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PHOTOMETRY OF THE VARIABLE CENTRAL STAR OF PLANETARY NEBULA NGC 2346 IN FEBRUARY 1984

Further photometry of the variable central star of planetary nebula NGC 2346 was made at the European Southern Observatory, La Silla, Chile (V-photometry; W.E.C.) as well as at the German-Spanish Astronomical Centre, Calar Alto, Spain (UBV-photometry; L.K.) in February 1984. We used the Bochum 61 cm telescope (f/15) equipped with a pulse counting photometer (EMI 9558A) at La Silla, and the 1.23 m telescope (f/8) with Photometer II (RCA 31034A-02) at Calar Alto. As photometric standards we observed α Car, β Cen at La Silla, and stars in the equatorial extinction star network (Barnes III, Moffett, 1979) as well as stars in the SA 102 (Landolt, 1983) at Calar Alto.

Our results are summarized in Table I: V_{obs}, B_{obs}, U_{obs} are observed (stellar + nebular) magnitudes through diaphragms either 18.2 arcsec (La Silla-LS) or 14.7 arcsec (Calar Alto-CA; on JD 5739.470 we observed through dia.21.0 arcsec only; the values given in Table I are those transformed to 14.7 arcsec using the mean brightness of the nebula); V, B, U are stellar magnitudes only, i.e. after subtracting the contribution of the nebular radiation; n - number of measurements. Great attention has been paid to the nebular radiation which reduces the accuracy of the stellar magnitudes very much. The mean nebular magnitudes in the respective diaphragms are given in Table II. It is hardly possible to use them generally, because they strongly depend on the given multiplier - filter combination.

The accuracy of our photometry of the central star can be estimated as follows: through the standard diaphragms 14.7 arcsec and 18.2 arcsec, respectively, the stellar magnitudes were fainter than the nebular ones in all colours. The internal errors of the stellar magnitudes are: $\sigma_{V,\,B} \simeq \pm 0.1$ to ± 0.2 mag, $\sigma_U \simeq \pm 0.2$ mag.

In February 1984 the light curve showed a flat maximum, $V_{max} \simeq 14.1$ mag, $(B-V)_{max} \simeq +0.6$ mag, at the time of about Feb. 6.0 ($JD_{max} = 2445736.5 \pm 0.4$). The descending branch to the following minimum was observed, the minimum itself not; we can estimate $V_{min} \gtrsim 15.0$ mag, $(B-V)_{min} \gtrsim +0.7$ mag.

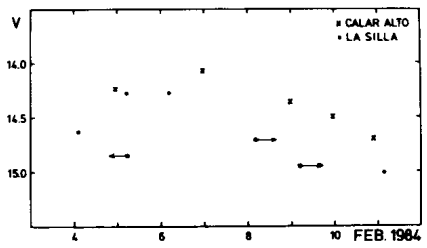

Figure 1: V light curve of the central star of NGC 2346 in February 1984.

Table I

Photoelectric observations of the central star of NGC 2346 in February 1984.

JD_{hel}	Observed brightness			Central star				
2445300+	V_{obs}	B_{obs}	U_{obs}	V	B	U	n	Obs.
5719.784	13.67	-	-	14.85	-	-	2	LS
5734.621	13.53	-	-	14.63	-	-	2	LS
5735.443	13.19	13.93	13.70	14.24	14.82	15.07	2	CA
5735.721	13.41	-	-	14.28	-	-	2	LS
5736.696	13.43	-	-	14.28	-	-	2	LS
5737.442	13.22	13.97	13.74	14.07	14.67	14.93	3	CA
5739.470	13.30	14.07	13.82	14.36	14.97	15.32	3	CA
5740.455	13.37	14.20	13.80	14.50	15.32	15.17	3	CA
5741.410	13.42	14.23	13.85	14.70	15.33	15.43	4	CA
5741.653	13.79	-	-	15.01	-	-	2	LS
5754.643	13.64	-	-	14.71	-	-	2	LS
5755.644	13.71	-	-	14.95	-	-	2	LS

Table II

Mean brightness of the nebula (mag).

La Silla		Calar Alto			
Diaphragm (arc sec)	V_{neb}	Diaphragm (arcsec)	V_{neb}	B_{neb}	U_{neb}
11.3	15.15	10.5	14.54	15.42	14.87
18.2	14.12	14.7	13.81	14.69	14.14
28.9	13.19	21.0	13.01	13.93	13.33
		29.4	12.46	13.42	12.74

The brightness of the central star of NGC 2346 derived from the La Silla observations is systematically fainter than that derived from the Calar Alto measurements. This difference (about 0.2 mag) is probably caused by the radiation of the nebula the subtraction of which is rather uncertain especially in the given range of magnitudes.

The V-values of JD 5719.784 and JD 5754.643, 5755.644 given in Table I correspond to the preceding and the following cycle, respectively. We have shifted them along the time-axis with the photometric period $P=15^{d}.957$ (Kohoutek, 1983) to the main interval of our observations (February 4-11), and we have obtained points significantly below the observed light curve. According to our opinion there are two possible explanations : either the period of the light curve was shorter than $15^{d}.957$, or the shape of the subsequent cycles was not identical with that of the main observations. We prefer the first explanation - the decrease of the binary orbiting period as a result of the motion of the A-component inside the dust cloud (moving from the planetary nucleus - Kohoutek, 1983) will be discussed in a separate paper. This decrease would also explain the "dephasing" light curve observed in Sep. - Oct. 1984 by Acker and Jasniewicz (1985) who used the period 15.991 days. Let us mention that the hypothesis of a clumpy shell ejected by the hot subdwarf in the planetary nucleus has very recently been proposed by Shaefer (1985).

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