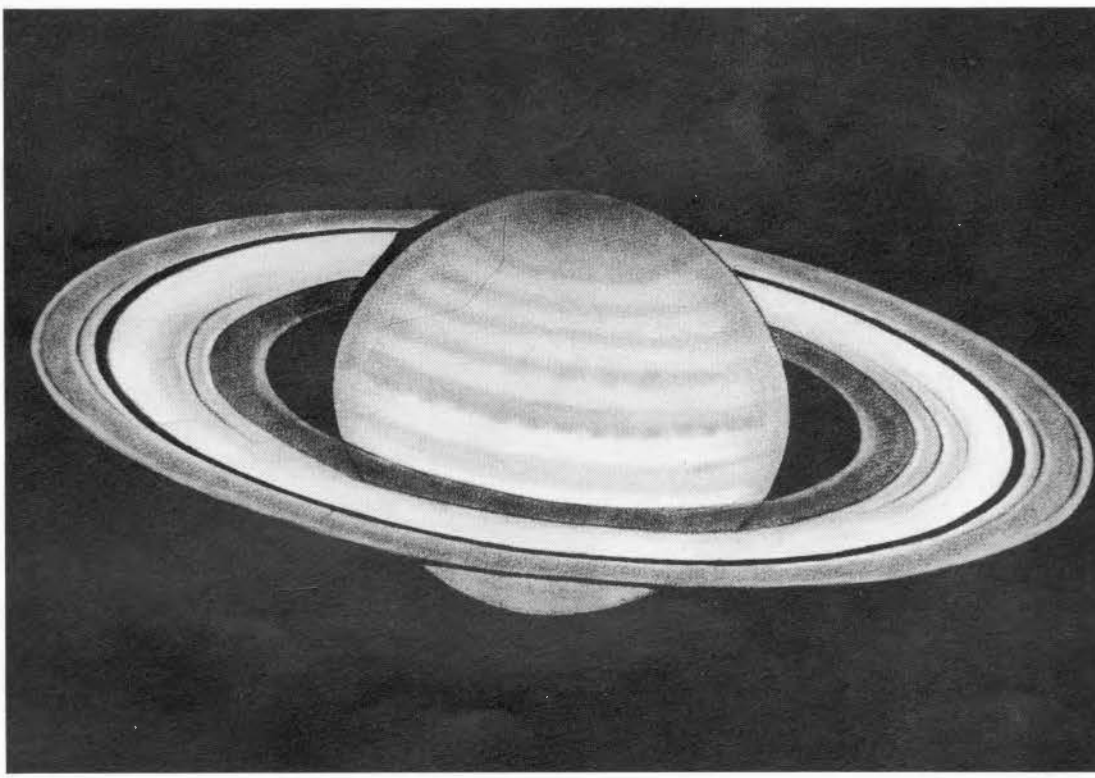

Drawing of Saturn by Dr. Jean Dragesco at the Pic du Midi Observatory on December 22, 1975 at 1 hr., 0 mins., Universal Time. 42-inch (107-cm.) Newtonian-Cassegrain reflector at 800X. Average seeing. Simply inverted view with south at the top. See also Julius Benton's report on the 1975-76 Saturn apparition on pages 173-184.

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IN THIS ISSUE

THE 1975-76 APPARITION OF SATURN

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Abstract

Visual and photographic observations of the planet Saturn during 1975-76 are reduced and discussed. Observers in the United States and collegagues in Hungary, Great Britain, and elsewhere participated in supplying their impressions of Saturn and its ring system, and these are entered cumulatively in a categorical presentation of the data. Reasons to suggest that Saturn remained rather quiescent from 1975, September through 1976, June are given, along with notes to indicate increased observer participation during the apparition. Suggestions for more detailed observing programs are described in the report.

Introduction

The present report deals with visual and photographic observations of the planet Saturn from 1975, September 2 through 1976, June 30. The numerical value of B, which is defined as the Saturnicentric latitude of the Earth referred to the ring plane, varied over a range from -20°.000 to -22°.484. Southern portions of the globe of Saturn and the accompanying ring system were thus visible to observers, with only a small fraction of the northern hemisphere of the planet detectable during the apparition. Opposition of the planet Saturn occurred on 1976, January 20^{d} 11^{h}, U.T. with an apparent visual stellar magnitude on that date of -0.1. The major axis of the ring system at opposition was 46".42, and the minor axis of the rings was then 16".83. The equatorial diameter of Saturn on the same date was 20".61, while the polar diameter measured 18".44.

The following individuals submitted observational data to the Saturn Recorder for the 1975-76 apparition:

Observer	Station	No. of Observing Dates	Instrument(s)*
Bakos, Gabor	Dunaujvaros, Hungary	5	6" (15.0-cm.) NEW
Balogh, Imre	Budapest, Hungary	25	6" (15.0-cm.) NEW
Benton, Julius L.	Clinton, SC	2	6" (15.0-cm.) RR
Boisclair, Norman J.	Rensselaer, NY	96	14" (35.5-cm.) S-C
Brlas, Pal	Szarvas, Hungary	1	6" (15.0-cm.) NEW
Csiszar, Tibor	Magvcs, Hungary	3	4" (10.0-cm.) NEW
Davis, Darryl J.	Fresno, CA	1	10" (25.0-cm.) S-C
Dragesco, Jean	Pic du Midi Obs., France	4	42" (107.0-cm.) N-C
Dürr, Janos	Budapest, Hungary	4	4" (10.0-cm.) RR
Farkas, Zsolt	Budapest, Hungary	7	2.8" (7.10-cm.) RR
Fliss, David M.	Buffalo, NY	39	8" (20.0-cm.) S-C
Haas, Walter H.	Las Cruces, NM	10	12.5" (31.0-cm.) NEW
Harbour, David A.	Enid, OK	3	12.5" (31.0-cm.) NEW
Heath, Alan W.	Nottingham, England	36	12.0" (30.0-cm.) NEW
Hull, Richard L.	Richmond, VA	5	12.0" (30.0-cm.) NEW & 7" (17.8-cm.) RR
Iskum, Jozsef	Budapest, Hungary	2	8" (20.0-cm.) NEW
Kart, Pal	Budapest, Hungary	4	4" (10.0-cm.) NEW
Kiszel, Gabor	Budapest, Hungary	2	8" (20.0-cm.) RR
Parker, Donald C.	Miami, FL	8	8" (20.0-cm.) NEW
Pastore, Peter F.	Massapequa, NY	3	10" (25.0-cm.) NEW
Pierce, William H.	San Bernardino, CA	4	10" (25.0-cm.) NEW
Sabia, John D.	Scranton, PA	8	9.5" (24.0-cm.) RR
Sledge, John	Montevallo, AL	15	6" (15.0-cm.) NEW
Smith, Michael B.	Alamorgordo, NM	34	3.27" (8.3-cm.) RR 4.25" (11.0-cm.) NEW 6.0" (15.0-cm.) NEW
Toth, Imre	Eger, Hungary	1	6" (15.0-cm.) NEW
Trexler, Laszlo	Esztergom, Hungary	4	8" (20.0-cm.) NEW
Tuboly, Vince	Hegylratsal, Hungary	5	12.0" (30.0-cm.) NEW

*RR is refractor, NEW is Newtonian reflector, S-C is Schmidt-Cassegrain, and N-C is Newtonian-Cassegrain.

Observer	Station	No.of Observing Dates	Instrument(s)
Ujvarosy, Antal	Nyiregyhaza, Hungary	4	12.0" (30.0-cm.) NEW
Varnai, Gyula	Dunaujvaros, Hungary	2	6" (15.0-cm.) NEW
Vörös, Jozsef	Esztergom, Hungary	4	8" (20.0-cm.) NEW
		341	

A total of 341 observation dates was recorded by the Saturn Section during 1975-76, and the distribution by month of submitted reports, in the form of a histogram, is presented in Figure 1 for interested readers.

The greatest concentration of observational material was to be found for the months of February and April, 1976, followed by a moderate number of reports during January, March, and May. Fewer observations were received for the earlier portions of the apparition than for the closing months, a situation which has persisted for several years, although more observers, it appears, are now beginning their programs much earlier than before and are following through up until the time of conjunction. The 1975-76 apparition of Saturn came to a close when the planet entered the domain of the Sun, at conjunction, on 1976, July 29^d 14^h, U.T.

The writer was most delighted to see the increased response to Saturn observing programs throughout 1975-76, and it is sincerely hoped that the trend will continue in subsequent years. In particular, recognition is due our Hungarian colleagues, who responded well during the 1975-76 period. A word of gratitude is extended to all who participated in the Section's research programs during the apparition.

The Globe of Saturn

Our discussion in the pages to follow is based upon descriptive notes taken from observational reports received by the Saturn Section during 1975-76. The names of observers, for the most part, have been omitted for the sake of brevity. In cases where the identity of an individual is essential to the importance and meaning of the text, such has been included. Members of the reading community who desire specific information on any portion of the present report, or with respect to a particular feature on Saturn, are invited to contact the Recorder. Reference to the illustrative material, tables, and graphs accompanying this report is encouraged for a full understanding and appreciation of the data. Refer to Figure 2 for the nomenclature here used.

Southern Portions of the Globe. In the course of the 1975-76 observing period, notes of some rather subtle brightenings in the zones and scattered reports of minor intensity variations in the belts on Saturn were amassed. In general, however, only a small number of confirmatory observations were accumulated; and it is quite reasonable to assume that the planet remained moderately quiescent during most of the apparition. Observers with more experience and larger apertures reported fewer variations on the globe of Saturn than individuals having smaller telescopes and less practice at the eyepiece.

On the whole, the belts on the planet's globe were darker than they had been throughout 1974-75, particularly in respect to the EB (Equatorial Belt) and STeB (South Temperate Belt). The SPB (South Polar Belt) had remained stable in overall intensity since the 1974-75 apparition, the same being also true of the SEB_s (South Equatorial Belt, Southern Component). The SEB_n (South Equatorial Belt, Northern Component) was slightly brighter than in 1974-75, according to intensity estimates. The SPR (South Polar Region) was considerably darker.

The zones on Saturn were also darker than in 1974-75, with the exception of the SEB Z (South Equatorial Belt Zone). The SPC (South Polar Cap) was darker than in the preceding observing season.

The above notes are based upon the extension of a comparative study of the numerical relative intensity estimates of selected global features. Such an investigative program was initiated several years ago in an effort to reveal any seasonal or other activity, but the study has not been in effect long enough to yield the graphical data sought over an extended period. Reference should be made to the 1974-75 apparition report which appeared in The Journal of the A.L.P.O., 26, (5-6), beginning on page 85. The comparative data just mentioned are presented in the following table:

Zones:	1974-75	1975-76	Comparison
EZ	6.6	6.1	Darker (0.5)
STeZ	5.9	5.3	Darker (0.6)
STrZ	5.7	5.3	Darker (0.4)

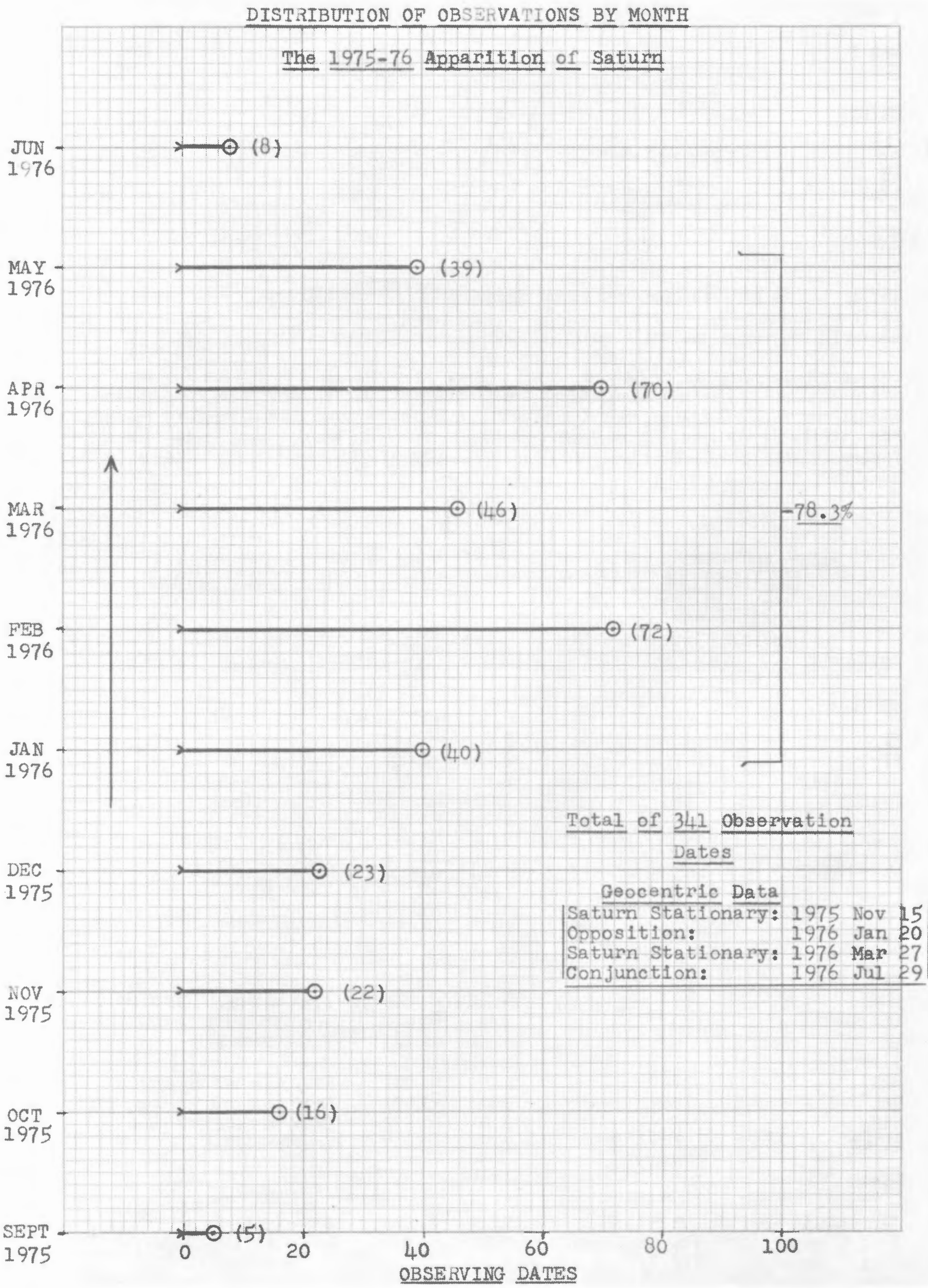

Figure 1. Histogram to show frequency distribution of A.L.P.O. observations of Saturn during its 1975-76 apparition. The total number of observation dates in each month of observation is shown. This diagram prepared by Dr. Julius Benton. See also text of his Saturn Report in this issue.

Zones:	1974-75	1975-76	Comparison
SEB Z	4.8	5.1	Brighter (0.3)
SPR	5.5	4.0	Darker (1.5)
Belts:			
SPC	5.6	4.9	Darker (0.7)
EB	4.6	3.8	Darker (0.8)
STeB	4.8	3.8	Darker (1.0)
SEB_s	3.8	3.8	Stable
SEB_n	3.1	3.2	Brighter (0.1)
SPB	3.5	3.5	Stable

(NOTE: It is of some question as to whether the SPR and SPC should be listed with the belts or along with the zones on Saturn. Because the tradition has been to list them as shown in the table, we shall continue to use such an arrangement.)

A regular feature of Saturn reports since the 1974-75 compilation has been to include a representative diagram of the planet with the accompanying standard nomenclature of global and ring features. For those who are unfamiliar with the planetary features and for clarity in reading of the present report, reference should be made to Figure 2. Observers should note that the ring inclination there depicted is for a value of B equal to -21°.0.

TABLE I.

VISUAL NUMERICAL RELATIVE INTENSITY ESTIMATES OF MAJOR SATURNIAN FEATURES FOR THE1975-76 APPARITION WITH ACCOMPANYING ABSOLUTE COLOR DATA

Feature(s)	Relative Intensity: No. of Visual Estimates	Mean Intensity with Standard Deviation		Estimated Color (Absolute)
ZONES:				
EZ_s	10	6.88	±0.140	Dull yellow to yellowish-white
EZ_n	6	6.60	±0.000	Dull yellow
EZ (whole)	110	6.08	±0.480	Yellowish-white to yellow
STeZ	106	5.31	±0.313	Dull yellow-white to yellow
STrZ	8	5.29	±0.298	Pale yellow-orange
SEB Z	32	5.14	±0.449	Very light yellowish-brown
Ball SEB to SPB	12	5.01	±0.178	Light yellow-grey
SPR	116	3.95	±0.534	Light yellow-grey to greyish
BELTS:				
SPC	107	4.90	±0.288	Brownish-grey
NPR	109	4.79	±0.299	Dull yellow
SEB (whole)	80	4.08	±0.185	Greyish-brown to reddish-brown
EB	4	3.80	±0.123	Brownish-orange
STeB	1	3.80		Grey
SEB_s	29	3.76	±0.301	Grey to reddish-brown
SPB	10	3.48	±0.199	Grey to brownish-grey or bluish-grey
SEB_n	35	3.20	±0.532	Grey to reddish-brown
SSTeB	7	2.90	±0.000	Greyish-brown
RINGS:				
Terby White Spot	8	9.00	±0.000	Brilliant white
Ring B (outer 1/3)	116 (Standard)	8.00	±0.000	Light yellowish-white
Ring B (inner 2/3)	112	7.40	±0.187	Light yellow
Ring A (outer 1/2)	113	6.37	±0.209	Greyish-white to bluish-white
Ring A (inner 1/2)	113	6.36	±0.219	Greyish-white to bluish-white
B 2 (ansae)	3	3.17	±0.111	Dark greyish
A 5 Encke's (ansae)	16	3.13	±0.226	Dark grey
Crape Band	106	2.34	±0.308	Dark grey to reddish-brown
Ring C (off globe)	90	0.62	±0.292	Very dark grey
B 10 (A 0) Cassini's (ansae)	96	0.03	±0.094	Very dark grey to greyish-black

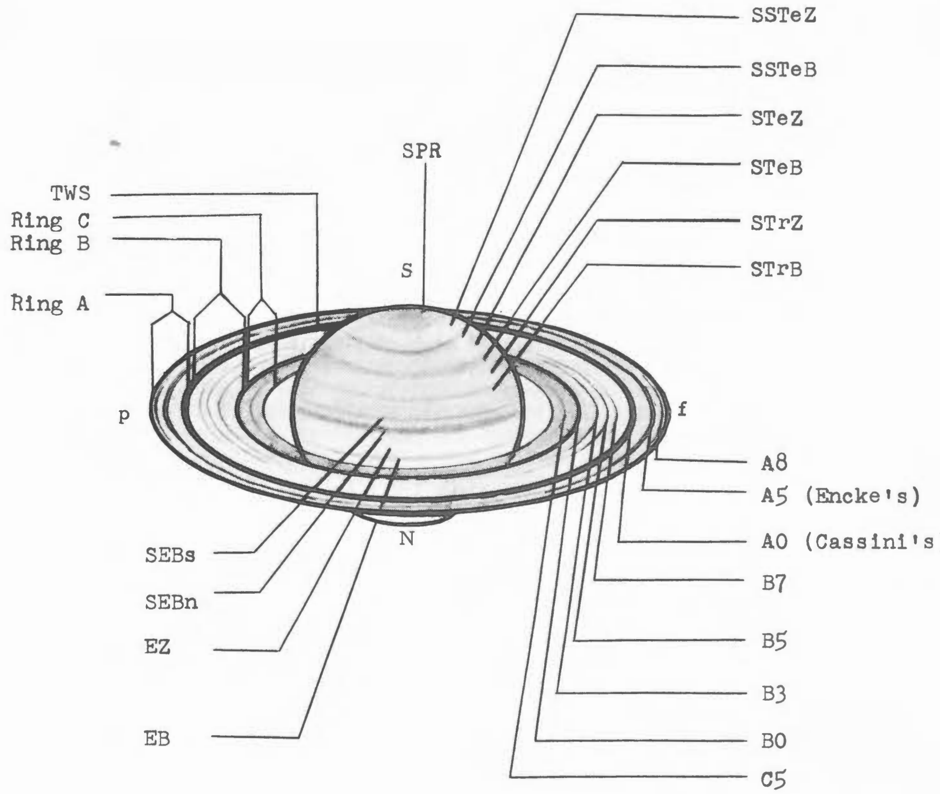

Figure 2. General nomenclature for Saturn's belts, zones, and rings during the 1975-76 apparition. Prepared and contributed by Saturn Recorder Julius Benton. See also text of his report in this issue.

