

THE TOTAL LUNAR ECLIPSE OF MAY 24-25, 1975

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Received 1976 January 19

RESUMEN

El eclipse de Luna del 24-25 de mayo de 1975 ha sido observado fotoeléctricamente en el sistema UBV mediante la medición de una pequeña área en la Luna. Se presentan las variaciones correspondientes a la magnitud V y al color B-V. Durante la fase de totalidad se observó una región central muy oscura rodeada por una banda más clara, pero sin embargo mucho más rojiza si se la compara con la región central.

ABSTRACT

The lunar eclipse of May 24-25, 1975 was photoelectrically observed in the UBV system following a small area on the Moon. The variations of the V magnitude and the B-V color are presented. During totality a dark center surrounded by a brighter band appeared. The B-V colors indicate that the band is much redder than the dark center.

Key words: LUNAR ECLIPSE — PHOTOMETRY.

With experience acquired in observing total lunar eclipses with a conventional photoelectric photometer, the eclipse of May 24-25, 1975 was observed with the technique employed earlier (Feinstein 1966; Feinstein *et al.* 1968).

With a single channel UBV photoelectric photometer attached to the 80-cm telescope of La Plata Observatory a small area in Mare Nubium was measured. The UBV data were reduced to the standard system by means of transformation coefficients obtained the night before. It is estimated that the error in the V magnitude is about $\pm 0.^m1$. After the reductions it was found that the U measures during totality were so small that they had to be rejected. At the beginning of the eclipse a few thin clouds passed in front of the Moon but disappeared completely before totality.

The procedure of the observations was the following: Forte guided the same lunar area through

the finder of the telescope, as Feinstein changed the filters, the diaphragms, and the gains of the amplifier. Meanwhile Cabrera took care of the recorder and wrote down the observing time, the gains, and the V, B and U bands corresponding to each deflection.

At the beginning of the eclipse a diameter of 7 arc sec and an integration time of 2 sec were selected. As the brightness decreased the aperture was increased to a diaphragm of 20 arc sec and later to 30 arc sec. Also the integration time was increased to 6 sec.

Table 1 lists in the first and second columns the time of observations (UT) and γ , the distance in minutes of arc of the observed place on the Moon to the center of the umbra. The computation of γ was carried out by the method described by Kozig (see Link 1969). The third and fourth columns list the V magnitude (m/\square'') reduced to the smallest diaphragm, and the B-V color.

