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and which presumably does possess fundamental significance in the meteorology of Jupiter.

A few exceptions exist to the latitudinal distribution of System I and System II stated above. A number of outbreaks of spots on the NTB_S (south edge of NTB) have occurred with periods even shorter than that of System I. Features in the SEB Z (South Equatorial Belt Zone) often show periods of rotation intermediate between System I and System II. A few other exceptions can arise.

More than 20 atmospheric currents have been identified at different Jovian latitudes. Some of these provided observable features during the 1979-80 apparition and appear in the tables of Mr. Budine's Jupiter Report, the first article in this issue.

The more detailed terminology of particular features is beyond the scope of this article. The STrZ is the location of the famous and variable Red Spot, which sometimes also exists as the bright oval Red Spot Hollow (RSH). The same zone also presents at intervals STrZ Disturbances - see Mr. Budine's report. The SEB has been the site of many major characteristic large Disturbances in this century, the first one in 1919. The STeZ is the location of three white ovals, BC, DE, and FA, which have existed from 1940 to the present time. The NEB_S is often the most active latitude on Jupiter.

If this elementary article has been helpful to readers of this journal, we shall try to provide future articles at a similar level on other subjects of interest to the planetary observer. Let us hear your wishes.

THE APPARITION OF COMET SUZUKI-SAIGUSA-MORA 1975 X

By: Daniel W. E. Green, A.L.P.O. Comets Section

Abstract

The A.L.P.O. observations of the long-period comet Suzuki-Saigusa-Mori 1975 X are discussed, and are correlated with data obtained by other observers. The unusual brightness behavior of this intrinsically-faint comet is analyzed, but caution must be used due to the short arc of observations in time and to the nature of the observations themselves and the physical behavior of the comet.

I. Introduction

Comet 1975 X (= 1975k) was discovered on 1975, October 5 as a ninth-magnitude object in Ursa Major by no less than five Japanese observers: Shigenori Suzuki (Aichi), Yoshikazu Saigusa (Yamanashi), Hiroaki Mori (Gifu), Kiyomi Okazaki (Yamagata), and Shigeru Furuyama (Ibaraki), according to IAU Circul r No. 2847. Official procedure dictates that only the three discoverers whose reports first reach the IAU Central Bureau for Astronomical Telegrams may have their names assigned to the comet, and this comet was called "Comet Suzuki-Saigusa-Mori." This diffuse object was found by Mori only 70 minutes after he had discovered Comet Mori-Sato-Fujikawa 1975 XII.

Having passed perihelion on October 15, the comet moved to within 16 million km of the Earth on November 1, 1975, as it passed between the Sun and Earth. Elements computed by Marsden (1979) from 82 observations, considering perturbations by the nine planets (Mercury-Pluto), are:

Epoch = 1975, Nov. 4

T = 1975 Oct. 15.3602, E.T.	ω = 152°.0241	1950.0
e = 0.985653	Ω = 216.1091	
q = 0.838047 AU	i = 118.2381	

An orbital period near 446 years is suggested by these elements. Once beyond its closest approach to the Earth, Comet Suzuki-Saigusa-Mori moved rapidly southward into Southern Hemisphere skies; travelling better than 15° per day at closest approach, it reached declination -50° by November 4.

Several A.L.P.O. observers followed Comet 1975k during October, and the Rev. Leo Boethin contributed some November observations which he made from his site at Abra in The Philippines. In addition to th se observers who are listed in Table I, accompanied by an asterik (*), included are several more observers of this comet who contributed data which were published in the IAU Circulars (Nos. 2849, 2850, 2856, 2858, 2861, 2869, 2877, and 2888) or which were sent directly to this author. The A.L.P.O. observations of Comet 1975 X were published in The International Comet Quarterly (Vol. 3, No. 1, January 1981), as were the observations from other sources (Vol. 3, No. 2, April 1981); this paper will give a general overview of the comet's appearance and an analysis of its unusual brightness behavior.