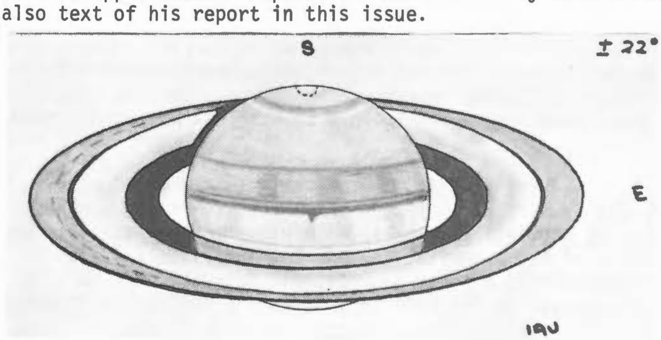

Figure 3. Drawing of Saturn by David Fliss on February 21, 1976, 0^h55^m-1^h15^m, U.T. Celestron 8-inch reflector, 163X and 200X. Seeing 5 (fair), transparency 4 (limiting stellar magnitude). Simply inverted view with south at the top. Encke's Division suspected on west ansa. SEB_n very thick. SPC glimpsed at intervals.

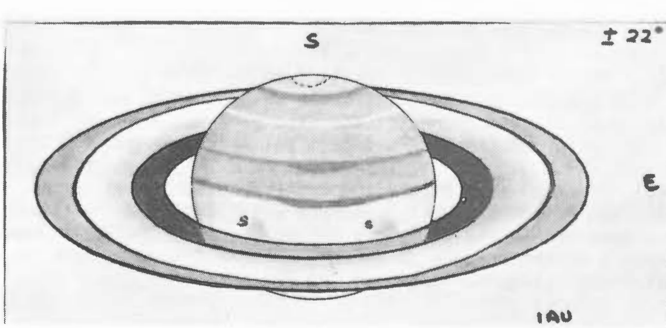

Figure 4. Drawing of Saturn by David Fliss on February 24, 1976, 2^h54^m-3^h20^m, U.T. Celestron 8-inch reflector, 163X and 200X. Seeing 4 to 5, transparency 5 (limiting magnitude). Simply inverted view with south at the top. Suspected spots in EZ, as drawn. White SPC glimpsed with averted vision. Occasional impression of delicate belts between STB and SSSTB.

TABLE I. (continued)

VISUAL NUMERICAL RELATIVE INTENSITY ESTIMATES OF MAJOR SATURNIAN FEATURES FOR THE 1975-76 APPARITION WITH ACCOMPANYING ABSOLUTE COLOR DATA

Feature(s)	Relative Intensity: No. of Visual Estimates	Mean Intensity with Standard Deviation	Estimated Color (Absolute)
RINGS:			
Shadow Globe on the Rings	100	0.01 $\pm$0.463	Greyish-black to black

Visual numerical intensity estimates are based upon the A.L.P.O. Intensity Scale, where 0.00 denotes complete black and 10.00 refers to the brilliant white condition of the very brightest objects. The adopted scale utilizes as its standard of reference the brightness of the outer third of Ring B, having an assigned intensity value of 8.00, which appears very stable with time and ring inclination. Details on the method of carrying out visual relative numerical intensity estimates (visual photometry) for Saturnian features can be found in the Saturn Handbook. Copies of this volume are available from the Recorder at cost.

* *

South Polar Region (SPR). As mentioned earlier in the present report, the SPR was considerably darker throughout the 1975-76 apparition than in the immediately preceding observing season. Even so, the SPR was not nearly so dark as it had been in 1973-74. The region showed little in the way of intensity fluctuations during the 1975-76 apparition, with any activity being of a very transient and vague nature. The overall color of the SPR was described by observers as being greyish to light yellowish-grey.

The SPC (South Polar Cap) was frequently seen by individuals who submitted reports to the Saturn Section. Most persons described the SPC as somewhat diffuse and usually light brownish grey, lighter in intensity than the surrounding environment of the SPR. On occasion, the SPB (South Polar Belt) was detected bordering the SPC; and the color of this elusive belt was noticed to be grey to greyish-brown, sometimes even bluish-grey. The SPC was not so bright as it had been in 1974-75, almost as dark as it was in 1973-74. The overall intensity of the SPB had remained unchanged since the last observing season.

South South Temperate Zone (SSTeZ). Observers consistently failed to detect this zone during the 1975-76 apparition.

South South Temperate Belt (SSTeB). The roughly linear, frequently ill-defined SSTeB was seen only at times of excellent seeing throughout the 1975-76 period. The color of the belt was greyish-brown, and it appeared a little more conspicuous and darker than in 1974-75.

South Temperate Zone (STeZ). The STeZ showed up second only to the EZ (Equatorial Zone) in brightness during the whole of 1975-76, although the intensity of the zone exhibited a darkening trend compared to the 1974-75 apparition. Minor festoon activity was suspected occasionally in the course of the observing season, but individuals failed to record any persistent phenomena. Confirming reports of transient activity were lacking. The color of the STeZ was usually reported to lie somewhere between a dull yellowish-white and yellow.

South Temperate Belt (STeB). Seen on only one occasion in 1975-76, the STeB was reported as a discontinuous, quite diffuse, brownish-orange feature. With some necessary reservation, the STeB was a little darker than in 1974-75

South Tropical Zone (STrZ). Vague suspicions of mottling in the STrZ were recorded by observers throughout the 1975-76 apparition. Most instances when activity was detected in this zone were accompanied by superior seeing conditions. The STrZ had a deeper intensity (darker) than in 1974-75. The color of the STrZ was pale yellowish-orange.

South Equatorial Belt (SEB). Taken as a single and undifferentiated belt, the SEB was brighter than in 1974-75; and most individuals recorded a greyish-brown to reddish-brown hue for the SEB. At times when the seeing was above average, some individuals remarked that the SEB could be seen to have a northern and a southern component (the SEB_n and SEB_s, respectively). Consistently, the SEB_n was darker than the SEB_s, but this difference was not pronounced. In comparison with the 1974-75 apparition, the SEB_n was only slightly brighter; the SEB_s remained stable in intensity. Colors for the SEB_n and SEB_s were grey to reddish-brown for both components.

When the SEB was divided into components, there was a fairly distinct zone separating the SEB_n and SEB_s, known as the SEB Z (South Equatorial Belt Zone). This region appeared brighter during 1975-76 than in the immediately preceding apparition, frequently having a very light yellowish-brown hue. Bright areas and dusky phenomena were noted in association with the SEB components, the SEB Z, and the region in general; but no significant activity was recorded by observers consistently, most visual accounts lacking adequate confirmation.

Equatorial Zone (EZ). Throughout all of 1975-76, the EZ was clearly the brightest zone on Saturn's globe; and collectively speaking, the EZ was the brightest feature seen in association with Saturn other than the Terby White Spot and Ring B. Since 1974-75 the EZ had diminished in brightness, a trend which has now continued since 1973-74. Some observers remarked that the EZ was a little brighter after opposition than before, but no definite picture could be derived from the varied reports. The color of the EZ, as a whole, was noted to be yellowish-white to pale yellow. On a very few dates the EB (Equatorial Belt) was detected as a continuous, narrow line, the EB appearing greyish to brownish-orange in color. At times when the EB was either suspected or definitely seen, the EZ was divided into northern and southern halves (referred to as the EZ_n and EZ_s, respectively). The EZ_s was always a little brighter than the EZ_n during the 1975-76 observing season; the same had been the case in 1974-75, but in that apparition the two components were brighter than during 1975-76. Both zone components displayed the same coloration, described as dull yellow to yellowish-white.

Some activity was confirmed in the EZ during the apparition, but widespread phenomena were lacking. Mostly observers' accounts carried notes of festoons, amorphous bright areas, and hazy spots within the EZ, sometimes suspected in association with the SEB. Transit timings of such regions were not possible owing to their transient and elusive nature.

Shadow of the Globe on the Rings. The shadow of Saturn's globe projected on the ring system was almost always noted to be completely black, exceptions taking place at times of poor seeing. Smaller instruments also produced an image of Saturn which was over-magnified in the judgement of the writer, hence a deviation in those instances from the black shadow.

Latitudes of Saturn's Belts and Zones. Unfortunately, only one set of latitude values was received by the Saturn Section for 1975-76. These are reduced and presented in tabular form in Table II. Because of the lack of participation in this aspect of Saturn observing, no conclusions have been drawn from the data on hand. When a number of numerical values are received from more than one observer, a suitable statistical evaluation of the data can be attempted. The writer must fervently appeal to our observers for more participation in the area of latitude work. Details on carrying out the program may be obtained upon request.

TABLE II.

LATITUDES OF SATURNIAN FEATURES DURING THE 1975-76 APPARITION

Feature	Eccentric Latitude	Planetocentric Latitude	Planetographic Latitude
N. Edge Crape Band*	+26°341	+23°853	+29°004
S Edge Crape Band*	+17.067	+15.336	+18.967
Center EB	+ 3.747	+ 3.352	+ 4.188
N Edge SEB_n	-21.869	-19.716	-24.205
S Edge SEB_n	-24.772	-22.395	-27.333
N Edge SEB_s	-28.111	-25.500	-30.892
S Edge SEB_s	-31.218	-28.421	-34.045
N Edge SPB	-78.806	-77.505	-79.977
S Edge SPB	-85.949	-85.467	-86.380

* These two latitudes vary with the changing value of B, the tilt of the rings to the Earth.

North Polar Region (NPR). Barely perceptible beyond the edge of the rings (Ring A) was the northern portion of the globe of Saturn, showing up as a diffuse, dull yellow region, almost as bright as the SPR. As the rings close in subsequent apparitions, more and more of the northern hemisphere will begin to appear to observers. No activity in this region was detected.

The Rings of Saturn

Our discussion of global features was based, as pointed out much earlier in this report, on descriptive accounts by observers during the 1975-76 apparition. We shall adopt the same method of treatment of the ring system and its components here.

With the 1974-75 report a comparative investigation of selected ring features and their components was conducted, in keeping with a similar study of the global phenomena. As our discussion commences of the ring system for 1975-76, references shall be made to the table of intensities given below, an extension of the one shown on page 91 of the Journal of the A.L.P.O., 26, (5-6):

	1974-75	1975-76	Comparison
Ring B (outer third)	8.0	8.0	(standard)
Ring B (inner portion)	7.2	7.4	Brighter (0.2)
Ring A (outside A5)	6.4	6.4	Stable
Ring A (inside A5)	6.2	6.4	Brighter (0.2)
Ring A (entire ring)	6.3	---	---
Crape Band	2.0	2.3	Brighter (0.3)
Ring C (off globe)	0.8	0.6	Darker (0.2)
B10 (Cassini's)	0.3	0.03	Darker (0.27)
A5 (Encke's)	---	3.1	---
Terby White Spot.	8.8	9.0	Brighter (0.2)

Ring B. The outer third of Ring B has been for many years the reference standard (intensity value 8.0) for estimating the relative numerical intensity of globe and ring features of Saturn, and the use of this reference is considered worthwhile in subsequent years for estimates made in integrated light (no filter).

With the exception of the Terby White Spot, Ring B was brightest of the ring components throughout the apparition, although the inner 2/3 of the ring was not so bright as the outer 1/3. Observers noticed that the inner 2/3 of Ring B was slightly brighter than it had been in 1974-75, and the color of the inner portion was described as light yellow. The outer 1/3 of the ring exhibited a light yellowish-white coloration.

No variation in the intensity of Ring B was noted consistently in 1975-76, but some individuals suspected possible radial streaks in the ring near the ansae on a few occasions; confirmation was lacking. Cassini's Division (A0 or B10) was always very dark, apparently much darker in 1975-76 than in the previous years, and it was seen to advantage near the ansae. Those with larger instruments and good seeing conditions saw B10 all the way around the ring occasionally. The color of B10 was usually described as very dark grey to greyish-black. Varied reports of intensity minima in Ring B included descriptions of B2 near the ansae, showing up there as a greyish streak on the three occasions when it was seen.

Ring A. Observers continuously described Ring A in terms of the inner and outer halves of the ring component, occasionally as the portion inside and outside of A5 (Encke's Division). During 1975-76, the inner and outer portions were essentially equal in intensity, although the portion inside A5 (inner half as it was most often noted) was brighter by a slight degree over 1974-75. The color of the inner and outer portions of Ring A was greyish-white to bluish-white. Intensity variations in Ring A were seldom noted, except for possible faint radial streaks in association with Ring B (which themselves were rare and ill-defined).

Encke's Division (A5) was seen occasionally throughout the 1975-76 apparition near the ansae, described as a dark grey curvilinear feature in larger instruments. A5 was not estimated using the visual photometry technique (numerical relative intensity) during 1974-75 so that comparisons of values are impossible.

Ring C. The dusky Ring C was consistently seen by individuals using larger apertures throughout the 1975-76 observing season, and their notes indicated that Ring C was slightly darker off the globe of Saturn than in 1974-75. The inner boundary of Ring C (portion approaching Saturn's globe) was fuzzy and uncertain. The coloration of Ring C was very dark grey, and the intensity estimates varied over a fairly wide range during the 1975-76 apparition; most individuals saw the ring clearly only at the ansae (at points off the globe). The Crape Band (Ring C in front of the globe) was easily seen during the apparition, described as a dark grey to reddish-brown feature, brighter by a small amount since 1974-75.

Ring D. In the 1976, May 24 issue of the Junior Astronomical Society's Circular (the Junior Astronomical Society in an affiliate of the British Astronomical Association) R. S. Scagell describes in an article, "Seeing Ring D," some interesting points concerning the newly-discovered Ring D (note that this is the new ring inside Ring C, not Ring D' external to Ring A). Since it was first detected in October of 1969 by Pierre Guérin on a photograph taken with the 106-cm. reflector at Pic du Midi in France, a few photographs taken around the same time under ideal conditions at other observatories have also showed the ring; but its reality has often been doubted. In particular, no visual accounts existed until a proposal by John Murray emerged at the University of London Observatory. Scagell notes:

"Many amateur astronomers may have seen the newly discovered faint 'Ring D' of Saturn without realizing it...

"Speaking at the March (1976) meeting of the B.A.A., he (Murray) outlined the evidence for the new ring...Guérin's very faint ring inside the comparatively well-known Ring C or Crêpe Ring."

Murray himself tried on several occasions to detect the ring with the same telescope at the Pic du Midi Observatory; yet success was not realized. The article by Scagell continues:

"Finally, however, on a night of exceptionally good seeing, he (Murray) found that he could see Ring D without any difficulty. The next night the same clarity persisted and he was able to make micrometer measurements of the ring's diameter. These agreed exactly with the values taken from Guérin's photographs. In particular, the inner edge of the ring appears to be almost coincident with the planet's surface itself.

"This led to an interesting possibility. Many observers find that they can see the Crêpe Band quite clearly against the body of the planet, because the Sun's light, creating a shadow on the disc of Saturn, and again as the light from the shadow traverses the ring on its way to Earth.

"Have observers unwittingly observed the shadow of the new ring, without being able to see the ring itself? Murray suggests that many observations of the EB (Equatorial Band) - a dusky belt sometimes seen encircling the planet's equator - may indeed be due to just this effect. He has analyzed many years of published observations, and has found that there is a noticeable tendency for the Equatorial Band to be most visible when the ring system is wide open. If the Band were an intrinsic feature of the planet then the inclination of the rings ought to make no difference to its visibility.

"Of course, now the secret is out it may be rather difficult to stop observers from interpreting any equatorial feature as the shadow of Ring D. But there exists enough observational evidence already for the work to be taken further, using the unbiased drawings made over many years but so far unpublished."

To this writer, the above account is very interesting and is worthy of consideration. It might be interesting to look into the A.L.P.O. files on Saturn and to ascertain whether the same impressions exist for American observers, i.e., if the tendency to see the EB clusters around the time when the rings are fully open or nearly so (putting aside effects of seeing, aperture, and observer experience). No opinion by the present writer is forthcoming until more study is undertaken on his part of this suggested correlation; yet it must be admitted that the points raised are thought-provoking.

Ring D'. The ring component suspected external to Ring A, which shall be denoted as in the Saturn Handbook as Ring D', was not seen or suspected during the 1975-76 apparition.

Terby White Spot (TWS). An exceptionally brilliant Terby White Spot was seen thoughout the 1975-76 apparition where Ring B ajoins the shadow of the planet's globe on the ring system. This phenomenon is usually attributed to a contrast effect between the exceedingly dark shadow of the globe on the rings and the very bright Ring B. In 1975-76, the TWS was even more prominent than in 1974-75 and preceding years.

Bicolored Aspect of the Rings. Only two individualsduring the 1975-76 apparition made observations in search of the curious bicolored aspect of Saturn's rings. The first set of observations was made by Mr. Boisclair of Rensselaer, New York, using a 14" Celestron on ninety-six occasions. He utilized several filters, but primarily the (Wratten) W47 (blue) and W25 (red) ones, while also making observations in integrated light. Mr. Boisclair saw no difference in the brightness of the E and W ansae at any time during the apparition while using the alternate filter method.

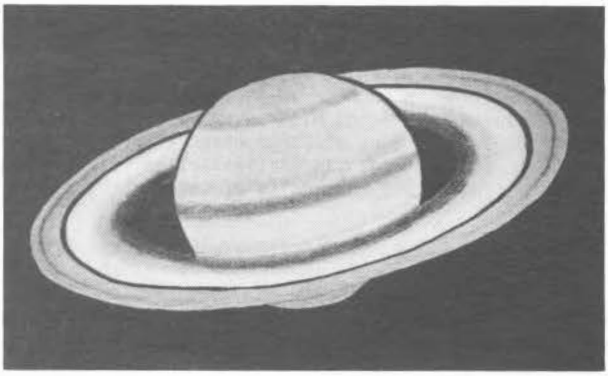

Figure 5. Drawing of Saturn by Alan W. Heath on January 22, 1976 at 21^h0^m, U.T. 12-inch reflector, 318X. Seeing fair. Simply inverted view with south at top. Mr. Heath is the Director of the Saturn Section of the British Astronomical Association. Note Encke's Division in Ring A, the duskiness of the inner part of Ring B, the prominent SEB_n, and the much weaker SEB_s just above it. Note the shadow of the ball on the rings, Saturn being only 2.4 days past opposition when this drawing was made.

Using a 12".5 reflector, Mr. Walter Haas, Director of the A.L.P.O., made observations using the same method as Mr. Boisclair. On 1976, June 12, the E and W ansae were equally bright in integrated light and with the W25 (red) filter; but in the W47 (blue) filter, the W ansa was very slightly the brighter. The same impression was noted on 1976, June 19 with no filter and with the W25 (red) filter; but with the W47 (blue) filter, the E ansa appeared slightly brighter. Finally, on 1976, June 27, Haas recorded equally bright ansae in integrated light; in the W25 filter, the W ansa was suspected of being slightly brighter than the E ansa. In the W 47 filter the E ansa was just barely brighter than the W ansa. It was pointed out by Haas that atmospheric dispersion may have caused the observed effects on June 27th.

No other instances of the bicolored aspect were reported during 1975-76.

The Satellites of Saturn

Observers continued to submit indications that several of Saturn's satellites were seen during the 1975-76 apparition. Few individuals made satellite visual magnitude estimates, however; and those that were received by the Saturn Section were inconsistent for analysis and comparison.