TABLE 1
PHOTOMETRY OF THE LUNAR ECLIPSE

V				V				V				V			
UT	γ (m/□")	B-V		UT	γ (m/□")	B-V		UT	γ (m/□")	B-V		UT	γ (m/□")	B-V	
4 ^h 00 ^m	54'	0.50	0.80	4 ^h 38 ^m	34'	6.60	1.10	5 ^h 35 ^m	8'	13.01	2.28	6 ^h 55 ^m	40'	6.54	0.90
01	53	0.60	0.80	39	34	7.12	0.84	39	7.8	13.21	2.07	58	42	6.31	0.79
03	52	0.69	0.81	41	33	7.33	0.82	43	8	13.24	1.93	7 01	44	5.16	0.75
04	52	0.77	0.86	42	32	7.49	0.96	45	8	12.77	2.28	03	44	5.96	0.65
06	51	0.88	0.82	44	31	7.44	1.07	46	8	12.53	2.40	05	45	5.62	0.55
07	50	1.00	0.85	45	31	7.82	1.05	48	9	12.45	2.44	07	46	4.23	0.71
09	49	1.12	0.86	47	30	8.35	1.15	51	10	12.38	2.47	10	48	3.47	0.40
10	49	1.25	0.86	49	28	8.72	1.23	54	11	12.27	2.61	12	49	2.64	0.77
11	48	1.41	0.91	51	27	8.72	1.23	57	12	12.11	2.63	13	49	2.17	0.87
13	47	1.56	0.86	54	26	9.17	1.40	6 00	13	11.86	2.83	15	51	1.78	0.78
14	47	1.72	0.86	57	24	9.71	1.49	03	14	11.71	2.84	16	51	1.58	0.83
16	45	1.92	0.88	59	23	10.25	1.88	07	16	11.40	3.08	18	52	1.37	0.80
17	45	2.11	0.86	5 01	23	10.83	2.01	11	18	11.57	2.84	20	54	1.15	0.85
19	44	2.21	0.95	04	21	11.29	2.31	15	20	11.20	2.91	21	54	0.96	0.88
21	43	2.60	0.96	08	19	11.10	2.65	20	22	11.09	2.80	23	55	0.85	0.81
23	42	3.00	0.90	11	17	11.14	2.77	24	24	10.80	2.87	25	56	0.69	0.88
24	41	3.37	0.97	13	17	11.27	3.05	28	26	10.51	2.69	27	57	0.58	0.76
26	40	4.89	0.94	15	16	10.99	3.41	32	28	10.11	2.44	29	58	0.54	0.76
27	40	4.52	0.72	18	14	11.77	2.82	35	30	9.64	2.21	31	59	0.34	0.88
29	39	5.39	0.64	21	13	11.56	3.00	39	32	9.14	1.63	33	60	0.25	0.87
33	37	5.69	0.77	24	12	11.78	2.90	42	34	8.49	1.24	35	61	0.23	0.80
35	35	5.80	0.89	26	11	12.03	2.77	46	35	7.83	1.09				
36	35	5.96	0.93	29	11	12.03	2.77	49	37	7.23	1.01				
37	34	6.71	0.74	32	9	12.75	2.42	52	39	6.95	0.83				

In Figure 1 are plotted the V magnitude (m/□") and the B-V color versus the U.T. and also versus γ , the distance to the center of the umbra. The two arrows at approximately U.T. = 5^h05^m and 6^h33^m indicate the time interval when the Moon was completely eclipsed, that is between second and third contacts. Figure 1 suggests an umbra with a dark center which reached V = 13.2 m/□", surrounded by a brighter but very red band of about V = 11.5 m/□", and 8 arc min width (see the horizontal arrows).

The correction of the observed magnitude per square second to the integrated magnitude for all the Moon is -12.2; its total magnitude then follows from measurements of the darkest area as V_t = 1.^m0. But if we use the brightness of the brighter circular band, V_t = -0.^m7. The actual magnitude of the eclipsed Moon probably is some value in between. This mean that the visual estimates of several observers (Ashbrook 1975) give a very rough indication of the total brightness, though the general description is quite consistent with our results. Also

the very peculiar distribution of the color, very red in the clear band of the umbra (B-V = 3.0) and less red at its dark center (B - V = 2.2) is correlated with the observations of visual observers.

The influence of scattered light, coming from other parts of the Moon to the diaphragm of the photometer, was not taken into consideration. This might be quite large at the beginning of the eclipse and at the end, when the Moon was partially illuminated, but it is surely not significant through the totality.

Visual estimates of the darkness of lunar eclipses were made through the use of the Danjon's luminosity scale (see Link 1969, page 97). On this scale, L = 0 is a very dark eclipse and L = 4 a very bright one. The degree of darkness compiled from the data published in the last 15 years in Sky and Telescope indicates that a normal eclipse has a value of about L = 2, or slightly brighter. According to the Danjon's scale, L = 2 is defined as "dark red or rust-colored eclipse with dark area in the center of the shadow, the edges brighter". This seems to be the