II. Visual Appearance

Comet Suzuki-Saigusa-Mori was a very diffuse object, the circular coma usually having ambiguous boundaries; some slight condensation was observed at times by some

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TABLE I. KEY TO OBSERVERS

(Asterisk indicates those observers who sent observations directly to the A.L.P.O. Comets Section.)

AND01		K. G. ANDERSSON, SWEDEN
BER		A. BERNASCONI, ITALY
BOE	*	LEO BOETHIN, THE PHILIPPINES
BOR	*	JOHN E. BORTLE, NY, U.S.A.
COL		PETER L. COLLINS, MA, U.S.A.
COM01		B. COMSA, CA, U.S.A.
GRE	*	DANIEL W. E. GREEN, NC, U.S.A.
HAD		K. A. HADDOW, ENGLAND
HER		D. HERALD, AUSTRALIA
HUD		B. HUDGENS, MS, U.S.A.
JON		A. F. JONES, NEW ZEALAND
KEE		R. KEEN, CO, U.S.A.
MAL		PAUL MALEY, TX, U.S.A.
MAT02	*	LEONARD MATUSZEWSKI, NJ, U.S.A.
MAY		MARVIN J. MAYO, CA, U.S.A.
MOO		E. MOORE, NM, U.S.A.
MOR		CHARLES S. MORRIS, MA, U.S.A.
POR	*	ALAIN PORTER, RI, U.S.A.
SEA		DAVID A. J. SEARGENT, AUSTRALIA
STE		M. STEWART, NEW ZEALAND
SUM		BRUCE SUMNER, AUSTRALIA
TRU	*	JOSEPH TRUXTON, CA, U.S.A.
WAL	*	DEREK WALLENTINSEN, NM, U.S.A.

observers. The observed angular coma diameter (5!2 to 5!3) on October 12, according to Morris and Bortle, places the diameter then in the vicinity of 160,000 km, this being only three days before perihelion. As the comet drew closer to the Earth in late October, the apparent visual diameter increased to 10' - 12', although this value suggests a true diameter of only half that observed two weeks earlier, a difference probably attributable to observing effects caused by the Earth's atmosphere. Boethin observed the comet until November 22 visually, then noting the fading, ninth-magnitude object as very diffuse with a slight central condensation. Matchett was perhaps the last to observe comet 1975k visually, seeing it at 11th magnitude on November 29 and 30, 1975. The Moon affected observations, being full on October 19.

Some observers (Bortle, Green, and Porter) reported seeing a faint, narrow tail spike up to as much as 1 degree in length at times. An October 10 photograph taken by Moore at the Joint Observatory for Cometary Research with a 37-cm f/2 Schmidt telescope showed the comet with a 1-degree tail in position angle 330°. Another photograph taken two nights later at Woolston Observatory by Haddow apparently revealed no tail, but showed a poorly condensed image surrounded by a 40" coma of total magnitude 8.0.

III. Magnitude Analysis

Comet Suzuki-Saigusa-Mori is a very difficult object to analyze in terms of brightness, as is well depicted by the scatter of data in Figure 11. Forty-seven points were plotted in Fig. 11 on a logarithmic scale of heliocentric distance (abscissa) versus heliocentric magnitude (ordinate). Attempts have been made to represent the magnitude of this comet, but the data resist allowing any order to be made of them.

Table II presents all of the magnitude estimates in the following order: column 1: Chronological numbering of the observations; 2: Date in Universal Time (U.T.); 3: Observed total visual magnitude; 4: Aperture-corrected magnitude to standard of 6.78 cm, after Morris (1973); 5: Instrument size in cm, with type of instrument (Key: L = reflector, B = binoculars, R = refractor, E = naked eye); 6: Heliocentric magnitude (see Green 1980a); 7 and 8: The comet's geocentric (Δ) and heliocentric (r) distances, respectively; 9: log r; 10: Observer (see Table I for Key).