One very big problem with satellite observations is the need for adoption of a universal method of making such estimates that would be useful throughout the observing community. Visual photometry of the satellites of Saturn, assuming that the planet is passing a well-defined field of stars of calibrated brightness, may be carried out by the selection of two stars having about the same color and brightness as the satellite whose magnitude is to be estimated. One of these stars should be slightly brighter, and the other slightly fainter than the satellite in question; however, the difference should not be greater than about one magnitude. The difference in brightness between the two comparison stars is divided into tenths, and the brightness of the given satellite is placed within the scheme. For instance, suppose that a given satellite is only slightly fainter than star X, but quite a bit brighter than star Y. If the satellite is, say, about 0.3 fainter than X and hence 0.7 brighter than star Y, then the observation would be written as : $X(0.3)V_{OS}(0.7)Y$, where V_{OS} denotes the magnitude of the satellite, yet underived. If the magnitudes of stars X and Y are, respectively 9.2 and 10.5 (as determined from the chart or catalogue employed), then the observation is reduced in the following manner:

X has a visual magnitude of 9.2.
Y has a visual magnitude of 10.5.

Find the difference X-Y or 10.5-9.2, which is 1.3.

Find the product of 1.3 and the fraction by which the satellite is fainter than X; that is, (1.3)(0.3), which yields 0.39.

Add the value 0.39 to the magnitude of X to obtain the magnitude of the satellite; that is, the sum of 0.39 and 9.2, which gives 9.59 or 9.6 (rounding off).

As was mentioned, the planet Saturn only very rarely passes into a star field to enable one to make use of this method and existing star charts. Generally, the identification

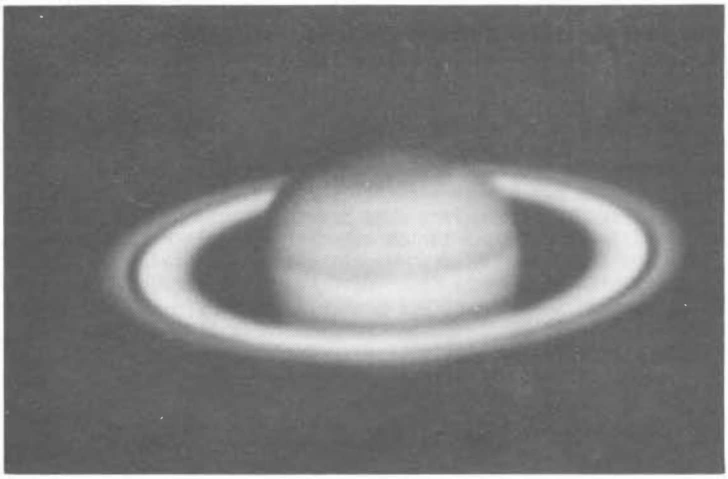

Figure 6. Photograph of Saturn by Jean Dragesco with 42-inch telescope at Pic du Midi Observatory on December 22, 1975 at 1^h0^m, U.T. Equivalent focal length 90 meters. Exposure 6 seconds. Pan F Ilford film. Average seeing. Simple inversion, south at top. The 42-inch is a Newtonian-Cassegrainian reflector.

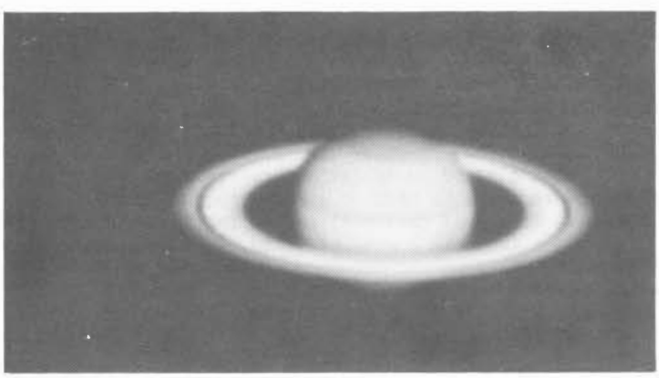

Figure 7. Photograph of Saturn on December 23, 1975 at 2^h45^m, U.T. by Jean Dragesco with 42-inch telescope at the Pic du Midi Observatory. Equivalent focal length 60 meters. Exposure 2 seconds. Pan F. Ilford film. Average seeing. Simple inversion, south at top.

of stars for comparison is difficult; and the selection of reliable visual magnitudes is even more troublesome. The Saturn Section is searching carefully for a set of visual stellar magnitudes of stars which can be utilized for our purposes; some success has been achieved, although difficulties arise with fainter stars. Observers who use the method briefly outlined above must realize that the proper identification of the stars used for comparison is essential, and notes as to the location and identity of the stars must become a part of the observing record. It is equally important to give the atlas and catalogue utilized as a source of such information since some sources are known to be unreliable (for example, the SAO Catalogue). Continuity is most important in such work, and teams of observers should employ similar techniques and references.

There is another possibility for estimating the magnitudes of Saturn's satellites, employing AAVSO charts as comparison references. As is well known, the AAVSO charts are accurate and are checked frequently by observers to insure that stable magnitude values are entered on the charts. When Saturn crosses a variable star field covered by a specific AAVSO chart, no opportunity to estimate satellite magnitudes should be passed up. The condition just noted is rare, to say the least; and observers should hence take advantage of such times. The Saturn Section will alert observers who are interested just when Saturn passes through a field of stars covered by an AAVSO chart. Such an announcement will be made well enough in advance, it is hoped, to allow individuals to obtain the necessary charts.

A rather crude method, but one which can be used more routinely, is the practice of estimating satellites of Saturn in reference to the visual magnitude of Titan, which remains reasonably stable with time. Many observers use such a technique, but it is open to question just how meaningful such estimates really are. In the absence of other methods, however, the one just described might be employed.

The Saturn Section urges those with photoelectric equipment to attempt the measurement of satellite magnitudes. It would be interesting to compare data, collected in mass over a long period of time by several methods, just to ascertain the internal accuracy of the techniques. Systematic and simultaneous observations are particularly valuable in such areas.

In the coming apparitions, the Recorder will attempt to organize several individuals into a team to stand ready when Saturn passes a suitable star field for employment of the first method described here. In particular, when Saturn crosses an AAVSO field, the team would be alerted and the proper charts obtained. As a last resort, even though the technique is questionable, the method ofcomparing satellite magnitudes to Titan's visual magnitude (and perhaps also to that of Rhea, down the scale somewhat, as a second reference point) should be used. It is considered meaningful to try to obtain at least some data, regardless of what method just described is used. One final point: observers must try to use "standard" techniques like the ones described in this section for continuity, putting aside attempts to guess at satellite magnitudes with no reference points.

Conclusions

Saturn received more attention during the 1975-76 apparition than in previous years, and such an increase in participation in the A.L.P.O. Saturn programs is most pleasing to see. Most of the data received were in the form of disc drawings, intensity estimates, and color estimates, with a general increase in the number of photographs submitted. While this wealth of observational material is most welcome, the Recorder must take this opportunity to encourage individuals to look into some of the areas that are commonly neglected. Specifically, a great deal more work is needed on the satellites (visual magnitude estimates), much more numerical information in the form of belt latitudes is sought, and attention should be given to long-term work on the bicolored aspect of Saturn's ring ansae. These suggestions are not meant to discourage work in the more general areas; but individuals who have grown tired of routine drawing, etc., should try other endeavors to rejuvenate, perhaps, their enthusiasm. Experienced observers are particularly urged to advance to the more specialized areas, while at the same time keeping up with the more common observational pursuits fairly regularly.

The Saturn Recorder shall be most pleased to assist observers in getting started in areas of their own interest, and he shall be gald to offer support for those who want to become more specialized. Work on Saturn is best outlined in the Saturn Handbook, and interested individuals should obtain a copy (at a cost of $6.50, including observing forms) from the Recorder.

Lastly, the writer extends once again his warmest thanks to all who took part in our observing programs during 1975-76, and a cordial welcome exists for those who wish to join us throughout 1976-77 and subsequent years.

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THE 1975 TRIPLE S.E.B. DISTURBANCE ON JUPITER

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

Notwithstanding recent speculations about the liquid nature of Jupiter's surface, the author is confident that Jupiter does have crustal elements of a solid nature that may float on this surface under a deep rich atmosphere of methane, ammonia, diatomic hydrogen, and helium.

The 1971 S.E.B. eruption, which was a double Disturbance, may have radically altered the crust of Jupiter in the vicinity of the S.E.B.$_s$ and S.E.B.Z., thereby making the 1975 eruption a premature event, if we recall the time lag intervening between the first double Disturbance of 1943. However, this entire lag thesis is complicated by the fact that a Disturbance may have taken place in late 1946 since Jupiter was not well observed at this time due to its conjunction with the Sun. The 1975 Disturbance may have differed fundamentally from past multiple occurrences by producing at least one eruption, out of the three, by a shock wave generated by the sucessive punctuations of upheavals at point source one resulting in a second point source one month later some 100° in longitude away from the first. In this case, the third eruption point may be considered to be the legitimate second Disturbance, even though this took place between the first and the second points of eruption in System II longitude. Color changes in the 1975 S.E.B. Disturbance were obvious in this regard. The Disturbance is punctuated by a series of upheavals or blow-outs from vents in the crustal surface of Jupiter. The critical parameter in suggesting that the second Disturbance was radically different from the third Disturbance was time. In 1943 it took a single month for the second Disturbance to occur, while in the 1971 event the second sequence of upheavals occurred some 28 days later. E. Reese informs me that all three Disturbances were well within predicted ranges of longitude in System II, based on his latest uniformly rotating surface theory.

These views are substantiated by the fact that spots in the S.E.B.Z. are often visible without any subsequent sign of activity. The spot fades out, and no further blow-out takes place. Several aborted Disturbances have been witnessed in the 1960's. Though this was the first triple Disturbance to odour on Jupiter during the last 110 years, it is not inconceivable that it may happen again. However, we might look for a double Disturbance in the year 1978; i.e., another premature eruption is expected.

The following observations constitute an adequate sample for purposes of analysis of the S.E.B.$_n$, S.E.B.Z., and S.E.B.$_s$ of Jupiter during the 1975-76 apparition. The planet was at opposition on October 13, 1975 at 15 hrs. U.T.

The contributing observers were as follows:

NAME	STATION	TELESCOPE(S)	OBSERVATIONS
Budine, Phillip W.	Walton, NY	3.5-inch refr.	1 disc drawing
		4-inch refr.	3 disc drawings
Hull, Richard L.	Richmond, VA	7-inch refr.	3 disc drawings
			1 strip sketch
		12-inch refl.	1 disc drawing
			25 photographs
Mackal, Paul K.	Mequon, WI	6-inch refl.	6 disc drawings
O'Meara, Stephen J.	Cambridge, MA	16-inch refl.	2 photographs
Osawa, Toshihiko	Nara, Japan	12.5-inch refl.	15 disc drawings
Rouse, James K.	Naples, FL	8-inch refl.	4 photographs
Sanford, John	Orange, CA	12-inch refl.	5 photographs
Seaman, Gary	Big Bear Lake, CA	14-inch refl.	3 photographs
Sherrod, Clay	N. Little Rock, AR	5-inch refr.	13 disc drawings
			1 strip sketch
		6-inch refl.	1 disc drawing
		8-inch refl.	1 disc drawing
		10-inch refl.	6 disc drawings
Tatum, Randy	Richmond, VA	6-inch refl.	2 disc drawings
Wessling, Richard J.	Milford, OH	12.5-inch refl.	10 disc drawings
			1 photograph

The total number of observations used in this report was 104.

On Jun. 9 Osawa observed the SEBZ clear and bright, the SEB$_n$ thin and gray, at 273°II. By Jun. 25 Sherrod recorded a similar impression at 270°II, as well as dusky STrZ. On Jun. 26 he also picked out a faint SEB$_s$ and a bright SEBZ at 73°II. On the same day he recorded a faded SEB$_n$, bright SEBZ, and dull STrZ at 103°II. Continuing on Jun. 27, Sherrod noted a tan SEB$_n$ with two small hooks or columns emerging into a clear crisp SEBZ at 206°II and 256° II, respectively, with a dusky STrZ at 226° II. In all likelihood these early SEBZ festoons were SEB$_n$ features. The preceding end of a thin SEB$_n$, recorded as brown on the same day, was at 256°II. On Jun. 29, Sherrod showed a narrow white SEBZ, a very tannish-brown SEB$_n$, a faint thin SEB$_s$, and a yellowish STrZ at 194°II. On Jun. 30 Osawa observed the SEBZ clear and bright again with the SEB$_n$ nodulated and active at 325°II. The SEB$_s$ was also absent. On Jul. 2 the initial eruption of the first SEB Disturbance took place, according to Elmer Reese, at 58°II. Quoting a bulletin: "It was then a small dark spot on the SEB$_s$ with a small oval in the SEBZ and thin festoon." The first distinct photographic record of this Disturbance was Jul. 5

on New Mexico State University plates, confirming its location within 5°II of source A. Two observations of July 7 by Sherrod, at 273°II and 324°II, detailed a thin solid SEB_n, bright narrow SEBZ, and dull STrZ just preceding the Red Spot. Quoting a letter by him on the same day: "The STrZ is divided not by a belt, but by a beautiful color and darkness contrast. The northern SEBZ is bright yellow, but the southern STrZ is dusky brownish..." Budine drew the SEB Disturbance on Jul. 8 at 57°II. See Figure 9. A white/bright oval rather small in size was seen exactly 10°II in front of a dark festoon which marked the location of the event. Hull confirmed this observation on Jul. 10. Also, Tatum on Jul. 10 noted a second dark festoon ahead of the small white oval. On Jul. 12 Sherrod recorded the same appearances that he had seen on Jul. 7, now at 355°II. The SEB_n was tan-brown, and the preceding end of the SEB_s was located near 350°II. The first black and white photo of the Disturbance was made by Hull on Jul. 20. On Jul 21 Tatum recorded interaction of the leading white oval with the following end of the R.S., and this was co-observed with Hull. On Jul. 22 Hull also reported a darkening of the SEB_s following the Disturbance. On Jul. 27 Tatum reported that the main festoon of the Disturbance was fading away. Bad seeing deprived Sherrod of detail at 207°II on Jul. 31. On Aug. 2 Spain's Dr. Gomez of the Barelona Astronomical Society recorded the outbreak of a second SEB Disturbance at 208°II, confirmed by Tatum at 209°II on the same day. Quoting Tatum: "A faded festoon was seen rising vertically from SEB_n to SEB_s... there was a small white oval beside it..." Quoting Hull: "Mr. Tatum said that on the second of Aug. he really believed that he could see the oval associated with the second Disturbance brighten noticeably as he watched it advance across the disc..." all the way to the following limb of Jupiter! The Recorder resolved Disturbance #2's festoon into three tiny dark spots on Aug. 11 at 200°II. See Figure 11. The SEB_s definitely issued from this new point of eruption, well within 10°II of source C. A black and white photo of Aug. 13 by Rouse showed a dark wide SEB_s following the R.S. and issuing from Disturbance #1, which was also reviving. This aspect was confirmed by Hull on Aug. 18 in a letter to the Recorder. He also added that he and Tatum had seen a new festoon near 160°II on Aug. 14. "The SEB_s now seems to be visible over most of the planet except a dim part between 300°II and 50°II". This belt was confirmed on Aug. 16 by Spain's Dr. Gomez and also by Reginaldo at 119°II. It was also seen by Tatum on Aug. 14 and by Hull on Aug. 17. By this time the I.A.U. had informed Phil Budine that on Aug. 12 Spain's M. Cortes observed a third Disturbance on Jupiter at 120°II within 10°II of source B. (I.A.U. Circular #2821.) The source of this information was J. Marelli.

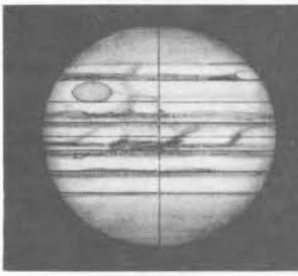
By Aug. 24 Osawa perceived the leading festoon of Disturbance #2 at 188°II, faintly preceded by the thin SEB_s. The SEB_n was active, yet remained thin, like the SEB_s following the circulating source. The Recorder was impressed by the lack of detail all during July and August in the longitudes covered both by the SEB_n branch and the SEB_s branch of Disturbance #1. It was a slow erupting event with a frequency periodicity of once every two weeks. At such times the festoons changed color from blue to red-brown. At the end of the cycle the festoons reverted back to their blue color. This cycle tends to confirm observations of color made by Ron Doel in 1974 of an aborted Disturbance in the same region. It appeared to be a weak Disturbance as in 1963-64; yet it revived every two weeks. A photo by Hull on Aug. 28 shows it weak. See Figure 13. I was hardly impressed by Disturbance #2's activity either in August. It seemed a pale event in comparison to the double Disturbance of 1971 (or of 1943). At this time I was convinced that the Disturbance was a result of a shock wave generated by the revival of Disturbance #1. I also felt that the festoon at 160°II had been produced by a shock wave rather than by an eruption of the SEB_n. Yet, it was still possible that Disturbance #2 was dependent on some independent eruption mechanism, though it appeared equally probable to me that the 1971 double Disturbance and also the 1943 event were not really double Disturbances, but rather a single eruption with a second shock-wave occurrence.