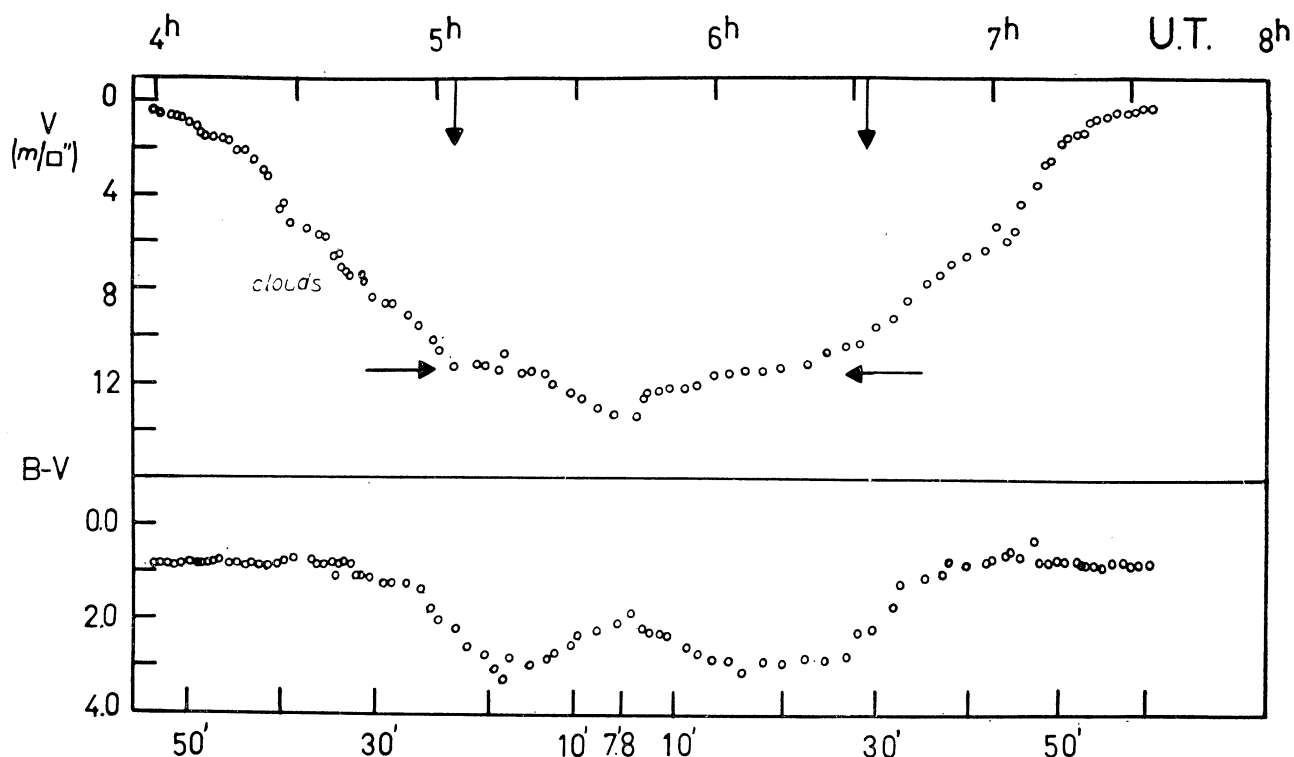


FIG. 1. The V magnitude and the B - V color versus the U. T. and the distance γ to the center of the umbra are given. The two vertical arrows indicate the time interval of the total eclipse of the Moon. The V magnitude of the circular band is suggested by the horizontal arrows.

case of the eclipse of May 24 - 25, 1975. But in other eclipses as in the one of December 30, 1963 estimated as $L = 0$, the Moon became extremely dark. Then, the dark area in the center of the umbra is variable, and in some cases appears larger than normal. This happens when fine dust ejected by a great volcano explosion increases the opacity of the atmosphere (Link 1969, page 80).

The eclipse of May 24 - 25, 1975 with $L = 1.6$ (Ashbrook 1975) seems to be slightly darker than normal, which may be due to the explosion in October 1974 of the volcano Fuego in Guatemala.

On the other hand the very peculiar distribution of color that we found, may be related to the distribution of dust and clouds in the earth's atmosphere which results in a preferential scattering of sunlight.

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