Most of the magnitude observations by far were made when the comet was between 0.85 and 0.87 Astronomical Units (A.U.) from the Sun, and any attempted analysis of these data should be used with extreme caution. The author decided to choose those observations which were most consistent with each other, producing the observations made by four experienced observers (Bortle, Green, Morris, and Wallentinsen). After choosing only one observation per observer per night, 15 observations from October 7-29 (r = 0.852-0.838-0.980 AU) reveal:

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$$n = 25.29 \pm 2.75 \text{ (p.e.)}$$

$$H_o = 13.47 \pm 0.48 \text{ (p.e.)},$$

following a least squares regression analysis as described by Green (1980a, b). The absolute magnitude, H_o = 13.47, suggests that Comet Suzuki-Saigusa-Mori was intrinsically a very faint comet; and while the parameter n is unusually large, the following formula fits the 15 data points well (see Figure 12):

$$m_1 = 13.47 + 5 \log \Delta + 63.22 \log r,$$

****

Figure 10. Photograph of Comet Suzuki-Saigusa-Mori (1975k) by Reverend Ronald Royer of Azusa, CA on October 28, 1975, when the comet was near its brightest. On this date visual observers estimated a stellar magnitude of 5½ and a coma diameter of 10'. The comet was very diffuse, and no nucleus was seen. Reverend Royer took this photograph on IIaO emulsion in a 4-inch f/5 camera. The 3-minute exposure began at 12^h50^m, U.T. Photograph contributed by Dennis Milon, A.L.P.O. Comets Recorder.

where m_1 is the observed total visual, aperture-corrected magnitude within the standard cometary magnitude formula. This fit is graphed with all of the observations of Fig. 11, for analogy, in Figure 13. While this line fits well the October observations made by Northern Hemisphere observers, nothing can really be done to correlate the Southern Hemisphere observations of November, 1975.

Acknowledgements

Dennis Milon, A.L.P.O. Comets Recorder, provided those A.L.P.O. observations which were used in the study of Comet Suzuki-Saigusa-Mori 1975 X. I also thank all those observers who sent me their observations of this comet in 1976, when I announced the need for such data to conduct my study which was published in the J.A.L.P.O. (Vol. 28, Nos. 7-8, August 1980, pp. 134ff.). Dr. Brian G. Marsden kindly supplied computer time at the Smithsonian Astrophysical Observatory for the reduction of the data described in this paper.

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TABLE II. MAGNITUDE OBSERVATIONAL ANALYSIS.