On Aug. 29 Sherrod recorded a dark active SEB_n, the preceding end of which preceding Disturbance #2 consisted of 2 bright/white ovals and 2 interspaced festoons following each, and an active SEB_s. Six SEBZ white ovals were seen during late August and early Sept. at 60°II, 88°II, 112°II, 165°II, 198°II, and 211°II on Sept. 14, according to Budine's bulletin. The scope of the activity of the circulating part of Disturbance #2 began at 143°II and ended at 198°II. See Figure 14. All of this detail is confirmed on a black and white photo by Rouse. These festoons of Disturbance #2 were also blue gray and slightly reddish on a color photo by Hull. Detail in the following end of Disturbance #1 and the preceding end of Disturbance #3 was recorded by Osawa on Sept. 2 at 98°II. See Figure 16. Just following the R.S. were 2 warm festoons; the first ended at 87°II, and the second began at 89°II, and 2 columns with a common center at 109°II. On Sept. 4 Osawa recorded two large bright ovals in the SEBZ affiliated with Disturbance #3, the center of the first one at 94°II and the preceding end of the second one at 133°II. The first one was flanked by festoons, and the second was flanked by columns. Hence, we were able to capture the original Disturbance and a revival of same, simultaneously. See Figure 17. Detail in the following end of Disturbance #3 and the preceding end of

(text continued on page 191)

SELECTED A.L.P.O. DRAWINGS AND PHOTOGRAPHS OF JUPITER IN THE 1975-76 APPARITION

Fig. 8



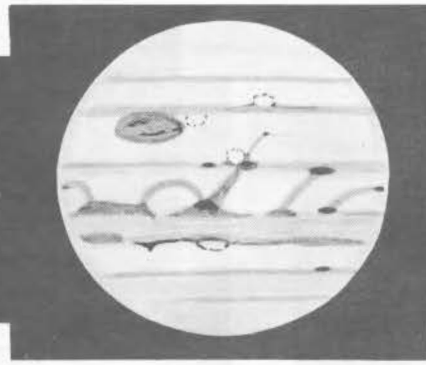


Fig. 9

Fig. 10

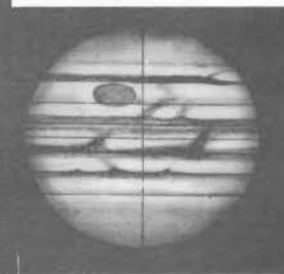


Fig. 11

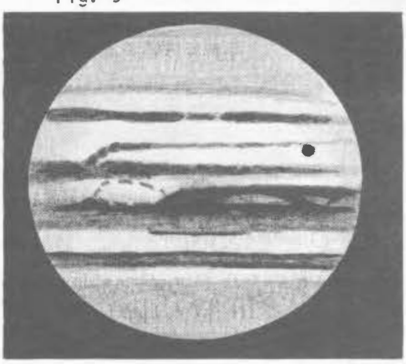


Fig. 12

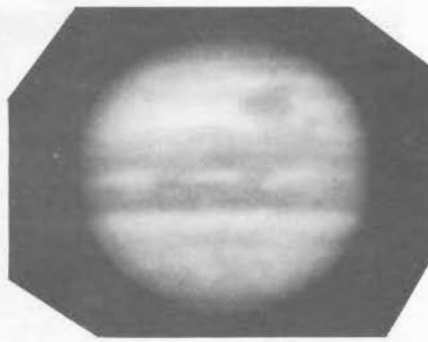


Fig. 13

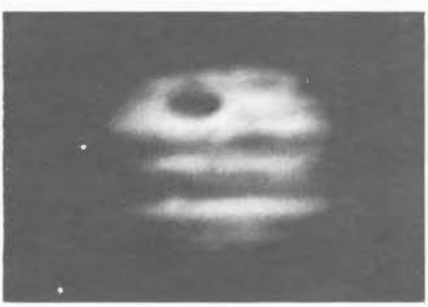


Fig. 14

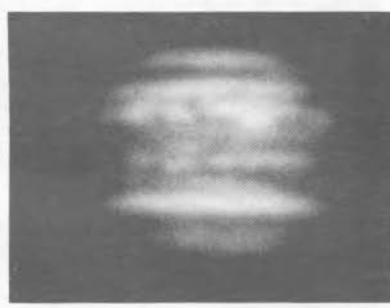


Fig. 15

Fig. 16

All drawings and photographs are simply inverted views with south at the top. All dates in 1975. Fig. 8. Drawing by Jean Dragesco on July 7. 10-in. refl. First SEB Disturbance. Fig 9. Drawing by Phillip W. Budine on July 8, 3.5-in. refr. 8^h19^m, U.T. Seeing good. CM= 244°(I), 57° (II). Fig. 10. Drawing by Dragesco on July 14. 10-in. refl. Fig.11. Drawing by Paul K. Mackal on Aug. 11. 6-in. refl. Second SEB Disturbance. Fig. 12. Photograph by G. Viscardy on Aug. 13 at 7^h4^m, U.T. 21-in. telescope, exposure 2 seconds. CM=123°(I), 21°(II). Fig. 13. Photograph by Richard L. Hull on Aug. 28. 12-in. refl. Fig. 14. Photograph by Hull on Aug. 30. 12-in. refl. Fig. 15. Photograph by Viscardy on Aug. 30, 1^h36^m, U.T. 21-in. telescope. CM=89°(I), 219°(II). Fig. 16. Drawing by Toshihiko Osawa on Sept. 2, 15^h37^m, U.T. 12.5-in. refl. Seeing fairly good. CM=355°(I), 98°(II).

SELECTED A.L.P.O. DRAWINGS AND PHOTOGRAPHS OF JUPITER IN THE 1975-76 APPARITION

Fig. 17

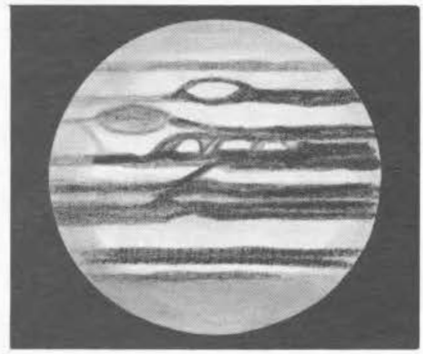


Fig. 18

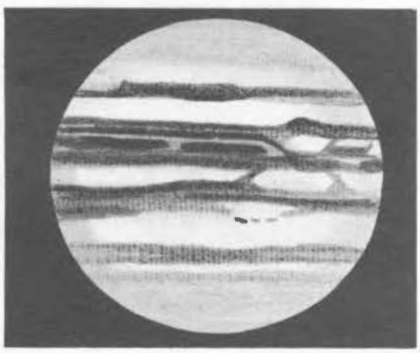


Fig. 19

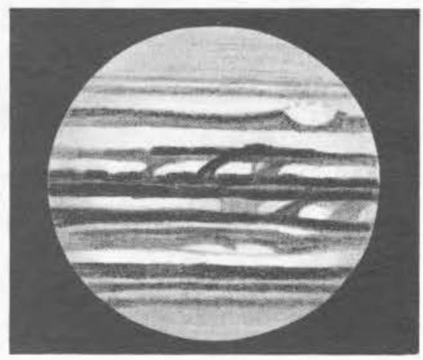


Fig. 20

ig. 21

Fig. 22

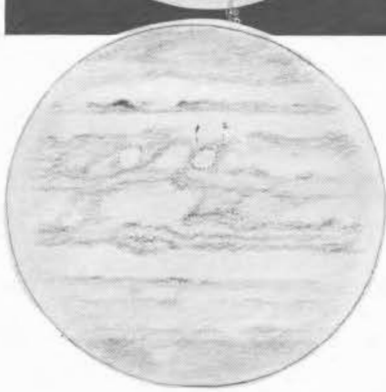


Fig. 23

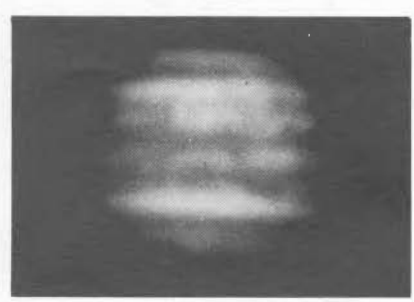


Fig. 24

All views simple inversions with south at the top, and all dates in 1975. Fig. 17. Drawing by Osawa on Sept. 4, $18^{h}5^{m}$, U.T. 12.5-in. refl. CM=42°(I), 129°(II). Fig. 18. Drawing by Mackal on Sept. 7, $4^{h}12^{m}$-$4^{h}32^{m}$, U.T. 6-in. refl. CM=8°-20°(I), 76°-88°(II). Fig. 19. Drawing by Mackal on Sept. 7, $4^{h}59^{m}$-$5^{h}11^{m}$, U.T. 6-in. refl. CM=37°-44°(I), 105°-112°(II). Fig 20. Drawing by Mackal on Sept. 7, $6^{h}57^{m}$-$7^{h}9^{m}$, U.T. 6-in. refl. CM=108°-116°(I), 176°-183°(II). Fig. 21. Drawing by Budine on Sept. 14 at $3^{h}59^{m}$, U.T. 4-in. refr. Seeing excellent. CM= 26°(I), 41°(II). Fig. 22. Drawing by Osawa on Sept. 16, $15^{h}30^{m}$, U.T. 12.5-in. refl. Seeing good. CM=42°(I), 40°(II). Fig. 23. Drawing by Osawa on Sept. 19, $17^{h}49^{m}$, U.T. 12.5-in. refl. CM=242°(I), 215°(II). Fig. 24. Photograph by Hull on Sept. 21. 12-in. refl.

SELECTED A.L.P.O. DRAWINGS AND PHOTOGRAPHS OF JUPITER IN THE 1975-76 APPARITION

Fig. 25

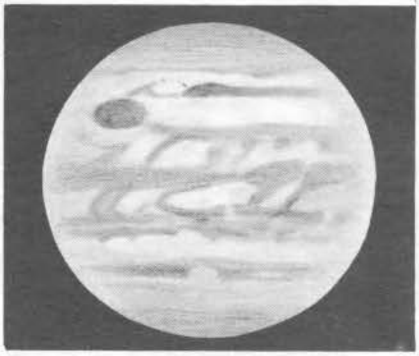


Fig. 26

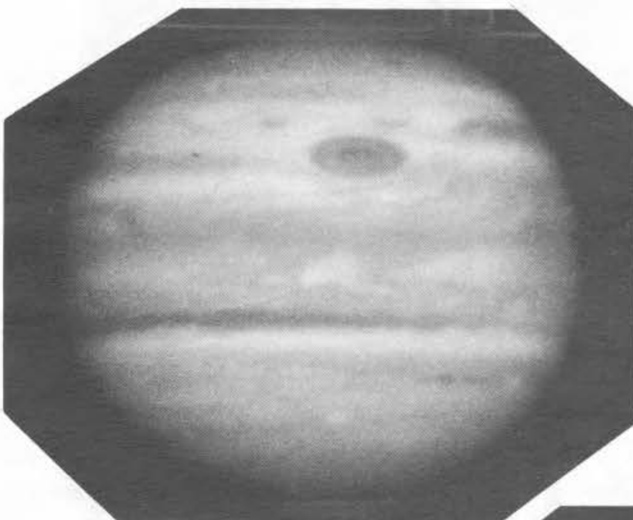
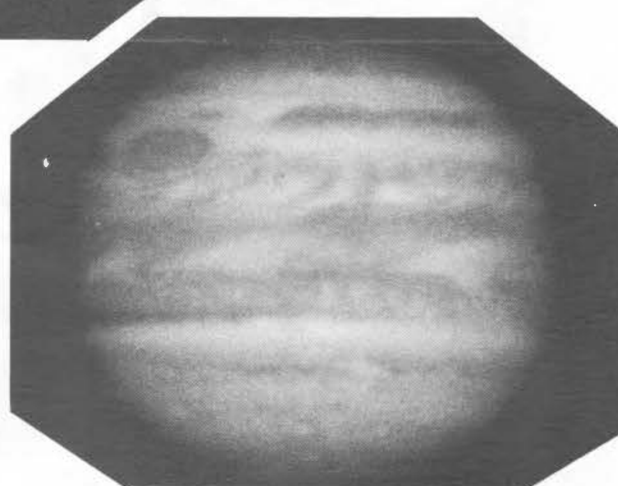


Fig. 27

Fig. 28



All views simple inversions with south at the top, and all dates in 1975. Fig. 25. Drawing by Richard J. Wessling on Sept. 29, 2^h11^m, U.T. 12.5-in. refl. CM=170°(I), 72°(II). Fig. 26. Photograph by James K. Rouse on Oct. 1, 3^h50^m, U.T. 8-in. refl. CM=187°(I), 73°(II). Fig. 27. Photograph by Stephen J. O'Meara in blue light on Oct. 1, 2^h28^m, U.T. 16-in. refl. CM= 137°(I), 23°(II). Fig. 28. Photograph by O'Meara in yellow light on Oct. 1, 3^h54^m, U.T. 16-in. refl. CM= 190°(I), 75°(II). This photograph only four minutes after the one in Figure 26.

SELECTED A.L.P.O. DRAWINGS AND PHOTOGRAPHS OF JUPITER IN THE 1975-76 APPARITION

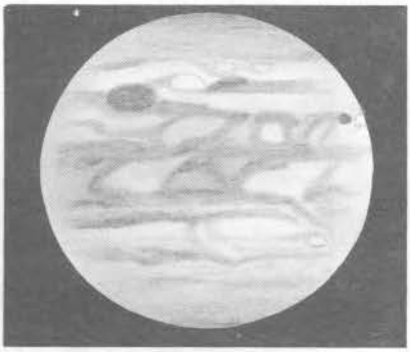


Fig. 29

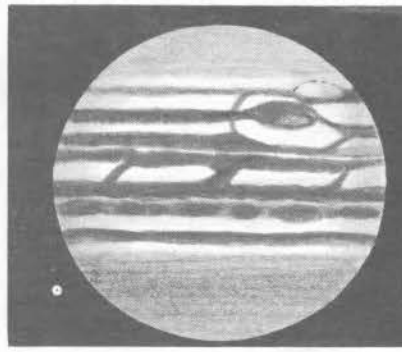


Fig. 30

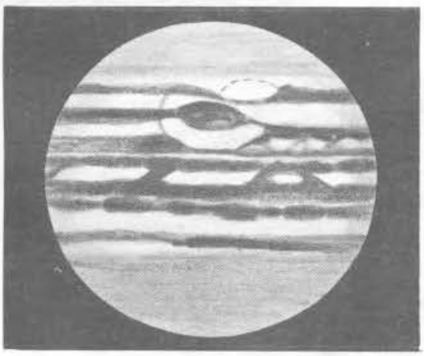


Fig. 31

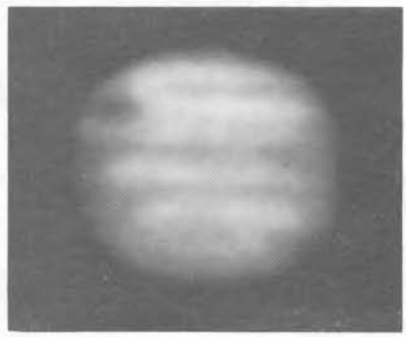


Fig. 32

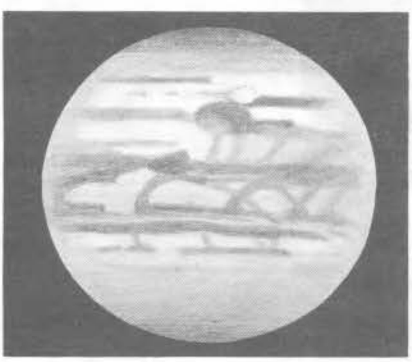


Fig. 33

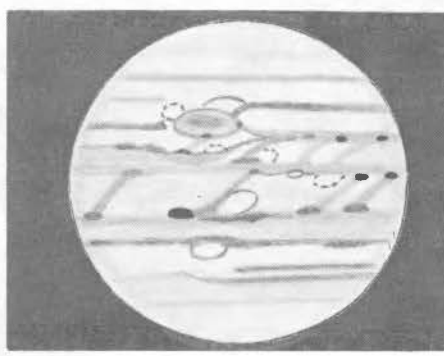


Fig. 34

Fig. 35

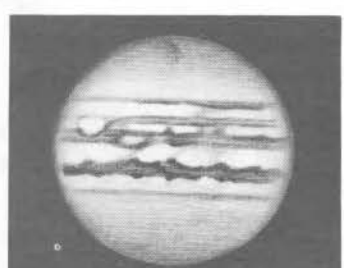


Fig. 36

All views simple inversions with south at the top, and all dates in 1975. Fig. 29. Drawing by Wessling on Oct. 4, 1^h13^m, U.T. 12.5-in. refl. CM=206°(I), 69°(II). Fig. 30. Drawing by Mackal on Oct. 5, 5^h30^m-5^h40^m, U.T. 6-in. refl. CM=160°-166°(I), 15°-21°(II). Fig. 31. Drawing by Mackal on Oct. 5, 6^h40^m-6^h50^m, U.T. 6-in. refl. CM=203°-209°(I), 57°-63°(II). Fig. 32. Photograph by Gary Seaman in blue light on Oct. 16. 14-in. refl., exposure 2.75 seconds. Fig. 33. Drawing by Wessling on Oct. 23, 1^h0^m, U.T. 12.5-in. refl. CM=320°(I), 39°(II). Fig. 34. Drawing by Budine on Oct. 28, 0^h24^m, U.T. 4-in. refr. Seeing excellent. CM=8°(I), 49°(II). Fig. 35. Photograph by John Sanford on Nov. 10, 12-in. refl., exposure 1 second. Fig. 36. Drawing by Matei Alexescu on Nov. 20, 20^h10^m-20^h25^m, U.T. 6-in. refl. CM=44°-53° (I), 263°-272°(II).

SELECTED A.L.P.O. DRAWINGS AND PHOTOGRAPHS OF JUPITER IN THE 1975-76 APPARITION

Fig. 37

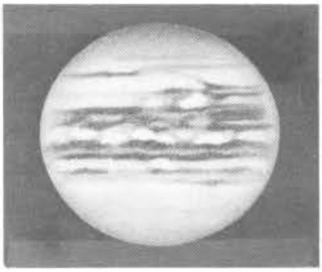


Fig. 38

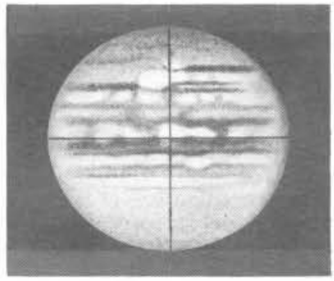
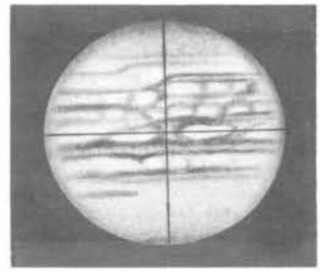


Fig. 39



All views simple inversions with south at the top, and all dates in 1976. Fig. 37. Drawing by Matei Alexescu on January 1 at 16^h13^m-16^h30^m, U.T. 6-in. refl. CM=48°-58°(I), 308°-318°(II). Fig. 38. Drawing by Alexescu on January 8 at 18^h28^m-18^h43^m, U.T. 6-in. refl. CM=155°-164°(I), 0°-9°(II). Fig. 39. Drawing by Alexescu on January 23 at 15^h50^m-16^h10^m, U.T. 6-in. refl. CM=264°-276°(I), 356°-8°(II).

* *

(text continued from page 186)

Disturbance #2 was also noted by Osawa on Sept. 4 at 144°II. A column was resolved at 114° II, a dark warm column at 144°II, preceded by a white spot and followed by two columns at 148°II and 152°II respectively, and a festoon roof following at 174°II. No significant details were seen at 255°II on Sept. 5 by Osawa; but the SEBZ was strong and active there, while the SEB_n was thin and undulating. On the same day at 303°II Osawa recorded a bright clear SEBZ, a faint following end of the SEB_n at 285°II, and a dark spot in the SEB_s at 303°II with a dusky STrZ.

The region of the collision of the SEB Disturbances, #1 and #3, just following the R.S., entailed several festoons recorded by Mackal on Sept. 7 at 76° to 88°II. See Figure 18. The two end festoons, just following the R.S. at 76°II and 88°II respectively, were red. The 2 columns following these were grayish brown. Mackal reported a bright whitish STrZ following the R.S. across the whole disc of Jupiter on Sept. 7 at 260°II. Detail seen by him on the same day from 105° to 112°II showed the following end of Disturbance #3 and the preceding end of Disturbance #2 in collision at 132°II and 142°II respectively. The SEB_s was double along the region of longitude defined by Disturbance #3. It was also double as it arched back to the SEB_n near the Red Spot Hollow following the R.S., while the other branch of the SEB_s was connected to the following end of the R.S. Hence, part of the SEB_s originated with the first Disturbance, while the other part appeared to be related exclusively to the R.S. It is not unlikely that portions of the SEB_s were also generated by Disturbance #3, and possibly also by Disturbance #2. The SEB_n was split into barge-like lines in this entire region. Details of Disturbance #2, consisting of re-eruption markings, were located at 176°II and 183°II on Sept. 7, according to Mackal. One brown festoon was at 161°II, a darker brown one lay at 176°II, and a third one was at 191°II. See Figure 20. Confirmation was obtained from Budine on Sept. 10, 165° to 175°II. The following end of Disturbance #1 collided with the re-eruption region following the R.S. at this time; yet the area retained its characteristic appearance. See Figures 21 and 22. On Sept. 16 Rouse and Osawa found the R.S. Hollow perfectly normal at 42°II, except for a white oval in its following end. Osawa's drawing confirms Rouse's black and white photo. The SEB Disturbance is somewhat faded just behind the RSH, according to Osawa. The SEB_s was connected to the preceding end of the RS, according to Rouse. On Sept. 19 Osawa showed the end of the re-eruption area of Disturbance #2 at 212°II as involving a sequence of three medium white ovals in the SEBZ at 198°, 205°, and 212°II. A dark festoon from the SEB_n was bent upwards to the south in a south preceding direction to the SEB_s at 205°II. The STrZ was clear. The following end of the first Disturbance was at 45°II on Sept. 21, according to Hull, and filled up the RSH. There was some confusion between the following end of the Disturbance and the re-eruption of same at this longitude. A disc by Wessling at 72°II on Sept. 29 (Figure 25) confirmed photographs by Hull and O'Meara taken on Oct. 1. Further rapid change could be detected on a subsequent photo by Rouse at 69°II and also on Oct. 4 by Wessling. This region just following the R.S. was well observed and henceforth showed itself to be bluish in color on Oct. 5, according to Mackal. See Figures 30 and 31. Deformation of the RSH by the SEB_n occurred at this time, according to Hull. Detail was seen by Wessling on Oct. 7 on two drawings at 172°II and 217°II, consisting of slanty columns from the SEB_n and undulating festoon roofs over white ovals to white ovals, preceding and following collision area two between the following end of Disturbance #3 and the preceding end of Disturbance #2. It has been demonstrated by R.B. Minton that some of these festoons are infra-red sources at 5 microns. Another observation by Wessling made on Oct. 12 showed detail at 291°II which was associated with Disturbance #1's preceding end in collision with the following end of Disturbance #2. Photographs in blue light by Gary Seaman on Oct. 16 were able to show eruption areas of Disturbance #1 in their blue phase. See Figure 32. I add that on Oct. 28 at 20^h, U.T. at 40°II the festoons in the SEBZ just following the R.S. were recorded as reddish by Alan Heath of Nottingham, U. K. (intensity 2 in red and intensity 8 in blue on a B.A.A. Jupiter intensity scale).

