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FURTHER OBSERVATIONS OF LIGHT-CHANGES OF THE CENTRAL STAR OF  
PLANETARY NEBULA NGC 2346 AT THE BEGINNING OF 1991\*)

We followed the central star of NGC 2346 ( $215+3^{\circ}1'$ ;  $AR_{1950} = 7^{\text{h}}06^{\text{m}}49^{\text{s}}.7$ ,  $D_{1950} = -0^{\circ}43'29''$ ) in order to supplement the observations of that star made in January 1991 (Kohoutek, 1991). L. M. and partly L. K. observed at the European Southern Observatory, La Silla, Chile, using the 50 cm telescope and a pulse counting photometer (EMI 9789 QB photomultiplier, dia. 21 arcsec). The measurements are summarized in Table I, where  $\Delta V$  and  $\Delta B$  are the differences between the respective brightness (in magnitudes) of the central star and of that of the comparison "b" (see Kohoutek, 1982); every night the central star was measured 3 times and the comparison star twice. The nebular radiation was not subtracted, because the observations were not made in different diaphragms. The  $\Delta V$  light curve is presented in Fig. 1: it shows the minimum with the depth of at least  $\Delta V = 0.12$  mag ( $\Delta B \cong 0.16$  mag) and the duration of about 9 - 10 days. Unfortunately it is not possible to determine the time of the minimum. If we adopt JD 2448282.0 (Jan. 25<sup>d</sup>.5), the photometric period would then be 14.4 days (the minimum of Jan. 11<sup>d</sup>.1 was used). After JD 2448287 the star was nearly constant having  $\Delta V = 0^{\text{m}}.17$  and  $\Delta B = -0^{\text{m}}.03$ .

In Table II are the measurements made by H. Debehogne using the 50 cm telescope at La Silla, Chile (Hamamatsu tube together with the UBV Johnson filters, dia. 21 arcsec); the table contains again  $\Delta V$ , based on one measurement of the star and one of the comparison every night. The minimum appears on JD 2448309.3 $\pm$ 2 (Feb. 21<sup>d</sup>.8). The lower brightness of the central star was also observed on JD 2448303.7 with  $\Delta V = +0^{\text{m}}.36$ , whereas in the maximum the star was  $\Delta V = +0^{\text{m}}.15$ . In the following four nights (JD 2448311.6 - 8315.6) the central star was observed by O. H. (Hamamatsu tube, VRI magnitudes) using the same telescope at La Silla - the star shows a nearly constant brightness of  $\Delta V = +0^{\text{m}}.05$ . The differences  $\Delta V$  in the maximum light of the star could be explained by the contribution of the nebula, which was not subtracted - the observed brightness of the nebula strongly depends both on the tube and the filter used. The connection of our two minima would lead to the photometric period of only 13.65 days.

\*) Based on observations collected at the  
European Southern Observatory, Chile

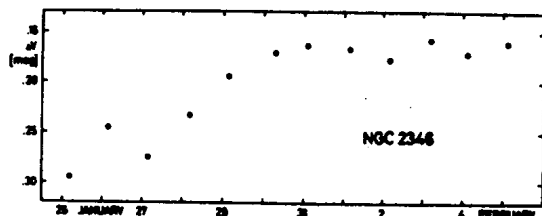
Table I Photoelectric observations of the central star plus nebula of NGC 2346 made by L. Mantegazza

JD 2440000+	$\Delta V$	$\Delta B$
8281.69	+0.295	+0.132
8282.65	0.246	0.072
8283.64	0.275	0.078
8284.67	0.234	0.038
8285.63	0.195	+0.004
8286.80	0.171	-0.028
8287.63	0.164	0.030
8288.64	0.167	0.016
8289.66	0.178	0.023
8290.69	0.158	0.037
8291.61	0.172	0.036
8292.62	+0.161	-0.030

Table II Photoelectric observations of the central star plus nebula of NGC 2346 made by H. Debehogne

JD 2440000+	$\Delta V$
8301.68	+0.16
8302.56	0.13
8303.72	0.36
8304.56	0.16
8305.55	0.15
8306.56	0.14
8308.57	0.49
8309.55	0.60
8310.56	+0.34

Fig.1  $\Delta V = V_{NGC} - V_{COMP.b}$  light curve of the central star of NGC 2346 in January-February 1991



The observers from New Zealand report the minimum of NGC 2346 to be  $11^m.8$  at JD 2448361.86, and the variability of the brightness of that star in April 1991 as  $10^m.3$ - $11^m.2$  (Bateson, 1991). The AAVSO observed some cyclic activity of that star in the range  $11^m.0$ - $12^m.0$  also in April 1991 (Bortle, 1991). If we connect the above minimum with that observed by Debehogne, we would get the photometric period only of 13.1 days. Hao (1991) states that the eclipse events reappeared already in 1988 and 1989; nevertheless the scatter of his photographic observations is rather large. Our photoelectric measurements (Kohoutek, unpublished) show nearly constant brightness of that star in both years.

The difference between the photometric and the orbital period (being  $P - 16$  days) could be attributed to the non central occultation by the dust cloud (Günter, 1991). Nevertheless, the dust region this time seems to be not so regular as in case of the cloud 1981 - 86. Further observations of that star will be necessary.

We are grateful to Dr. H. Debehogne for having observed the central star of NGC 2346.

L. KOHOUTEK  
Hamburger Sternwarte  
D-2050 Hamburg 80  
Germany

L. MANTEGAZZA  
Osservatorio Astro-  
nomico di Brera  
I-22055 Merate  
Italy

O. HAINAUT  
European Southern  
Observatory  
La Silla, Chile

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