No.	Date (U.T.)	Mag.	Corr.	Inst.	H-Mag.	Delta	r	log r	Obs.
1	1975 10 7.410	8.50	8.34	15.0L	8.59	0.894	0.852	-.0696	MOR
2	1975 10 8.340	8.20	8.30	5.0B	8.63	0.860	0.849	-.0711	BOR
3	1975 10 8.350	8.10	7.81	12.0R	8.14	0.860	0.849	-.0711	COL
4	1975 10 8.460	8.10	7.76	13.0R	8.09	0.860	0.849	-.0711	MAL
5	1975 10 9.460	8.20	7.86	13.0R	8.27	0.827	0.846	-.0726	MAL
6	1975 10 11.430	8.30	8.14	15.0L	8.74	0.759	0.842	-.0747	MOR
7	1975 10 12.400	7.80	7.90	5.0B	8.60	0.724	0.840	-.0757	BOR
8	1975 10 12.430	8.30	8.14	15.0L	8.85	0.724	0.840	-.0757	MOR
9	1975 10 12.470	8.10	7.76	13.0R	8.46	0.724	0.840	-.0757	MAL
10	1975 10 14.390	7.50	7.60	5.0B	8.52	0.655	0.838	-.0768	GRE
11	1975 10 15.460	8.20	7.85	25.4L	8.88	0.620	0.838	-.0768	TRU
12	1975 10 17.460	8.30	7.96	13.0R	9.26	0.549	0.839	-.0762	MAL
13	1975 10 18.460	8.00	7.65	25.0L	9.10	0.514	0.839	-.0762	HUD
14	1975 10 18.480	8.00	7.66	13.0R	9.10	0.514	0.839	-.0762	MAL
15	1975 10 19.470	8.00	7.66	13.0R	9.26	0.478	0.841	-.0752	MAL
16	1975 10 20.480	7.90	7.56	13.0R	9.33	0.442	0.842	-.0747	MAL
17	1975 10 21.070	7.50	7.43	8.0B	9.38	0.407	0.845	-.0731	AND01
18	1975 10 21.370	6.50	6.60	5.0B	8.55	0.407	0.845	-.0731	MAT02
19	1975 10 21.400	7.00	7.10	5.0B	9.05	0.407	0.845	-.0731	BOR
20	1975 10 21.480	7.90	7.56	13.0R	9.51	0.407	0.845	-.0731	MAL
21	1975 10 22.390	6.80	6.90	5.0B	9.05	0.372	0.847	-.0721	BOR
22	1975 10 23.380	7.20	7.04	15.0L	9.41	0.336	0.850	-.0706	POR
23	1975 10 23.390	6.80	6.90	5.0B	9.27	0.336	0.850	-.0706	BOR
24	1975 10 23.450	7.00	6.92	11.0L	9.29	0.336	0.850	-.0706	WAL
25	1975 10 24.400	6.50	6.34	15.0L	8.95	0.301	0.853	-.0691	POR
26	1975 10 24.480	7.80	7.46	13.0R	10.07	0.301	0.853	-.0691	MAL
27	1975 10 24.520	6.80	6.90	5.0B	9.51	0.301	0.853	-.0691	TRU
28	1975 10 26.470	5.90	6.08	3.5B	9.24	0.233	0.861	-.0650	WAL
29	1975 10 27.190	6.10	6.14	6.0B	9.63	0.201	0.866	-.0625	BER
30	1975 10 27.480	5.80	5.98	3.5B	9.46	0.201	0.866	-.0625	WAL
31	1975 10 27.500	5.50	5.68	3.5B	9.16	0.201	0.866	-.0625	KEE
32	1975 10 28.410	5.50	5.60	5.0B	9.45	0.170	0.870	-.0605	BOR
33	1975 10 28.490	5.90	6.08	3.5B	9.93	0.170	0.870	-.0605	WAL
34	1975 10 28.540	6.00	6.10	5.0B	9.95	0.170	0.870	-.0605	MAY
35	1975 10 29.190	5.80	5.84	6.0B	10.08	0.142	0.876	-.0575	BER
36	1975 10 29.510	5.50	5.68	3.5B	9.92	0.142	0.876	-.0575	WAL
37	1975 11 4.390	5.20	5.30	5.0B	9.24	0.163	0.914	-.0391	STE
38	1975 11 4.440	6.50	6.43	8.0B	10.37	0.163	0.914	-.0391	BOE
39	1975 11 4.470	5.00	5.13	0.0E	9.07	0.163	0.914	-.0391	HER
40	1975 11 6.420	4.80	4.93	0.0E	8.17	0.225	0.929	-.0320	SEA
41	1975 11 8.450	6.20	6.13	8.0B	8.81	0.292	0.945	-.0246	BOE
42	1975 11 11.400	7.50	7.63	4.5R	9.63	0.397	0.971	-.0128	JON
43	1975 11 11.430	7.10	7.20	5.0B	9.20	0.397	0.971	-.0128	SUM
44	1975 11 12.420	7.80	7.93	4.5R	9.75	0.432	0.980	-.0088	JON
45	1975 11 12.530	7.20	7.04	15.0L	8.87	0.432	0.980	-.0088	SUM
46	1975 11 21.440	8.80	8.54	20.3L	9.18	0.745	1.071	0.0298	BOE
47	1975 11 22.450	8.80	8.54	20.3L	9.08	0.780	1.082	0.0342	BOE

REPORT ON THE A.L.P.O.-LTP OBSERVING PROGRAM

By: Winifred Sawtell Cameron, NSSDC, GSFC, Greenbelt, MD

This on-going observing program has been operating since late 1972. The objectives are to: 1) monitor the Moon for Lunar Transient Phenomena (LTP), 2) establish the normal albedo behavior over a lunation period of the more active LTP sites (100 out of 200 total), some non-LTP comparison sites, and the seismic epicenters obtained from the Apollo seismic experiments under all lighting aspects, including earthlit, by a standardized procedure, and 3) establish an objective seeing scale based on a star's diffraction of out-of-focus disk behavior. Appeals for observers have elicited a large response in inquiries. The number who have reported observations is only a fraction of those.