By Oct. 19 Osawa observed the collision area between the following end of Disturbance #2 and the preceding end of Disturbance #1 in the SEBZ to be annihilated at 273°II. It may have been obliterated by a cloud, though this appears unlikely. The SEBZ was dusky over fully 60° of System II longitude. Detail was present at 233°II on Oct. 21, according to Osawa with fair seeing. The preceding end of the dark SEB_n was discernible at 230°II, and the SEB_s was still clearly double throughout the rest of the apparition. On Oct. 23 a disc by Wessling in the Red Spot longitude showed a large white oval being expelled from the preceding end of the RSH and two festoons following the R.S. In the SEBZ at 39°II Hull detected the overlay of the following end of Disturbance #3, remnants of Disturbance #2, and the preceding end of the re-erupted Disturbance #2 at 208°II on Oct. 26. Both Budine and Wessling delineated eruption point #1 and re-eruption dark matter of Disturbance #1 on Oct. 28 at 49°II and 101°II respectively. The feature was in its red-brown phase. Clearly, a Disturbance has infra-red sources at both its preceding and following ends. A photograph taken by Hull on Oct. 29 showed the SEB_n literally wrapped about the north edge of the R.S. Quoting Alan Heath on Nov. 3, 1975, at 20:15 UT: "There is also a vague white oval in the STrZ joining the STB and SEB_s, and it is a fraction brighter than the STrZ, generally." On Nov. 6 Heath also noted that the R.S. remained red, at B.A.A. intensity one, while by Nov. 15 C. Capen, our Mars Recorder, detected a yellow southward retreating portion in the 24-inch Clark refractor of the Lowell Observatory. The seeing was fairly good. In this time period the SEB_n peeled itself off the R.S. partially, and retreated northward, according to Wessling, Sanford, and Capen. By Nov. 16, however, Sherrod showed the RSH back to normal at 47° II. The SEB_n was then back in its normal place. The situation remained stable throughout December. On Dec. 12, however, the SEB_s was wrapped about the north edge of the R.S., as a bar-like feature, confirming the notions of the Recorder in his 1968 convention paper at Las Cruces, N.M., that the R.S. is to some extent fed its red matter by the belt in question. It is now believed by N.A.S.A. that the R.S. is composed of phosphene. This no doubt explained the persistence of the red color to the south of the SEB_s during the last part of the apparition.

In late 1975 about half of the R.S. turned yellow and remained fairly indistinguishable from the STrZ in smaller telescopes, but by early 1976 there was only a gray smudge left even to the south of the SEB_s on Jan. 29. In the 1880's the R.S. was very dark red because it had decelerated its rotation period and finally kept a slow rotation briefly before the advent of the classical STrZ Disturbance in 1901. The classical STrZ Disturbance had two general effects on the R.S. in ten conjunctions of the two features from 1901 to 1941--(1) The Disturbance speeded up the R.S., and (2) it siphoned red matter from the Spot. The SEB Disturbances during this same period thus had the temporary effect of making the R.S. fade, but only due to the assistance of the STrZ Disturbance, which took material away from the SEB_s as well as from the R.S. In the 1960's and early 70's the R.S. no longer faded altogether due to its slower rotation and the absence of the STrZ Disturbances. Indeed, the R.S. was prominent from 1960 to 1975, with a brief browning over on March 30, 1968, as noted by Mackal and Capen. Only when the SEB Disturbance was very strong in 1971 did the R.S. show signs of partial fading, which permitted it to revive as soon as the affair was over in 1972. By 1975 the R.S. did fade and remained faint in 1976 due to the abnormal strength of the triple Disturbance of 1975.

AN HISTORICAL FOOTNOTE IN OBSERVATIONAL ASTRONOMY: THE FOUR-TO-FIVE DAY ROTATION PERIOD OF THE ATMOSPHERE OF THE PLANET VENUS

By: Paul K. Mackal

In a recent book review in this journal, I mentioned the fact that the discovery of the four-day rotation period of the atmosphere of the planet Venus, which differs from the 247-day rotation period of the solid surface of the planet, can be credited to Elmer Reese and Tom Pope at New Mexico State University Observatory and to Dr. C. Boyer of Pic du Midi Observatory in France, in 1968. (Journal ALPO, Vol. 26, pg. 119, 1976.) It now appears evident to this author and to Rodger Gordon, an A.L.P.O. Assistant Jupiter Recorder, that this entire statement is in error!

On January 16, 1977 Rodger Gordon wrote me a very interesting letter to the effect that in 1962, particularly during the summer and early fall months, he had noted the

Figure 40. Photograph of Paul K. Mackal, A.L.P.O. Jupiter Recorder. Taken in 1977(?) by Dr. Roy P. Mackal on their farm near Mequon, Wisconsin.

intensities of the various Venusian features, had recorded their brightness and duskiness in color filters, had plotted them on graph paper, and had deduced a rotation period of 4-5 days! To quote (letter to the author): "Back in 1962 when I had my RV-6 Dynascope and 4-inch Unitron refractor, I did a whole summer of studying Venus with color filters. After plotting the visible markings as seen with these filters over a period of weeks and their changes (and extensive visual observation), I deduced a rotation period of 4-5 days for the planet and published my results in our Society's Observer (for which I've written a column called 'The Observer's Corner' since 1961). Of course, I was disappointed when Venus was found to rotate in 247 days, but I became elated when in 1968 Bradford Smith published his results of the 4-5 day rotation of the Venusian atmospheric 'body' around the planet." In mid-August of 1968 the author heard Mr. Smith give a paper on this subject at the Las Cruces Convention. These were the results obtained from the careful professional observations of Elmer Reese and Tom Pope. Knowledge of a co-discoverer in 1968, Dr. C. Boyer, was imparted to me by Prof. Jean Dragesco in 1975.

On January 17, 1977 I answered Mr. Gordon's letter, after having checked my own observations of Venus in color filters for 1962: "As to Venus, I have data showing maximum and minimum intensities of features in a wide variety of filters. The two most prominent nodes are 5 and 12 days, respectively.* Though I can hardly claim to being a co-discoverer of a 4-day rotation, I am confident that 4, 8, 12, 16, and 20 day minima (of intensity) are indicative of the correct rotation period! These observations were made in 1962 with an RV-6 Dynascope..." A few days later I decided to inform Walter Haas of this state of affairs since the dual set of observations appeared to be mutually reinforcing, thereby much strengthening the validity of our joint claim that the Venusian atmospheric rotation period was inferred to be 4-5 days back in 1962!

On February 7, 1977 Walter Haas wrote me another interesting letter, the second paragraph of which is quoted in full: "In a recent postcard you mention that you and Rodger Gordon (independently) discovered the 4-day period of rotation of the atmosphere of Venus in 1962. Perhaps this incident would be worth a short article in J.A.L.P.O. --say a few paragraphs. Maybe you and Rodger would like to be co-authors? The evidence would need to be presented with some diffidence since the history of visual determinations of the rotation of Venus is full of many contradictions and inconsistencies. However, I would suggest that the matter might be of some interest to our readers." The data are presented below, and represent only the author's visual determinations.

Venus-North Polar Cap--1962--Yellow light-K-2 Filter

Date	Intensity	
Aug. 10	0.75---	
" 11	0.45	
" 18	0.20	cycle 1
" 20	0.33	
" 23	0.90---	
" 28	0.40	cycle 2
" 30	0.90---	
Sept. 2	0.50	cycle 3
" 12	0.90---	

July 22 ---Sept. 29.

Clearly, this is an oscillating intensity curve, which may be a little too bright to be meaningful. Cycle 1 consisted of 13 (3x4) days, cycle 2 consisted of 7 days, and cycle 3 consisted of 13 (3x4) days. These features may have been cloud shadows over the N.P.C.

Venus-South Polar Cap--1962--Yellow light-K-2 Filter

Clearly, this one is a falling intensity curve, beginning July 23 and ending on

*In actual fact, the data presented below show that the most frequent dels are 8 and 5, respectively.

September 29. The data were obtained under "too bright conditions" and are not presented. In general, they are contradictory.

Venus-North Polar Cap--1962--Blue light-C-5 Filter

Date	Intensity	
Aug. 10	0.95---	
" 11	negative	cycle 1
" 18	0.75---	
" 20	0.50	cycle 2
" 23	negative	
" 28	0.95---	
" 30	0.45	cycle 3
Sept. 2	0.95---	

Aug. 3 ---Sept.29.

Clearly, this is also an oscillating intensity curve, which is a bit darker and hence more reliable for indicating variations in dusky shadings on the N.P.C. Note that the minima of the dusky patches in the N.P.C. are 8 and 10 days apart, respectively, from Aug. 10 to 18 and from Aug. 18 to 28. This is followed by cycle 3 consisting of 5 days. Note also that the observations are sufficiently close together to yield 3 cycles, two composed of two revolutions of the atmosphere of Venus, and the last consisting of a single revolution of same.

Venus-South Polar Cap--1962--Blue light-C-5 Filter

Date	Intensity	
Aug. 12	0.75---	
" 18	negative	cycle 1
" 20	0.48--	
" 23	negative	cycle 2
" 28	0.95---	
" 30	0.35	cycle 3
Sept. 2	0.90---	

Aug. 3---Sept. 29.

This is also an oscillating intensity curve, in which cycle 1 consisted of 8 days, cycle 2 of 8 days, and cycle 3 of 5 days. In cycles 2 and 3 there is no longer a 2-day difference when this table is compared with the previous table. Cycle 3 is from Aug. 28 to Sept. 2 (a 5 day period) in exact alignment with the time frame of the 5-day period of the N.P.C. Certainly this correspondence between the S.P.C. and the N.P.C. is an interesting one.

Venus-North Cusp Band--1962--Yellow light-K-2 Filter

Date	Intensity	
July 31	1.70---	
Aug. 2	1.50	cycle 1
" 4	1.80---	
" 10	1.50	cycle 2
" 11	1.80---	
" 18	1.65	cycle 3
" 20	1.80---	
" 23	1.50	cycle 4
" 28	2.00---	

July 24 --Sept. 29.

For a dark feature we can employ either brightest or darkest appearances. I have chosen the latter since contrast of darkenings of the band at certain Venusian longitudes (a function of rotation period) is enhanced in yellow light, but suppressed in blue light. (Furthermore, this choice allows all of the data to be compared.) Cycle 1 consisted of 4 days, cycle 2 of 8 (2x4) days, cycle 3 of 9 (2x4.5) days, and cycle 4 of 8 (2x4) days.

* *

Note by Editor. We hope that readers enjoy this "footnote", showing how amateur visual observers apparently might have discovered back in 1962 the 4- or 5-day rotation of the clouds at the visible surface of Venus. Mr. Mackal's method rests on the assumption that the cusp-caps and cusp-bands differ in brightness in different Venusian longitudes so that their estimated brightness varies with a period of one rotation. An associated question, not considered here, is the accuracy of the estimated intensities.

Venus-South Cusp Band--1962--Yellow light-K-2 Filter

Date	Intensity	
Aug. 2	1.60---	
" 3	1.80	cycle 1
" 10	1.75---	
" 11	1.40	cycle 2
" 18	1.50---	
" 20	0.95	cycle 3
" 23	2.00---	

July 31 ---Sept. 29.

This is also an oscillating intensity curve, in which cycle 1 consisted of 7.5 days, cycle 2 consisted of 8 (2x4) days, and cycle 3 consisted of 5 days. There is little temporal correspondence with the data, but none was expected.

Venus-North Cusp Band--1962--Blue light-C-5 Filter
Clearly, this is an oscillating intensity curve, beginning on August 2 and ending on September 29. The data were obtained under "too dark conditions" and are not presented. In general they neither support nor contradict a 4-day rotation.

Venus-South Cusp Band--1962--Blue light-C-5 Filter

Date	Intensity	
Aug. 18	1.0---	
" 20	1.8	cycle 1
" 22	1.0---	

Aug. 2 ---Sept. 29.

This one cycle consisted of 5 days, and utilized a reverse sequence, a brightness maximum rather than a brightness minimum. The rest of the data was "too dark" to provide information about oscillations in intensity minima.

In conclusion, these data were obtained with a 6-inch reflector in the early evening hours, when the contrast on Venus is neither too strong nor too weak, though sometimes the observations were made in full daylight. The seeing was fair for the most part; and though some may be constrained to disregard the results as "amateur", these are the very same careful methods used by professional astronomers some 100 years ago before the advent of photography. A considerable amount of "white noise" may have reduced the value of the data actually presented, while "black noise" invalidated that not presented.

References

(1) Patrick Moore. The Planet Venus. The Macmillan Co., New York, New York, 1956.
(2) Paul K. Mackal. "Venus during 1962". Unpublished manuscript submitted to former A.L.P.O. Venus Recorder William K. Hartmann in 1963.
(3) Jet Propulsion Laboratory staff. Mariner: Mission to Venus. McGraw-Hill Book Co., Inc., New York, New York, 1963.

THE A.L.P.O. LUNAR ORTHOPHOTOMAP COLLECTION

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

N.A.S.A. has given the A.L.P.O. a set of 76 "Lunar Orthophotomaps", covering 41 separate areas. These maps are distributed by N.A.S.A., and were prepared and published by the Defense Mapping Agency Topographic Center. Each map base consists of a mosaic of Apollo or Orbiter lunar photographs, enlarged to a common scale of 1:250:000 (about 1 in./4 mi.) and optically corrected for camera tilt and topography to produce a true, plan view of the Moon's surface. This base is called an "orthophoto"; when overprinted with map information (names of features, longitude and latitude, plane coördinates, and marginal data), it becomes an "orthophotomap"--finally, when contour lines and spot heights are overprinted as well, one has a "topographic orthophotomap". (The A.L.P.O. collection consists of "topographic orthophotomaps" for all 41 areas, and contourless, but less cluttered, "orthophotomaps" for 35 of the same areas.)
A sample of part of a topographic orthophotomap appears in Figure 41, map 39A1 "Krieger" (the 24-kilometer crater Krieger itself appears in the portion shown). These maps are at 1:250,000 scale and each covers a quadrangle 5° of longitude wide and 4° of

latitude high. Note that the map margin provides longitude and latitude (at 5-minute intervals), as well as 10,000-meter plane coördinates. Data overprinted on the map base itself consist of names of features, as well as 100-meter interval contour lines (and spot heights to 1 meter) on the topographic orthophotomap. All elevations are referred to an arbitrary datum whose radius vector is 1,730,000 meters from the lunar mass center.

Information on the expected accuracy of each map is printed in its margin. The nominal mean accuracy (for all 41 areas) is: 90 percent of the horizontal positions are correct to ± 307 meters (range 197-457 meters), and 90 percent of the elevations are correct to ∓ 46 meters (range 20-112 meters).

In the text below lunar <u>east</u> and <u>west</u> are used in the modern sense, where <u>east</u> is the hemisphere of Mare Crisium and <u>west</u> that of Mare Humorum.

Table 1 summarizes data for the orthophotomaps in the A.L.P.O. collection. The "Location Code" refers to the quadrant shown in terms of the LAC lunar map series; the first two digits are the LAC map number, the letter refers to the quadrant of the map (where A=NW, B=NE, C=SE, and D=SW), and the final digit gives the subquadrant (1=NW, 2=NE, 3=SE, 4=SW). Next is the name of the orthophotomap followed by the longitude and latitude of its southeast corner. Finally, "Notes" are as follows: <u>O</u>=Orthophotomap, <u>T</u>=Topographic Orthophotomap, <u>H</u>=high sun angle, <u>M</u>=medium sun angle, <u>L</u>=low sun angle, and <u>Pt.</u> means that only part of the map quadrangle is actually shown. It should be noted that it is difficult to detect low relief features (i.e., local relief under 100 meters) on those maps using high-sun angle photographs. Note also that 12 maps depict only part of their 5° X 4° quadrangle.

<u>Table 1. Lunar Orthophotomaps in the A.L.P.O. Collection</u>

Location Code	Name	SE Corner Long.	SE Corner Lat.	Notes
38B2	Nielson	50°W	28°N	O,T,L,Pt.
38B3	Freud	50°W	24°N	O,T,L,Pt.
39A1	Krieger	45°W	28°N	O,T,L,Pt.
39A2	Angström	40°W	28°N	O,T,L,Pt.
39A3	Prinz	40°W	24°N	O,T,L,Pt.
39A4	Väisälä	45°W	24°N	O,T,L,Pt.
39B1	Fedorov	35°W	28°N	O,T,L,Pt.
39B2	Delisle	30°W	28°N	O,T,L,Pt.
39B3	Diophantus	30°W	24°N	O,T,L
39B4	Artsimovich	35°W	24°N	O,T,L
40A3	Lambert	20°W	24°N	O,T,L
40B2	Landsteiner	10°W	28°N	O,T,M
41A3	Spurr	00°	24°N	O,T,L
41A4	Beer	05°W	24°N	O,T,M
41C1	Conon	05°E	20°N	O,T,M
41D2	Huxley	00°	20°N	O,T,M
42A4	Linné	15°E	24°N	O,T,M,Pt.
42B3	Very	30°E	24°N	O,T,M,Pt.
42C2	Clerke	30°E	20°N	O,T,M
42C3	Dawes	30°E	16°N	O,T,M&H
42D3	Menelaus	20°E	16°N	O,T,M&H
42D4	Sulpicius Gallus	15°E	16°N	O,T,M&H
43D4	Vitruvius	35°E	16°N	O,T,M&H
60A1	Daubrée	15°E	12°N	O,T,H,Pt.
60A2	Auwers	20°E	12°N	O,T,H
60B1	Plinius	25°E	12°N	O,T,H
60B2	Jansen	30°E	12°N	O,T,H
61A1	Cajal	35°E	12°N	O,T,H
61A2	Lucian	40°E	12°N	O,T,H
61A3	Cauchy	40°E	08°N	O,T,H
61C3	Anville	50°E	00°	O,T,H
61C4	Secchi	45°E	00°	O,T,H
62A1	Yerkes	55°E	12°N	O,T,H
62A4	Tebbutt	55°E	08°N	O,T,H

(table continued on page 200)

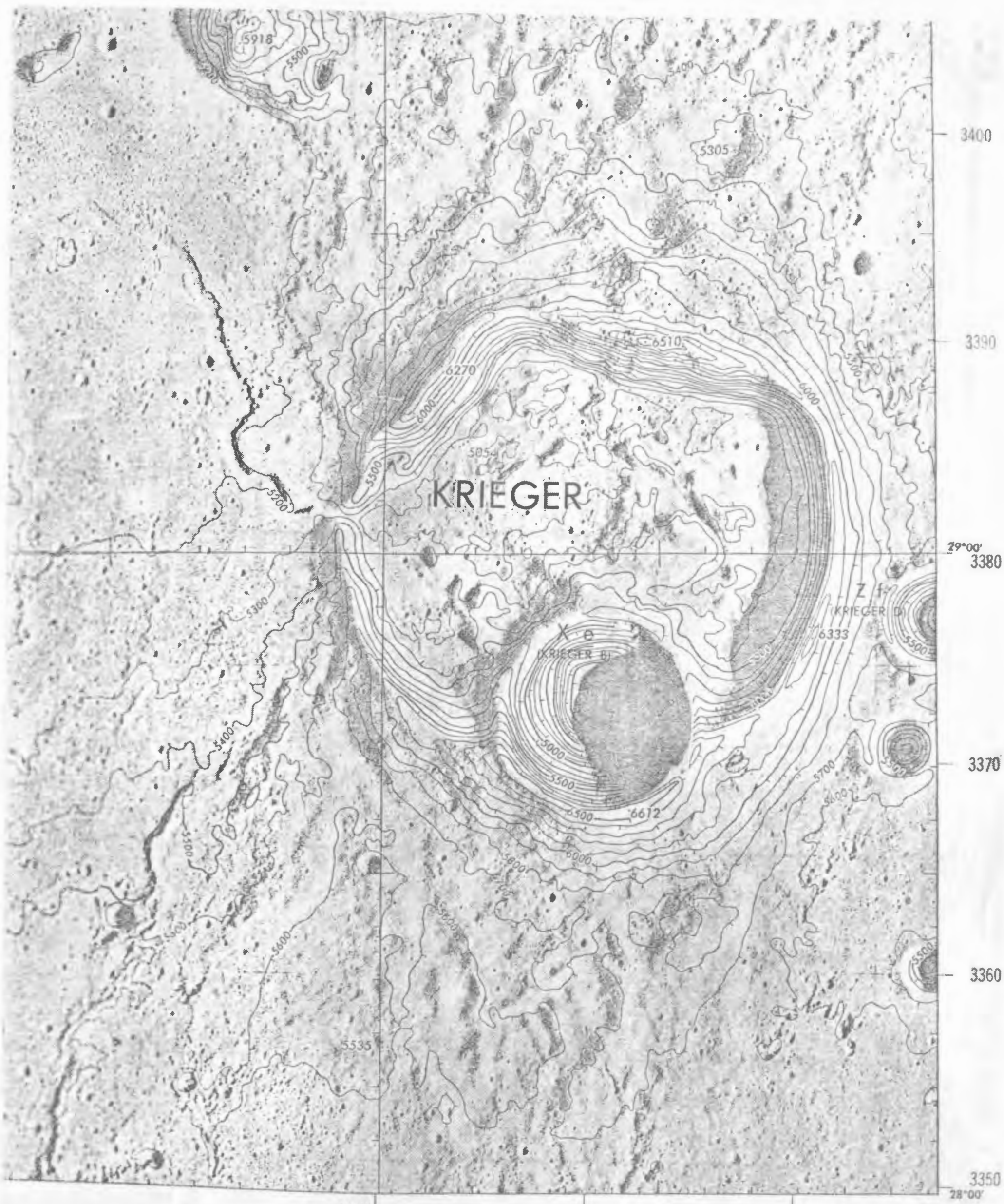


Figure 41. A portion of the Lunar Topographic Orthophotomap 39A1, "Krieger", in the A.L.P.O. collection. The 24-km. diameter crater Krieger itself is shown, and relief is depicted with 100-meter interval contour lines. Note longitude and latitude, and 10,000-meter plane coördinates, in the map margin. See also text of Dr. John Westfall's article in this issue.

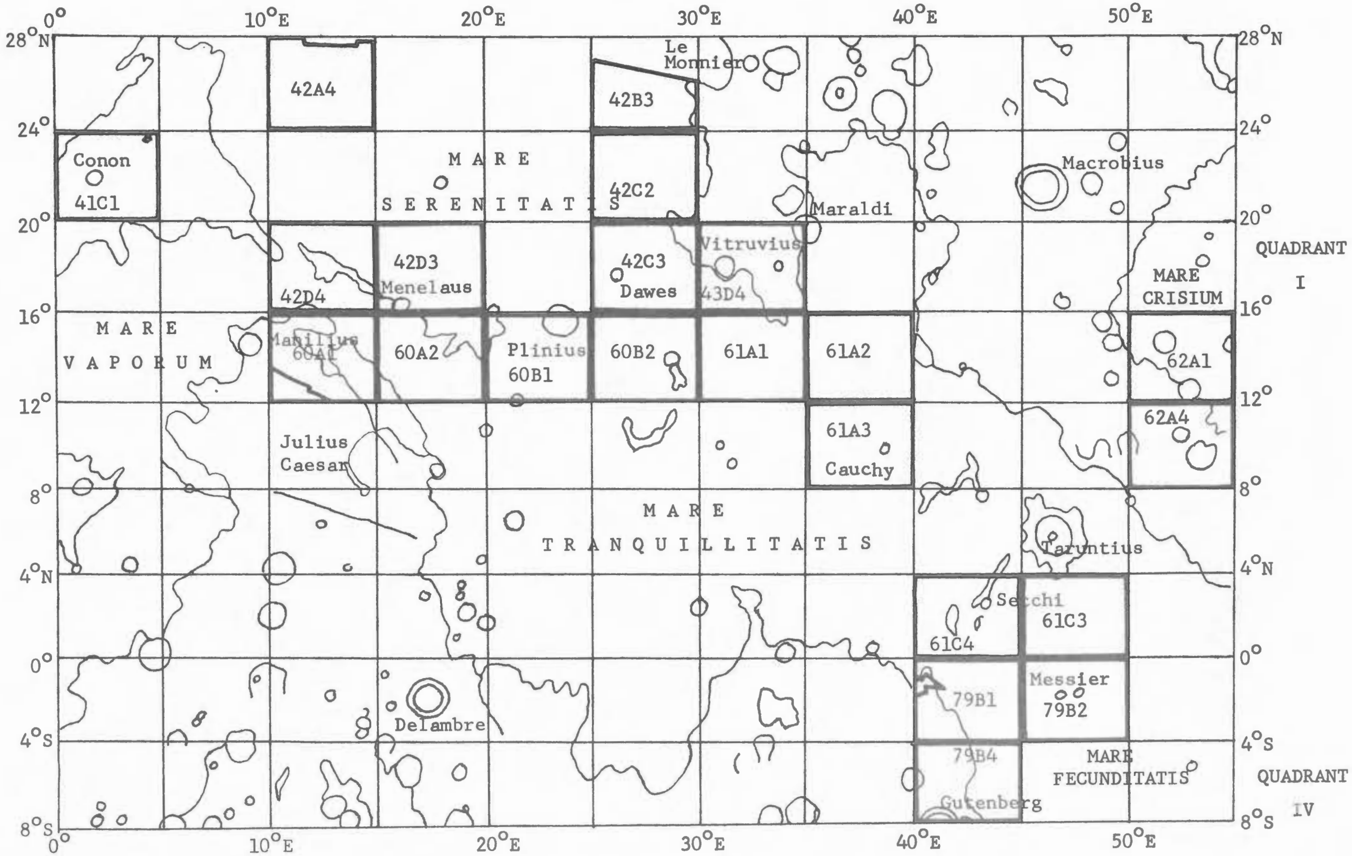


Figure 42. Index map for Lunar Orthophotomaps in A.L.P.O. collection, in lunar quadrants I and IV. Map location codes are shown, with heavy lines representing map outlines. See also text.

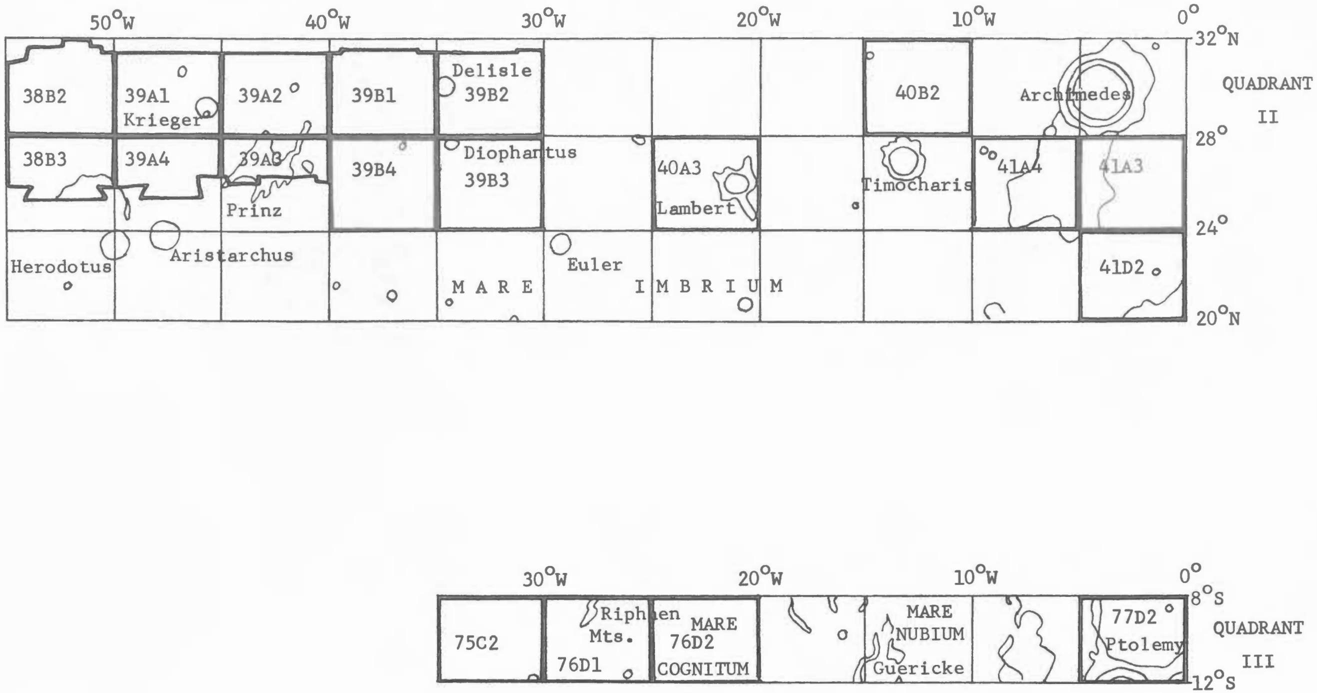


Figure 43. Index map for Lunar Orthophotomaps in the A.L.P.O. collection, in lunar quadrant II and lunar quadrant III. See also text.

Table 1. Lunar Orthophotomaps in the A.L.P.O. Collection (continued)

Location Code	Name	SE Corner Long./Lat.		Notes
75C2	Norman	30°W	12°S	T,L
76D1	Eppinger	25°W	12°S	T,L
76D2	Kuiper	20°W	12°S	T,M
77D2	Ammonius	00°	12°S	T,M
79B1	Lubbock	45°E	04°S	T,H,Pt.
79B2	Messier	50°E	04°S	O,T,H
79B4	Gutenberg	45°E	08°S	T,H

Figures 42 and 43 are index maps showing the locations of the lunar orthophotomaps in the A.L.P.O. collection. A variety of lunar areas is covered, including several areas containing domes and dark-haloed craters (DHC's). Several areas of suspected unusual lunar events are also shown (e.g., Conon, Linné, and Messier).

The A.L.P.O. Lunar Orthophotomap Collection is housed in the Map Library of the Department of Geography, San Francisco State University, 1600 Holloway Avenue, San Francisco, CA 94132 (Room 289 in the HLL Building) and is available for on-site study from 8-12 and 1-5 on weekdays. A.L.P.O. members wishing xerox copies of parts of these maps (8 1/2 X 11 inches) should send the writer a request, at the above address, including 15¢ in stamps per copy desired, with specific information as to the area(s) of interest (a conventional xerox copy will cover a lunar area about 54 X 70 km., or 33 X 43 mi.).

BOOK REVIEWS

The Saturn Handbook, by Dr. Julius L. Benton, Jr. Available from the author at P.O. Box 60, Clinton, South Carolina 29325. 57 pages, 21.5 X 28 cm., paperbound. Price $6.50.

Reviewed by Alain Porter

The Saturn Handbook is a comprehensive expansion and updating of the Saturn Handbook published in 1971. The discussions of observational technique have been amply fleshed out in this edition with examples, tables, graphs, and a solid but comprehensive introduction to observing theory. As a result, the length of the work has been increased threefold.

It is the consideration of observational theory which begins the booklet. The reader encounters short quantitative discussions of telescope performance, seeing, transparency, planetary albedo, contrast, color, etc., all geared to help him achieve optimum observing efficiency. There follows a qualitative discussion of drawing technique, which gives some observing hints and points out possible problems, and a short overview of Saturn's appearance in the telescope. There is a section on visual photometry, and the colorimetry of Saturn's belts has also been explained. The tantalizing possibility of a seasonal variation in the belts is mentioned, and there is a discussion of color filters and their uses. As has already been stated, helpful charts and diagrams appear every few pages, especially in the sections on latitude measurements, the rings, and the satellites.

Whatever level they may be operating on, all amateur observers of Saturn (and of any other planet, for that matter, but especially Jupiter) will find much valuable information in this book. Beginners might or might not find some of the theory in the introduction imposing, but it is they who would most benefit from the description of Saturn's telescopic appearance and the review of drawing technique. Those who have been observing longer, and are seeking to pursue a more disciplined program of studies, will use the introduction to great advantage. The 3 1/2-page bibliography would serve the most sophisticated observer well.

Misprints and omissions are very few. On page 50, line 5, the word "illumintaed" should read "unilluminated". Also parentheses should really be used in equations 17-23 (e.g.: thus eq. 17 is $C=(B_2 - B_1)/B_2$); their absence can cause temporary confusion. The source by Chapman and Cruikshank (1962) is referred to frequently in the text. However, this source appears in the references as the unpublished "A.L.P.O. Observing Manual".

These, however, are minor points, and do not diminish the value of The Saturn Handbook as a useful companion at the telescope. It is hoped that this volume will interest more amateurs in the study of a fascinating if normally serene planet so that its secrets may be the sooner puzzled out.

* *

1977 Yearbook of Astronomy, edited by Patrick Moore. W.W. Norton and Company, 500 Fifth Avenue, New York, N.Y. 10036. 1976. 204 pages. Price $9.95.

Reviewed by James Bryan

The Yearbook is an interesting combination of observing information for the sky in 1977 and numerous stories and reports on historical and current aspects of astronomy. For individuals recently introduced to the science, the book will be informative and entertaining. Those with more background may not require it since other volumes in wide circulation present the same material. Regrettably, the high price justifies second thoughts as to the need for purchase.

The text is prepared in three parts: Events of 1977, Article Section, and Miscellaneous. The last is a small listing of standard telescopic objects, recognition of contributors, and newly printed books.

Part I, treating events, outlines planet positions for each month and gives remarks on special occurrences such as eclipses. Accompanying this information are short statements which cover many subjects. Some of these include "Mars in 1977", "J. J. Cassini", "The Closing Rings of Saturn", "The Craters of Mercury", "Recent Novae", and "The Moon--After Apollo". Seasonal descriptions of the constellations are avoided through the use of fifty-two simple charts. An annual table of Moon phases is provided.

In an effort to answer requests for treatment of the southern sky, Mr. Moore has included a repetition of the monthly sky descriptions, but with a southern slant. In the reviewer's opinion the treatment, although well intended, is inadequate. Unlike the northern sky, which is depicted in numerous charts, the southern sky is described in the most brief terms accompanied by four isolated star charts lacking the quality of their northern counterparts. Locations of the planets are restated with a concern for a different aspect with respect to the horizon than is seen from the north. Reference to the most prominent clusters, nebulae, and galaxies, a feature lacking from the descriptions of both hemispheres, might benefit new observers.

Part I concludes with sections about the year's eclipses, occultations, comets, meteors, and asteroids. Highlights of 1978 appear also.

Part II contains eight essays written by well informed individuals about historical and modern astronomy. All are enjoyable, easily read, and informative. These articles are concerned with John Flamsteed as a clergyman and first Astronomer Royal, the surface of Venus, Io and its unusual environment near Jupiter, detection of unseen stellar and planetary companions of other stars, water ice and other molecules in interstellar space, the contributions of infra-red observing techniques in the study of galactic dust and gas clouds, the accomplishments of Viking, and recent advances in astronomy. This section is the book's greatest strength providing non-technical descriptions of current activities in astronomy. Particularly enlightening was the discussion of Jupiter's immediate neighborhood. This careful presentation is helpful in understanding the importance of the upcoming Mariner missions to that planet. Also of significance were the essays on interstellar molecules and H II regions. Both emphasized the role of observations from modern detectors in improving existing theory, and in providing additional information from which new ideas can be developed. After reviewing some recent developments, one contributing author thoughtfully concluded that "the greatest lesson for us to learn in astronomy is that we know and understand less than we think."

The 1977 Yearbook of Astronomy represents worthwhile reading. Apart from its price, it is a desirable publication.

* *

Space Science and Astronomy, edited by Thornton Page and Lou Williams Page. Macmillan Publishing Company, Inc., 866 Third Avenue, New York, New York 10022. 1976. 467 Pages. Price $13.95.

Reviewed by Charles S. Morris

Space Science and Astronomy is the ninth volume of the Macmillan Sky and Telescope Library of Astronomy. Subtitled Escape from Earth, this book presents a history of space flight and discusses advancements in astronomy which resulted from space flight. Previous books in this series detailed subjects ranging from telescopes to the evolution of stars and the structure of the universe.

Space Science and Astronomy, like previous volumes, consists of articles from Sky and Telescope magazine. The articles in each chapter are presented in more or less a chronological sequence, which depicts the history of the subject being discussed. The editors attempt to improve the continuity of the book by adding their own comments between many of the articles.

In all, there are over 135 articles in this volume. Thus, it is not surprising that a wide range of subjects is covered. Some of these subjects include the exploration of Mercury, Venus, Mars, Jupiter, and the Moon. Manned space flight and related hazards are also discussed. In addition, some of the results of Skylab are presented, as well as other optical, X-ray, and gamma ray observations, This list is at best only an indication of the book's scope.

This volume has several excellent features which make it a good reference book. First, the use of magazine articles makes it possible for the reader to read individual articles independently of the rest of the chapter and book. Secondly, the book is well illustrated. In all, there are 160 photographs and drawings. Thirdly, there are five appendices which include a glossary and a chronology of the space age. Finally, this volume contains suggestions for further reading for those people who are interested in obtaining additional information on the subjects discussed.

Space Science and Astronomy gives an interesting perspective of the history of space flight and the advancements in astronomy which resulted from it. This book is recommended for anyone interested in this aspect of astronomy.

* *

The Universe, Its Beginning and End, by Dr. Lloyd Motz. Charles Scribner's Sons, New York, NY. 1975. 343 pages. Price $14.95.

Reviewed by Wynn K. Wacker

For over half a millenium, from the time of Copernicus, advances in astronomy and cosmology have profoundly influenced Man's view of the universe and of himself. The past several decades have seen explosive growth of our knowledge in these areas so that it is no surprise that a number of new books have appeared which attempt to make available to the lay public an overview of the universe as revealed in the light of recent developments. This volume is one such work.

The author tries to describe virtually all the major physical and biological phenomena within a framework of an evolving universe. This is a tall order; but Dr. Motz proceeds quite methodically, starting with a chapter on the physical forces which define and structure the universe, and continuing through the structure of the universe at present, the development of that structure from the "big bang", the nature and life cycle of stars, the origin of the Solar System and the Earth, the structure of atoms and molecules, and the origin and nature of life. Two concluding chapters explore possible ends to the world and to the universe, while an epilogue deals principally with Man's place in the cosmic scheme of things.

The book as a whole is well written and builds logically, although a certain unevenness of style is evident. The chapter on the Solar System, for example, appears overcrowded with facts and figures which might have been better summarized in tables, while the material on stars, which is undoubtedly the best popular account of the subject I've encountered, flows much more freely.

A number of errors and misprints are evident in the text, but in the physical sciences portion of the book these are of a minor nature. The incorrect proportions between the star Betelgeuse and the Earth's orbit in a diagram on p. 127 is perhaps the worst mistake in that category. In the area of the biological sciences, however, Dr. Motz rates a failing grade.