Briefly, the procedures to be effected by observers are the following:

A) At Full Moon construct an albedo scale by matching grays to Elger's scale in one of the following ways:

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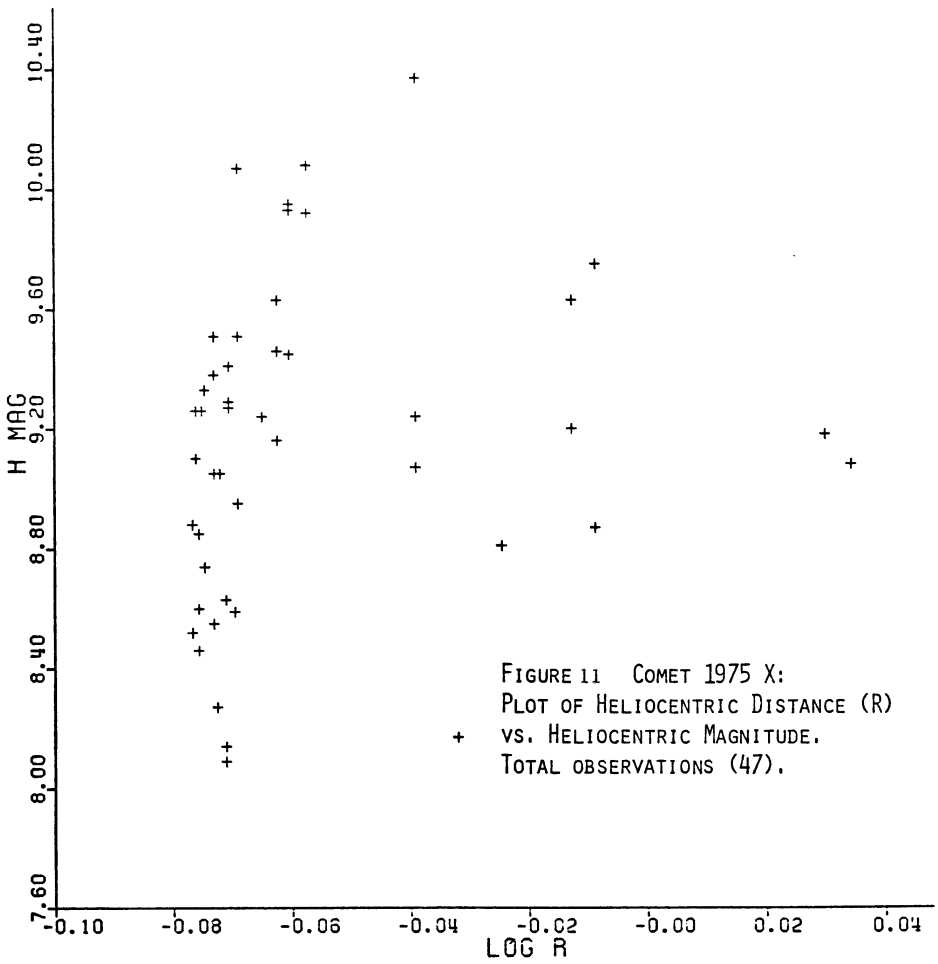

FIGURE 11 COMET 1975 X:
PLOT OF HELIOCENTRIC DISTANCE (R)
VS. HELIOCENTRIC MAGNITUDE.
TOTAL OBSERVATIONS (47).