On p. 249 structural formulas of the purine and pyrimidine bases of nucleic acids are labeled "the five nucleotides of protein". This is a double error since they are not found in protein and are not nucleotides (which are phosphate esters of these bases combined with pentose sugars). Even in an area of a more astronomical nature we find a first magnitude blunder. On p. 163 Motz states that since the Sun's luminosity was 10% lower a billion years ago "life could not have existed", thus gaining the dubious distinction of making the same error as Lord Kelvin did in the last century (a glance in any modern biology text shows that the oldest fossils are dated at 3.2 billion vears old).

Not content with factual errors such as these, the author goes on to hack at the fundamental underpinnings of biological science. On p. 258 Motz presents a theory of viral origin for living cells. This is most improbable, given what is known about the structure of viruses and cells. On p. 247 Motz makes a statement which implies that living systems appear to operate contrary to our current understanding of natural law, and this blatant falsehood is reinforced in the virus section. The coup de grace, however, is reserved for the epilogue when Motz, in effect, rejects modern evolutionary theory. Motz feels that the random forces of natural selection cannot account for "many highly developed and extremely complex attributes and characteristics of advanced living organisms that neither have suvival value now for the organism nor had any such value at any stage of their development." Dr. Motz even has difficulty seeing how some characteristics which have survival value now could have evolved through nonfunctional intermediate states, and uses the venom injecting apparatus of the rattlesnake as an example. Perhaps he would have found this problem, at least, a bit less puzzling had he bothered to do the brief research to find out that the poison gland of the rattlesnake is homologous to (evolutionally derived from the same structure as) the parotid salivary gland of mammals. Anyone who has seen the tissue necrosis surrounding a rattlesnake bite will little doubt the digestive function the poison still serves. Motz solves his self-made dilemma with a new version of an idea long abandoned in biology, orthogenesis. Basically, this concept states that there is some kind of internal force which guides evolution along some particular direction, some "main track", regardless of side tracks which external conditions might foster. Man, of course, is on the main line.

It is somewhat surprising to find that this book was written by as prestigious a person as a professor of astronomy at Columbia University. It is as though a professor of biology were to write a popular book detailing the latest advances in molecular genetics and ecology and set it in a Ptolemaic Solar System. It can only be described as very unprofessional carelessness at best. What is more surprising, and disheartening, is that both of the reviews of this book which I've seen elsewhere, one in <u>Sky and Telescope</u>, praise it and make no mention whatever of these gross errors.

* *

<u>Jupiter</u>, edited by Tom Gehrels. The University of Arizona Press, Tucson, Arizona, 1976. 1254 pages. Price $38.50.

Reviewed by Ron Doel

Perhaps now we can safely say that one of the definitive studies of Jupiter has finally been published. Against formidable odds, Tom Gehrels has edited one of the most complete and timely compilations of Jovian research ever produced. This book is based largely on the data beamed back from Pioneer spacecrafts 10 and 11. Gehrels, wisely realizing the impracticality of authoring such a book alone and the shortcomings of presenting mere conference proceedings lacking indices and cross-references, has interwoven the research and thoughts of over a hundred qualified experts on Jupiter, whose papers were written especially for this work. It is, in a word, simply fascinating.

Gehrels has adhered to a plan throughout this volume which makes it readily accessible to readers either intimately acquainted or sketchy in their knowledge of the Giant Planet. It opens with "Introduction and Overview"---a helpfully up-to-date look through several sections at what our probes have deciphered from this colorful enigmatic ball lying nearly half a billion miles distant. These early chapters provide a welcome assortment of background information, not merely of Jupiter's evolution, which is thoroughly covered, but for the more specialized chapters which follow. Beginning each succeeding section (there are five in all, which besides the already mentioned "Introduction and Overview" include "Origin and Interior", "Atmosphere", "Magnetosphere and Radiation Belts", and "Satellites"), the reader finds what Gehrels terms review chapters, carefully written with the honest intention of elucidating, not obfuscating. He allows you to remember without embarrassment the equations and theories you learned in college (then promptly forgot) letting you experience that same smug satisfaction you felt waliking into the final exam before coaxing you into their new and exciting applications. This clarity of writing is a credit to the contributors---and Gehrels' editing ---and fortunately is a characteristic of the entire work.

And incredibly, this is only the beginning. The wealth of information in this volume is amazing--any observer familiar with the Giant Planet through the big glass or even through the excellent articles in <u>Journal A.L.P.O.</u> will soon be thumbing through such titles as "Motions and Morphology of Clouds in the Atmosphere of Jupiter," or perhaps "The Chemistry and Spectroscopy of the Jovian Cloud Cover"; those of a more theoretical persuasion will find interest in "Model Ionospheres of Jupiter" and "Io, Its Atmosphere and Optical Emissions." The Satellites Section contains, among other interests, a high resolution photo of Ganymede rarely seen in print. In short, this is---there is no other way to put it---an encycopedia of Jupiter studies. Every field of professional research is covered--- and if even this seemingly inexhaustible sourcebook is wanting in some detail, its lists of references for further consultation are indispensable.

The volume weighs a full five pounds. Yet it is not ungainly--this blue hardcovered edition is about the size of the average dictionary, with thin crisp pages and a typeface easy on the eyes even after long hours of reading. Its figures and diagrams are impressively numerous, all clearly and properly labelled. (Credit again belongs to Gehrels, who with his assistants pored over the writing of the assembled multitude before publication to correct unintentional errors and to increase its already good uniformity.) Pioneer photographs of Jupiter are sharp and properly contrasted. Its phenomenal index is a full twenty-seven pages long---and included on its extensive list of contributors are the familiar names of Elmer Reese and Dale Cruikshank.

While not a narrative account, and certainly too specialized for the layman wishing only a casual acquaintance with the planets, or with this one in particular, Gehrels' work stands out as far more than what is popularly implied by the label "textbook." I recommend the book without hesitation to anyone sparked with the curiosity to discover the mechanisms working behind the accustomed bright spot gracing our evening skies. "We may never do a better book," Gehrels wrote in his introduction. The reviewer could have chosen no better words!

* *

Observe and Understand the Sun, edited by Russell C. Maag, Jerry M. Sherlin, and Rollin P. Van Zandt. The Astronomical League, Washington, D.C.1976. Order from Astronomical League Book Service, c/o Mrs. Sheran Brettman, 13 Meadowlark, Carpentersville, Illinois 60610. 48 pages, paperbound. Price $2.00. Quantity discounts available.

Reviewed by Michael B. Smith

Observe and Understand the Sun is the third in a series of booklets published by the Astronomical League. This booklet is arranged in a very logical sequence, starting with the easiest methods of solar observing and progressing to more and more complex and specialized methods of gathering different types of data.

In the first chapter, one finds excellent definitions of terminology, which are a great help to the beginning observer. The methods of observing the Sun are excellent in content as well as format. All classes of spots and group types are well explained and are accompanied by very good illustrations. The next chapter on the use of the Stonyhurst charts is perhaps the most valuable part of the booklet. However, the explanation is rather complicated for the beginning visual observer. As a supplement to the chapter, the observer will find Sidgwick's Observational Astronomy for Amateurs and The Amateur Astronomer's Handbook very helpful. "The 'Direct View' Heliographic Coördinate Determination System" is most ingenious and is full of useful tips for the solar observers with more advanced knowledge of solar studies; but for beginners, it would be rather rigorous.

The chapter entitled "Combination Sun-Viewing and Richfield Telescope" is a beautiful combination of amateur telescope making and usual visual work. The text and illustrations are really excellent and are certainly well conceived. The rest of the booklet becomes increasingly difficult for any beginners or even for the moderately advanced solar student to understand. The instruments explained become more specialized and, of course, very rapidly more expensive. A most outstanding final chapter deals with the monitoring of solar flares at radio frequencies. Anyone who has an interest and talent in amateur radio work will probably find this chapter to be the most interesting in the booklet. Great detail is given for the construction of the antenna and receiver with an excellent parts and price list at the conclusion of the chapter.

The bibliography is an excellent source of further references with regard to more detailed books on solar studies.

All in all, I would highly recommend this latest publication of the Astronomical League. It is very difficult to prepare so much information in such a logical order in the space of 48 pages, but in my opinion this has been accomplished in grand style.

NEW BOOKS RECEIVED

By: J. Russell Smith and Paul K. Mackal

Comets, by Patrick Moore. Charles Scribner's Sons, 597 5th Avenue, New York, NY 10017. 1976. 149 pages. Price $7.95. Notes by Mr. Smith.

This is a revised version of the 1973 edition. The text has been updated and enlarged, and quite a number of new illustrations have been added. The author, known to many as a fluent writer in the field of astronomy, has given the reader a general survey of some of our most interesting objects from space. The text is elementary and explains almost everything one would want to know about comets. The appendix contains several tables, and a glossary of about thirty words is followed by a suitable index.

* *

Doctor Copernicus, by John Banville. W.W. Norton and Co., 500 Fifth Avenue, New York, NY, 1977. 244 pages. Price $8.95. Notes by Mr. Mackal.

This is a well written historical novel about the life of Copernicus, which is still shrouded in mystery. Probably, the novel should be compared by the reader to a more accurate historical sketch - W. Iwanowska's Nicolaus Copernicus and Modern Science, Journal of the Royal Astronomical Society of Canada, Vol. 67, pages 105-114, 1973. Though fictional, the book shows some scholarship and an occasional philosophical observation; yet, its graphic language is such that I would not recommend it to anyone under 17 years of age.

I believe the book deals with Copernicus as a vulnerable human being, not some kind of measuring machine for astronomical science. In the final analysis, however, all scientists are measuring instruments, whose exotic work can hardly be compared to the working of the Solar System itself.

AN OCCULTATION OF URANUS BY THE MOON ON FEBRUARY 10, 1977

Abstract. Julius L. Benton at Clinton, South Carolina timed the third and fourth contacts when Uranus emerged from occultation by the Moon. The attendant circumstances are described.

* *

This short article is based on information supplied by Dr. Julius L. Benton, Jr., Thornwell Museum, P.O. Box 60, Clinton, South Carolina 29325. Perhaps his report will interest others in the ALPO in making observations of this kind.

Dr. Benton employed a 7.5-cm. f/16 equatorial refractor with a power of 171X. The site of observation was latitude 34° 27' 45".6255 north, longitude 81° 53' 21".5265 west, and height above mean sea level 190 meters, being in a field adjacent to the Highland Point Observatory. The instrument was set accurately above a cement survey marker. The method employed for timing was electronic voice recording with WWV time signals over 5.0 MHz. The observed times of emersion in Universal Time at the dark limb of the Moon were:

Third Contact: 1977, Feb. 10, $9^h38^m18^s.5 \pm 0^s.2$

Fourth Contact: 1977, Feb. 10, $9^h38^m38^s.5 \pm 0^s.2$

The two (equal) plus-or-minus items are estimated probable errors. The observer notes: "Owing to the ill-defined disc of Uranus---the timing of the two events mentioned is to be considered of limited accuracy, with a confidence level of moderate." The seeing was 5-6 on the ALPO scale of 0 (worst) to 10 (perfect); there were intermittent periods about 1.5 seconds long of steady image quality. The transparency was 5 (magnitude of faintest star visible). No filter was used.

At the time of the occultation reappearance the Moon had an altitude of 38° above the horizon and an azimuth of 160° (from 0° at north to 90° at east, etc.). The Moon was nearing Last Quarter and was 59% illuminated. The position angle of the event was 229°, as measured at the center of the Moon from 0° at the north cusp.

Perhaps some enterprising reader would like to compute the apparent angular diameter of Uranus from the difference between the Third and Fourth Contacts, using data on the geometry of the phenomenon from the 1977 American Ephemeris and Nautical Almanac.

* *

THE ALPO SELECTED AREAS PROGRAM: PRELIMINARY REPORT ON PICO

By: Marvin W. Huddleston, ALPO Lunar Recorder

Abstract. Some tentative results on studies of the lunar mountain Pico are offered. The program is continuing, and suggestions are made for future studies.

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This report is the first in a series of projected preliminary reports covering the features presently under study by participants in the ALPO Lunar Selected Areas Program. These reports should in no way be considered conclusive since a large part of the derived or desired data have been omitted and/or are in need of confirmation.

With these circumstances in mind, we present here a preliminary outline chart of the lunar mountain Pico and its surrounding region (Figure 44), based on 35 observations by 8 contributing observers. We also provide a key or detailed explanation of the features on the chart and related data.

The participating observers are as follows:

1. Michael Fornarucci, 6-inch reflector, Garfield, New Jersey.

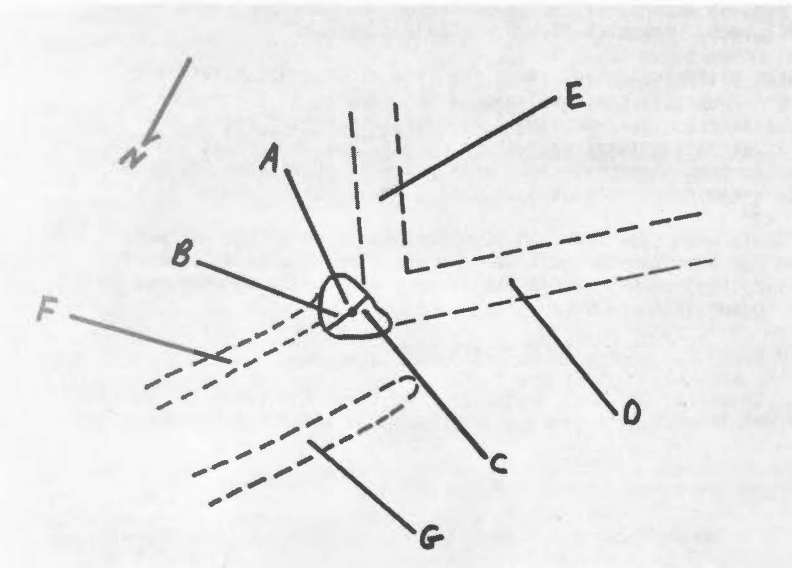
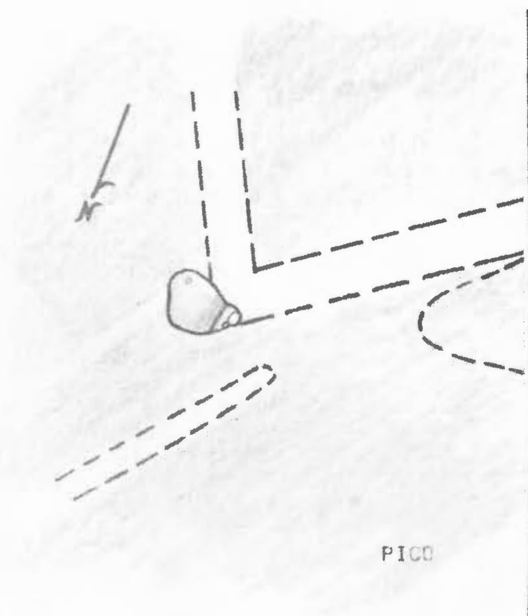


Figure 44. Preliminary outline chart of lunar mountain Pico and vicinity. Prepared and contributed by Marvin W. Huddleston. Orientation a simple inversion with lunar north indicated by arrow. See text for nomenclature and other details.



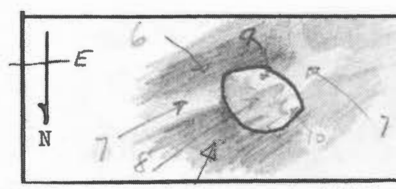


Figure 46. Drawing of lunar mountain Pico by Richard J. Wessling on December 15, 1970, 2^h25^m- 3^h42^m, U.T. 12.5-inch Newtonian reflector,356X. Seeing 2 and transparency 3 on scales noted for Figure 45. Colongitude = 112°.1-112°.5. Note lunar directions, but on Figure 46 east is the same as in the Earth's sky. The intensities marked on this drawing are on the usual lunar scale of 0 (shadows) to 10 (most brilliant features). Pico was brightest at its northeast corner, this point being brighter than even the neighboring rays (intensity 10 against intensity 7). Contrariwise, the rays of the neighboring mountain Piton were noted by Mr. Wessling to be brighter than Piton.

Figure 45. Drawing of lunar mountain Pico by Marvin W. Huddleston on February 6, 1977, 4^h30^m - $5^h 15^m$, U.T. 6-inch reflector. Seeing 5 1/2 on a scale of 0 to 10 with 10 best. Transparency 4 as limiting stellar magnitude. Colongitude = 119°.5-119°.9. Simply inverted view with direction of lunar north shown by arrow.

* *

2. Paul Gruntmeyer, 6-inch reflector, Brockton, Massachusetts.
3. Eddie Harris, Jr., 4-inch reflector, Lake Charles, Louisiana.
4. Marvin W. Huddleston, 6-inch reflector, Mesquite, Texas.
5. Frank des Lauriers, 4-inch reflector, Plaistow, New Hampshire.

Figure 47. Photograph of Pico by Orbiter IV, H122, frame 2 of 3. Original scale 1:620,000. Taken on May 19, 1967, $18^h\ 24^m\ 11^s.31$, U.T. Solar altitude 18.4 degrees at nadir of camera. Lunar north at left, lunar east in I.A.U. sense at top. Colongitude ≐ $37^{\circ}.1$, morning lighting.

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6. Dr. Thomas C. Peterson, 14-inch Cassegrain reflector, Gadsen, Alabama.
7. Alain C. Porter, 6-inch reflector, Narragansett, Rhode Island.
8. Richard J. Wessling, 12.5-inch Cassegrain reflector, Milford, Ohio.

The Recorder extends his appreciation to those who have contributed to the past

Figure 48. Photograph of Pico, Plato, and adjacent parts of the Moon by Dr. Jean Dragesco on September 30, 1971 at 19^h15^m, U.T. 10-inch reflector. Scale of original print 1:3,400,000. Colongitude = 45°.0. Compare the aspect of Pico to Figure 47, taken by Orbiter IV under lower morning lighting. Lunar north at bottom, lunar east in IAU sense at left.

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efforts of the program and hopes that they will join in the continuing present research. New observers are most heartily invited to join us.

Key to Chart (Figure 44):

Mark A is the well-confirmed summit craterlet. Its average intensity, based on 7 observations, is 2.64, on the Standard Lunar Scale of 0 (shadows) to 10 (most brilliant features). The intensity probably varies.

Mark B is a "Structural Wall Band". Features so designated are in need of much observation and under all lighting conditions. It is suspected that they are due to wall crests. Observers should note whether such markings cast observable shadows, and observation with 10 inches or more of aperture is recommended. Several other features of this type are suspected. The average intensity of Mark B, based on 4 estimates, is 1.75. Variation is possible. This feature is considered confirmed.

Mark C is another "Structural Wall Band". Its average intensity from 4 estimates is 4.17. Mark C is considered as tentatively confirmed.

Mark D is a ray running southwest from Pico. Its average intensity, based on 14 estimates, is 5.75. It is well confirmed and may be visible throughout the whole lunation. The intensity probably varies by 2.5 units or more.

Mark E is a south-southeast bright ray. Its average intensity is 5.72, based on 15 estimates. Same variation as D.

Mark F is a northeast ray. The average intensity is 5.72, based on 10 estimates. Same variation as D and E.

Mark G is a bright ray north of Pico. Its average intensity from 11 estimates is 5.65. Same variation as D, E, and F. Mark G is a confirmed feature.

Necessary Information. The Recorder will gladly provide standard observation forms for participants in the Selected Areas Program. It is of the greatest importance that observers use these forms and that all information be correct. Lettered nomenclature should always be added in order that mistakes be prevented. The nomenclature of Figure 44 should always be used in observations of the markings there shown, with all additional markings assigned additional letters beginning with H and running counterclockwise. Descriptive notes are of great value.

Height Measurements. Accurate measurements of the heights of lunar features such as Pico are of great value. The Selected Areas Program is now adding these measurements into its area of research. Observers should use an accurate lunar atlas such as the Orthographic Lunar Atlas and should estimate the lengtn of a shadow in relation to a known point. A sample fictitious observation could be that Pico's shadow extends 1/4 of the way to a craterlet at coördinates +555-777. Such estimates should also be made during observations of the mountain Piton. All reductions of lunar heights are handled by the Recorder using methods developed by Mr. Harry Jamieson and a programmable Texas Istruments SR-56 handheld pocket calculator.

Frequency of Observations. Observations secured in a series of consecutive dates are of great value. The Recorder wishes to encourage observers to make as many observations as possible during a single lunation.

Reference

Marvin W. Huddleston. "The ALPO Lunar Selected Areas Program", Journal ALPO, Vol. 26, Nos. 5-6, pp. 113-117, November, 1976.

A CURIOUS LUNAR VALLEY

The material in this note was communicated by Mr. Alika K. Herring, 825 Mancos Place, Anaheim, CA 92806. Mr. Herring was at one time a Lunar Recorder of the ALPO. For a number of later years he carried on professional lunar research at the Lunar and Planetary Laboratory of the University of Arizona. He is also highly regarded as a maker of telescope mirrors of great optical excellence. We shall quote portions of letters he wrote on October 8, 1976 and March 23, 1977.

"Several years ago, while examining some lunar photographs I had just taken of the nearly First Quarter Moon, I noticed a wide shallow valley or trough extending for some distance across the lunar surface. It is pretty ill-defined, but I think it can pretty definitely be traced from Julius Caesar to Aliacensis. [See Figures 49 and 50.]

"Oddly enough, the bright Bessel ray seems to line up with this feature and seems to extend as far as Hercules. Probably this bright streak has no connection with the valley; but it is curious that if you lay them out on a lunar globe, they all form part of a great circle.

Figure 49. Photograph of the Moon by Alika K. Herring on April 7, 1976 at 4^h20^m, U.T. 12.5-inch reflector, 48X eyepiece projection. Tri-X film. Exposure 1/50 second. Simply inverted view with south at top. Colongitude = 0°.6. Attention is directed to a wide shallow lunar valley extending from Julius Caesar to Aliacensis. The bounds of the valley and of the Bessel bright ray across Mare Serenitatis are enhanced with ink marks. See also text.

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"...As far as I know, this feature has never been previously observed or reported. Obviously the visibility of the valley is dependent on a critical angle of illumination. I would hesitate to say what significance it might have ....It would certainly be interesting to find out what kind of response [the valley] would arouse in other lunar observers, since some of them may even have difficulty in detecting it. As an experiment, I showed the discovery photograph to several people, some of whom could readily see the feature while others could not.

"The valley will be seen best with a very low power, for a general instead of a specific view is preferred. Also, the angle of illumination is critical for a best view; the rudimentary scarps along each side are generally low and tend to disappear with only a slight change in lighting. However, the valley itself can still be detected in some degree for several days afterwards, I think primarily because the floor of the feature appears to be somewhat smoother than the adjacent terrain on each side.

In my opinion the alignment with the Bessel ray is most likely coincidental. My reasoning on this question is as follows: I think the valley itself is very probably a 'fossil' feature which almost certainly predates the surface as we now see it. It was probably a very conspicuous feature at one time but has been almost obliterated by later events in the formation of the lunar surface. There is very good evidence that the lunar rays slowly darken and disappear under the bombardment of the solar wind and other solar radiations, which indicates that the bright rays we see were probably formed quite recently, geologically speaking. I therefore believe that there was a considerable span of time between the two features."

Mr. Herring further notes that the valley is present on an undated photograph hanging on the wall of Mr. Thomas Cave's private observatory in Long Beach, California. Some of our readers must have seen it there.

If the optimum conditions for the visibility of this lunar valley occur at colongitude 0°, then in the near future searches might be made near the following Universal Time dates and times in 1977: June 23, 23 hrs.; July 23, 10 hrs.; August 21, 21 hrs.; and September 20, 9 hrs.

ANNOUNCEMENTS

Educational Materials for Saturn and Venus Sections. Dr. Julius L. Benton, the Recorder of these two sections, can supply the materials listed below at the prices stated. His address is on the back inside cover of this issue.

1."The Saturn Kit", containing an introductory booklet on observing Saturn, 25 observing forms, and instructions. $4.50 postpaid. For the novice observer.

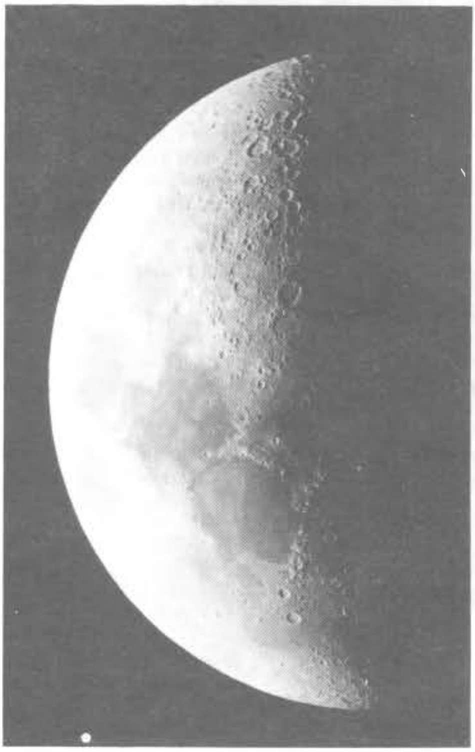

Figure 50. Photograph of the Moon by Alika K. Herring. Circumstances very similar to those for Figure 49. Here, however, the bounds of the valley and of the Bessel ray have not been enhanced.

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2. "The Venus Kit", containing an introductory booklet on Venus observing, 25 observing forms, and instructions. $4.50 postpaid. For the novice.

3. The Saturn Handbook, which is intended for advanced observers, not for the novice. It is an extension of the introductory booklet mentioned above. Price $6.50 postpaid. The Saturn Handbook is reviewed by Mr. Alain Porter on page 200 of this issue.

4. Observing forms for either Saturn or Venus in lots of 25, $3.00 postpaid.

5. A Simultaneous Observing Program Schedule for Saturn during its 1977-78 apparition. The goals of this project were discussed in Journal ALPO, Vol. 26, Nos. 7-8, pp. 164-166. Participation is keenly encouraged, especially on the part of experienced and/or well-equipped observers. The schedule is free with a self-addressed, stamped envelope.

6. A current Saturn central meridian ephemeris. The one for 1977 is also given in JALPO, Vol. 26, Nos. 7-8, pp. 154-157. Free with a self-addressed stamped envelope.

Checks for these items should be made payable to Julius Benton, the Saturn and Venus Recorder. It is a matter of regret to the whole ALPO staff that it is necessary to charge, and even to charge more, for services like the ones above. Unending inflation and ever-higher postal rates leave no alternative. Even within the United States, a Recorder can now reply to only six or seven inquiries for a dollar.

Blunder on Front Cover of Vol. 26, Nos. 7-8. The drawings of Jupiter by Dr. Dragesco in the cover illustration may be regarded as simply inverted views but with north at top. The caption falsely asserts that south is at the top. We are sorry for this error and any confusion it may well have caused. The belt just below (south of) the dark oval of the Great Red Spot is hence the South Temperate Belt, and the prominent belt near the top of each sketch is the South Equatorial Belt North. Our apologies to Dr. Dragesco and to any readers who were misled!

Change in WWV Time Signals. In a note dated February 7, 1977 Julius Benton calls attention to a change in the WWV broadcasts of time signals. The station will no longer transmit at 20 and 25 MHz but will continue to do so at 2.5, 5.0, 10.0, and 15.0 MHz. Observers using WWV time signals in their work, presumably including some active observers among our readers, might make note of this change.

Invitation to Youthful Correspondence. Monsieur Dominique Chipot, La Cotelle, 88510 Eloyes, France is the founder and promoter of an astronomy club, "Les Aquarides". Wishing to increase contacts between amateur astronomers in different countries, he invites interested boys and girls aged about 17 to 19 to send him a preliminary letter with their names, nationalities, addresses, phone numbers, and photographs, along with their work in astronomy and other hobbies. The members of "Les Aquarides" can write only in French or in English. Monsieur Chipot suggests both letters and phone calls for such contacts.

Invitation to 1978 WAA Convention. Mr. Charles Townsend, the President of the Western Amateur Astronomers, 3521 San Juan Ave., Oxnard, CA 93030 has graciously invited the ALPO to join their 1978 Convention. The place will be Cal Poly Tech at San Luis Obispo, California. A review of the campus and meeting facilities by the WAA Board in 1976 showed the site to be fully acceptable for a three day meeting with star parties, paper sessions, demonstrations, invited professional speakers, and executive meetings. Tours and other activities are under study.

Mr. Townsend would prefer that we should give him an answer to his suggestion of another WAA/ALPO meeting by August 1, 1977. Usually these decisions are made at the ALPO Business Meetings during the annual Convention, which would be on August 10-13, 1977. It would hence be helpful if interested readers would write us their wishes about where we should meet next year. At present we have no other invitations for 1978.

Defective Issues. We receive a few complaints about defective issues of this journal, usually with missing pages. It is our policy to replace such bad copies without charge. Complaints should be made promptly because some issues run out of stock quickly.

Addresses of New Staff Members. The current addresses of the Assistant Jupiter Recorders are given on the back inside cover.

Sustaining Members and Sponsors. The persons listed below support the work of the ALPO by paying higher dues, $30 per volume for Sponsors and $15 per volume for Sustaining Members. Their generous assistance has been, and is, of great value.

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National Amateur Astronomers Convention (1977 ALPO Convention). The fourth National Amateur Astronomers (NAA) Convention will be held on August 10-13, 1977 at the University of Colorado in Boulder, Colorado, The General Chairman is Mr. Derald D. Nye, 5604 Bowron Place, Longmont, CO 80501. The NAA functions as an independent, incorporated organization affiliated with the Denver Astronomical Society. This year's convention will bring together four organizations: the Astronomical League, the Association of Lunar and Planetary Observers, the International Occultation Timing Association, and the Western Amateur Astronomers - for a truly national convention.

Accommodations will be available at the Kittredge Residence Halls located across the street from the Sommers-Bausch Observatory and the Fiske Planetarium. Room and board for 5 nights lodging (August 9th through 13th) and meals for 4 full days, including the Flagstaff Mountain cookout and Saturday banquet, will cost $94.15 per person for single occupancy of a room, $70.87 per person for double occupancy, $60.35 per child under 13 for single occupancy, and $48.71 per child under 13 for double occupancy. One should not pay for lodging and meals at Kittredge until arriving at Boulder.

The registration fee is $18.00 for either single persons or families before August 1 and $20.00 after that date. Checks for registration should be made payable to the "National Amateur Astronomers" and should be mailed to Mrs. Denise Nye, 5604 Bowron Place, Longmont, CO 80501.

Convention activities include field trips to the National Center for Atmospheric Research (NCAR), the Time and Frequency Division at the National Bureau of Standards (NBS), and the Solar Flare Patrol at the National Oceanic and Atomospheric Administration (NOAA). Of special interest to observers will be a high-altitude cookout and star party on Flagstaff Mountain. A planetarium show at Fiske Planetarium and two nights of observing with the 24-inch reflector at Sommers-Bausch Observatory are also scheduled. Informal late night star parties for those bringing their own telescopes will be held at Huzanga Meadows, elevation 9395 feet, a favorite Denver Astronomical Society site about

20 miles west of Boulder. New Moon comes on August 14, leaving the sky dark. The pre-midnight sky will unfortunately lack bright planets, except for Mercury at an unfavor-albe greatest elongation east on August 8. Activities for non-astronomers are also planned.

The Astronomical League is sponsoring a telescope and astrophotography contest open to any amateur astronomer. Telescope contestants need merely bring a telescope in order to enter; the contest will be outdoors with an afternoon set aside for set-up, viewing, and judging. Those who preregister will receive instructions and application forms for the astrophotography contest. Those who cannot attend but want to enter the contest should write to Mr. Paul Thayer, Photo Contest Chairman, 550 Webster St., Apt. 13, Denver, CO 80226. The deadline for receiving photographs is August 1, 1977.

In past years the ALPO's chief contribution to the gatherings in which it has participated has probably been the papers which its leading members have contributed. Qualified members are again invited to contribute; the ALPO Papers Chairman is Walter H. Haas, Box 3AZ, University Park, New Mexico 88003. In truth, we yet <u>need</u> a goodly number of worthwhile papers to maintain our past reputation! The overall Papers Chairman is Andrew Gassmann, 222 East Yucca Hills Road, Castle Rock, CO 80104. Mr. Gassmann stresses his desire for papers on new subjects with new ideas. The Editor will gladly supply intending authors with a page of needed instructions and with a form which must be mailed to Mr. Gassmann before July 10, 1977. There is hence need for haste! The forms includes a brief abstract of the paper and a statement of the projection equipment required for its presentation. The Proceedings are to be printed <u>after</u> the NAA Convention so that authors can make last-minute changes.

The ALPO has also enhanced past meetings in which it has taken part with astronomical exhibits. Experience has shown that the best items for such displays are drawings and photographs by members, though occasional other items are not ruled out (e.g., old maps of Mars or rare astronomical books). We have been very fortunate in finding someone near Boulder to take charge of this year's ALPO Exhibit. He is Mr. Harold Anderson, 7784 S. Elizabeth Way, Littleton, CO 80122. Those who are attending the Convention should either mail their set of drawings and photographs to Mr. Anderson or else give it to him when they arrive; in the latter case, they should let him know in advance just what they are bringing so that space requirements can be properly planned. Therefore, Section Recorders, active observers, comet photographers, etc. - we need your assistance to show what work the ALPO is doing and ask your help in producing an instructive and attractive display. The overall NAA Display Chairman is Mr. Merrill Manion, 1775 West Kentucky Ave., Denver, CO 80223.

We look forward to seeing you at Boulder soon!

<u>Possible ALPO Solar Section.</u> This question is still under consideration, and we thank all those who have given us their thoughts and ideas.

IN MEMORIAM: GRACE A. FOX

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

Her many friends among our readers must share our sorrow at the news of the death of Miss Grace A. Fox of Fort Dodge, Iowa, on November 17, 1976.

In truth, this little old lady had without doubt attended more ALPO Conventions than anyone else, including the Director and other staff members. She must certainly also have been one of the most highly regarded and best respected of all the persons who have gone to these meetings in the last 15-20 years. We know little of the personal circumstances of her life. We suspect that she would not have wished to have them recited here in the traditional way. We do know that she took the keenest interest in astronomical education in its truest sense, teaching a number of evening classes in astronomy at the Fort Dodge Community College. She described numerous teaching experiences in talks at various ALPO Conventions and showed a lively sense of humor. Her students at first were small groups of adults, but later she discovered, and insisted, that classes of children were more responsive. She brought samples of their astronomical work to ALPO Exhibits; and we who saw them perceived both that the young people were learning some astronomy and that Miss Fox was giving them far more than just scientific data. She was also a member of a camera club and an art society at Fort Dodge, and her efforts sometimes won prizes in their contests.

For many years she amazed us by travelling across the country by bus and alone. From Iowa to California is a long and tiresome bus trip for most of us, but Grace Fox filled it with pleasure and the companionship of those she met on the way. The unavoidable

delays and mishaps of travelling she met with unfailing patience and serenity. Failing health did at length persuade her to fly to an astronomical meeting, where we last saw her at San Francisco in 1975. In spite of repeated surgery, she wrote several times in 1976 to ask where her astronomical friends would meet that year.

We shall miss you, Grace.

OBSERVATIONS AND COMMENTS

Concerning the Size of Secondary Mirrors. In a letter of March 31, 1977, Mr. Rodger W. Gordon, one of our Assistant Jupiter Recorders, offers the following suggestion: "Most of the drawing forms of the various A.L.P.O. Sections require the usual sort of data to be given such as seeing, transparency, telescope size, magnification, filter, etc. However, in light of my paper on 'Resolution and Contrast' I think it might be a good idea to insert on these forms a place to list the diameter of the central obstruction of the observer's [reflecting] telescope. We are all concerned with observer reliability (and rightly so) but what about instrumental reliability? We assume good optics, which may or may not exist and are sometimes difficult to evaluate. However, it should be obvious that if two observers use 6-inch telescopes and observe Venus (or any other planet with markings at the threshold of vision), and one reports markings while the other does not (I assume nearly simultaneous observation), we perhaps should know the diameter of the central obstruction for each of them. There may be an instrumental factor at work; perhaps one observer did not report the markings because of too large a central obstruction. I wonder whether past (and present) Venus and Saturn Recorders have ever taken this matter into account when assigning weights to observations. I think this item should be required if an observer uses a reflecting telescope (regardless of type). It might help to explain why controversial markings are seen or are not seen or why some observers report faint markings when others report nothing."

Mr. Gordon's paper "Resolution and Contrast" is a revision and expansion of a talk he gave at the 1976 Astronomical League National Convention. It is scheduled for near-future publication in this journal. The Editor invites interested readers to comment on this idea. (It might have the practical advantage of forcing observers at least to know how large their secondary mirror is.) The quality of the telescopic image of a planetary disc is a very complex function of such parameters as seeing, transparency, image brightness, visual acuity, observer experience, telescope aperture, amount of atmospheric dispersion, etc. Perhaps the size of the central obstruction is fully as important as some of these others which we do record.

Observed Telescopic Meteor Rates. Mr. Don Machholz of Los Gatos, California contributes the following table of observed data on telescopic meteors in 1975. His similar data for 1976 were given on pg. 171 of JALPO, Vol. 26, Nos. 7-8.

	Morning			Evening		
Month	Hours	Meteors	Rate	Hours	Meteors	Rate
January	0.00	0	---	15.50	2	0.13
February	3.25	2	0.62	10.25	0	0.00
March	3.00	1	0.33	18.00	4	0.22
April	5.75	2	0.35	9.50	3	0.32
May	4.00	1	0.25	13.25	1	0.08
June	3.75	1	0.27	14.75	4	0.27
July	3.25	1	0.31	17.25	3	0.17
August	8.00	10	1.25	23.00	12	0.52
September	28.25	18	0.64	20.75	6	0.29
October	32.75	29	0.89	17.25	10	0.58
November	16.75	24	1.43	6.25	6	0.96
December	24.25	56	2.31	8.25	8	0.97
Totals	133.0	145		174.00	59	

All meteors were recorded in the course of searches for comets. From January 1 to November 11, 1975 Mr. Machholz observed from his backyard in Concord, Calif., where the skies are fairly bright. From November 12 to December 31 he observed from areas around Concord, where the skies are fairly dark.

The telescopes employed were as follows: Jan. 1 to Sept. 29, 4.25-inch, f/5 reflector at 20X, field 3.0 degrees; Sept. 29 to Oct. 20, 10-inch, f/3.8 reflector at 42X, field 2.4 degrees, but with an inferior secondary mirror; Oct. 21 to Dec. 31, same 10-inch reflector with a good secondary. This very energetic observer is still seeking to discover his first comet.

Penumbral Lunar Eclipse of November 6-7, 1976. Mr. John Sledge of Montevallo, Alabama has contributed the only report on this phenomenon. The middle of the eclipse was at 23^h1^m on November 6, U.T.; and the Moon left the penumbra at 1^h17^m on November 7. At 23^h20^m Mr. Sledge observed the Moon just rising over the water in a large lake; Luna was yellowish with a lighter ring on the bottom. The observer could not decide whether the color was due to the penumbra or to atmospheric dust. At 23^h35^m the Moon was higher but lacked its normal brightness. Any color was extremely subtle with 7 X 35 binoculars. After 23^h40^m, U.T. the Moon was quite normal.

Request for Observations of Partial Lunar Eclipse on April 4, 1977. Very few reports on this eclipse have arrived, and we would appreciate it if observers would now submit their late observations as soon as convenient. An unexpected by-product of the data on hand was evidence of large systematic errors in umbral contact times for craters. The exact location the observer chooses for the edge of the umbra is influenced by such things as aperture and magnification. Such timing errors were exaggerated at this eclipse because the crater immersions and emersions were almost tangential.

The Strolling Astronomer

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