****

1) pencil shadings on a white sheet of paper,
2) pieces of film print (perhaps of a lunar photograph),
3) pieces of exposed film of various densities,
4) photographic gray scale,
5) inserting pieces of exposed film, between the eye and eyepiece and adding together till they extinguish the feature examined (from Elger's example), or
6) use neutral filters in the same ways as in 5).

Values at Full Moon give the true albedo. Once a gray is matched to Elger's scale, then any measure at any time that matches that gray step is the albedo recorded.

B) Select several permanent points in each assigned feature including wall, floor, and central peak, and one outside the feature on the nearby terrain (usually a plain). These are the points always measured and reported.

C) Before observing the Moon estimate the seeing by the following:

1) With the clock drive off, set the star's disk (near the Moon) at the edge of the field of view (FOV) and time (by counting seconds) how long it takes to drift out of the FOV,
2) watch the expansion and contraction of the image and time (by counting) the interval between blow-ups,
3) switch the clock drive on, set the star at the edge of the FOV, and time the interval between darts toward the center (excursions) of the FOV.
4) estimate how far toward the center it darted (in fractions of the FOV),
5) estimate the ratio of the largest blown-up disk to the smallest, and
6) estimate the seeing by some old method as to poor to excellent, or 0-10 (10 best), or the Antoniadi Scale I-V (I best).

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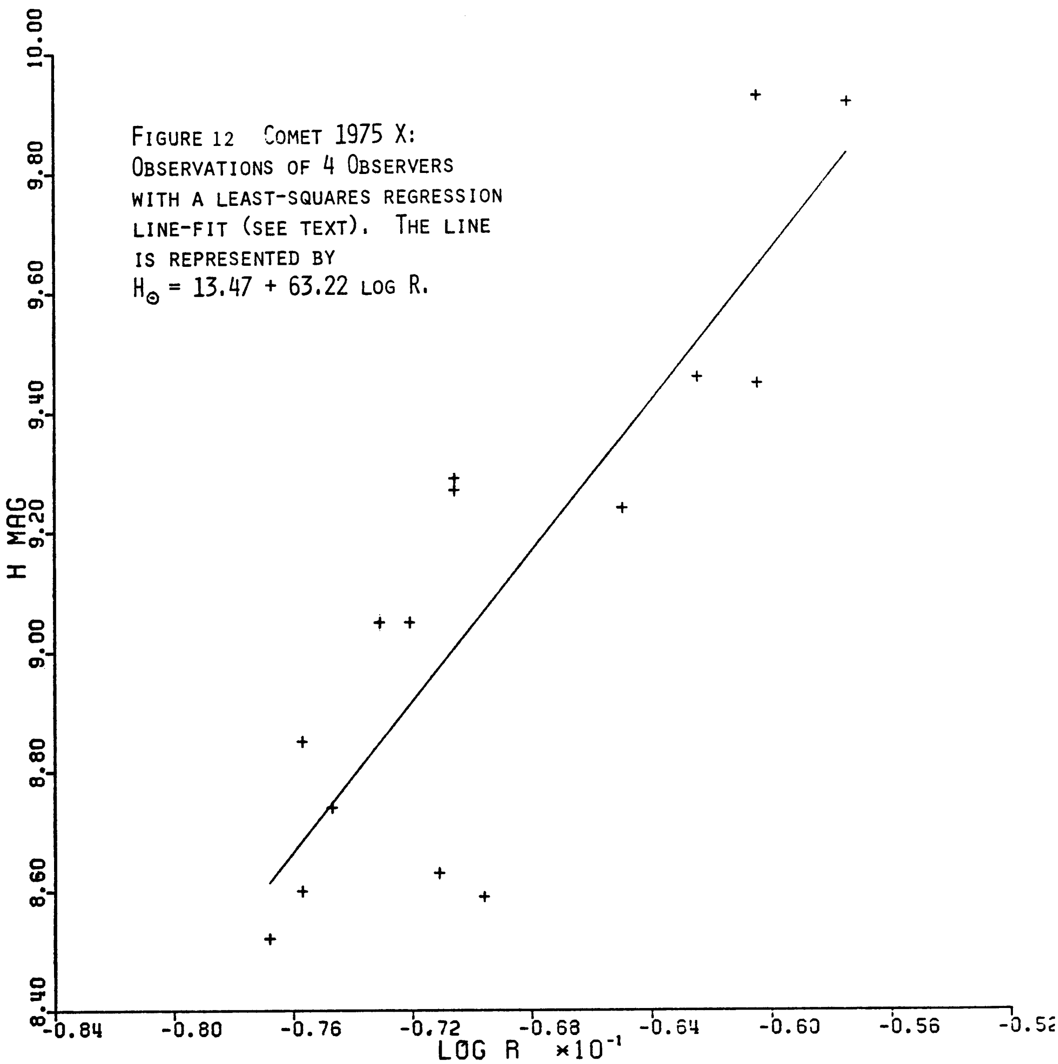

FIGURE 12 COMET 1975 X: OBSERVATIONS OF 4 OBSERVERS WITH A LEAST-SQUARES REGRESSION LINE-FIT (SEE TEXT). THE LINE IS REPRESENTED BY $H_{\odot} = 13.47 + 63.22 \log R$.

****

An observing session should have at least two measures of every point of each feature visible separated by a minimum of ten minutes in time. All measures are reported to me monthly, but LTP reports should be sent in immediately. If an anomaly is noted, minute detail as to color, obscuration, albedo, variations (with timings), hue of color, motions, etc. should be made. Comparison with other features especially north or south of the anomaly and with similar structure and albedo should also be made. Instructions for procedures, Elger's scale, and reporting forms are provided. I assign four LTP, one non-LTP comparison feature, and one seismic epicenter site to each observer. In this way I can assure that all 100 LTP features and all seismic zones will be covered. In a few instances observers requested more features to monitor.

From 1972 to the present (August, 1980), there were 68 inquiries, three of which were professional astronomer groups, with recording equipment (none of which have reported any observations). All 100+ LTP and seismic sites were distributed among the 68 inquirers with many duplicates. Table 1 lists all inquirers who were assigned features. Of the 68 inquirers, 13 have reported observations (asterisked). These 13 cover 64 features, of which 17 were duplicated, 1939 nights, and 15,094 individual measurements of albedos through August, 1980. Among the 1939 nights there were 52 nights on which LTP with 105 individual measures were reported. These figures represent 2.7 percent of nights and 0.7 of one percent of individual measures. Table 2 summarizes the 13 observers' reports. Some of the 13 have dropped out, as can be seen in the last column which gives the date of the last reported observations. Two of the reporters (superscript 1) are not actual members of the program, but they send measures of albedos similar to the A.L.P.O. method on an irregular basis.

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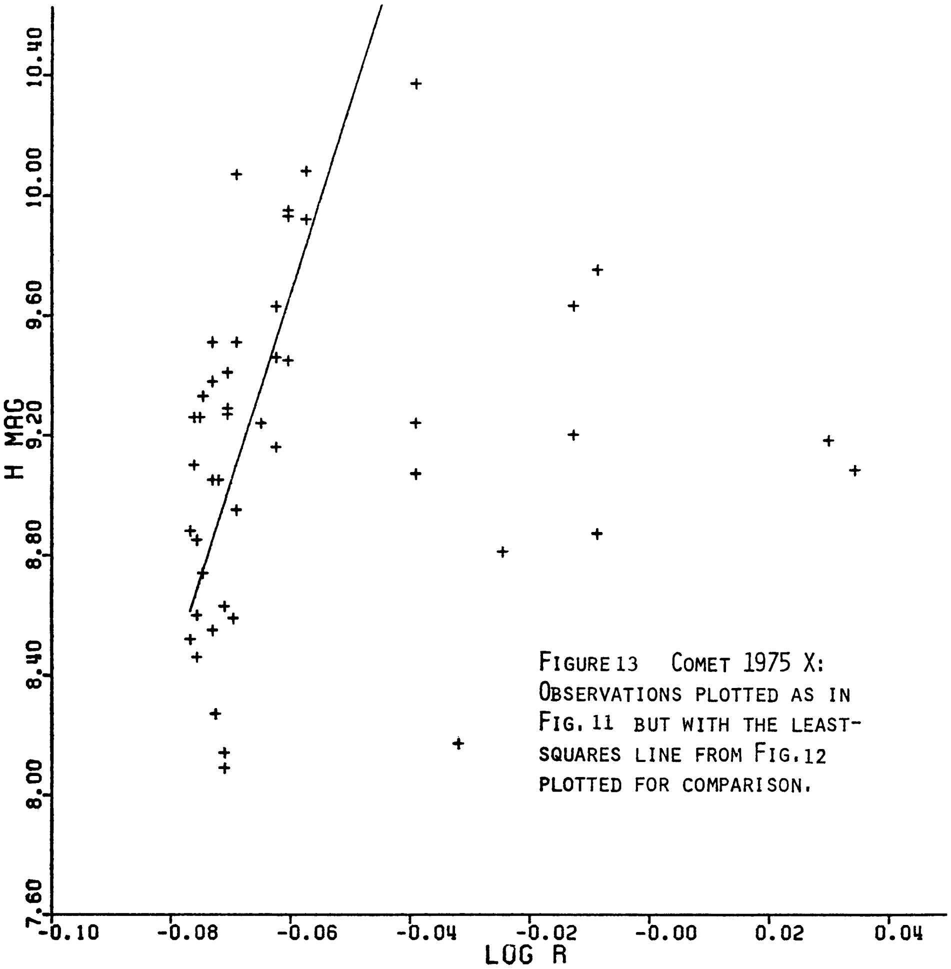

FIGURE 13 COMET 1975 X: OBSERVATIONS PLOTTED AS IN FIG. 11 BUT WITH THE LEAST-SQUARES LINE FROM FIG. 12 PLOTTED FOR COMPARISON.

****

Upon receipt of the observations I construct albedo charts of albedo vs. Moon's age, a typical one of which may be seen in Table 3. (Commas separate measures during a night, and semicolons separate nights of observation.) Figure 14 shows the average behavior of each point in graphical form. Pertinent information, e.g., sunrise and sunset, lunar phases, and magnetic tail boundaries are indicated at the top. Note that the nearby plain (Mare Crisium) point is always of lower albedo than the Cape, and point C appears to deviate from the other points. Point A is the brightest generally. Occasionally I find measures that differ from the average or surrounding Moon's age measures by four half-steps or more on Elger's scale (circled in Table 3). Since LTP of as little as one-half step have been reported, I think 4 half steps is a significant deviation and can be considered a possible anomaly. Point E was quite low in the second night's measure but the Sun's altitude was only 4^{o}. However, on the first night's measures, the altitude was only 9^{o} so the 4's may be anomalously low since the other points weren't so far off. The one other anomaly was in the nearby plain comparison point. This region of M. Crisium is subject to LTP. Most points tend to brighten slightly at or near Full Moon. The possible anomalies were not noted by the observer. A number of reasons could account for this; e.g. the observers didn't know or remember (and shouldn't) what the normal albedo was. Also, there were no variations in albedo during observation to command their attention. There was no color or obscuration associated with the unusual albedo to gain attention. In Table 2 we could apply the same analysis. Here (considering each feature separately) we find 152 nights and 285 individual anomalous measures which equal 7.8% and 1.9% respectively. We find the total nights of reported and possible anomalies was 204/1939 and the total of individual measures was 390/15,094. These are 10.5% and 2.6% respectively. This result suggests that once in about 10 nights or once in about 40 individual measures one might record an anomaly. I encourage my observers to compare their night's measures to previous ones for the same phase after observing; and if they differ from previous ones of the same age (or surrounding ages) by 4 one-half steps or more, to go back and observe such features carefully.

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