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A NEW BRIGHT Be VARIABLE AND SUSPECTED ECLIPSING BINARY

60 Cyg /HR 8053, HD 200310, MWC 360, $\alpha_{1950} = 20^h59^m26^s$, $\sigma_{1950} = +45^o57'31''$/ is an interesting bright Be star, suspected spectroscopic binary /Plaskett and Pearce 1931/ and the brighter component of the visual binary ADS 14549 /the other component, 4.5^m fainter, is 2.6" away/. According to a recent determination /Slettebak 1982/, its spectral type is B1 Ve and v sin i = 300 km/s. Various available records /c.f., e.g., Hubert-Delplace and Hubert 1979, Slettebak 1982, etc./ clearly indicate long-term variations of the hydrogen emission lines and occasional presence of the Balmer shell lines.

To our best knowledge, 60 Cyg has neither been known nor suspected to be a variable star. Yet, its variability seems probable from an inspection of available records. Mendoza /1958/ obtained $V = 5.43^m$, $B-V = -0.22^m$, $U-B = -0.92^m$ /the date of his observation is unknown/. Beljakina and Chugainov /1960/ derived $B-V = -0.191^m$, $U-B = -0.928^m$ from 5 observations in summer 1957. Häggkvist and Oja /1966/ determined $V = 5.36^m$, $B-V = -0.25^m$ from 3 observations secured between May 1964 and December 1965. The most convincing evidence of variability comes from two differential observations of the star by Haupt and Schroll /1974, and priv. comm./:

	V	B-V	U-B
JD 2440449.5	5.341^m	-0.174^m	-0.961^m
JD 2440451.5	5.479^m	-0.168^m	-0.949^m .

Their comparison star was HD 199986, for which we assume $V = 7.03^m$, $B-V = 0.21^m$, $U-B = 0.09^m$ to derive the above values for 60 Cyg.

We have secured 55 UBV observations of 60 Cyg during 17 nights in August - September 1985 as a part of the on-going international observing campaign on bright Be stars /Harmanec et al. 1980/. All the observations were obtained using the 0.65-m reflector installed at the Hvar Observatory, Yugoslavia. Obligatory campaign comparison and check star, HD 199311 and HD 199479, respectively, were used. The data were corrected for extinction and carefully reduced to the standard UBV system.

Differentially derived V, B-V, and U-B values /averages of 3 to 5 individual observations/ of 60 Cyg and of HD 199479 are plotted versus heliocentric Julian date in Fig. 1. Rapid light variations of 60 Cyg, with the amplitude as large as 0.1^m, have clearly been detected. Any accompanying colour variations, if present at all, have amplitudes below 0.02^m.

A period search, using Stellingwerf's /1978/ technique, indicated a family of frequencies of 0.42 /$P = 2.4^d$/, 1.42, 2.42, etc. cycles per day in the individual V observations but the analysis seems unwarranted considering the scarcity and limited number of the data.

As the range of the radial-velocity variations observed is rather large /almost 80 km/s/, we decided to compile 21 radial-velocity observations available in the astronomical literature and analyse them with Morbey's /1978/ period-finding technique. The following possible periods were detected: 22.55^d, 13.797^d, 5.8868^d, 4.62463^d, 3.51389^d, 2.48257^d, and 1.31997^d. Formal orbital solutions, with the allowance for different systemic velocities of different spectrographs, indicated

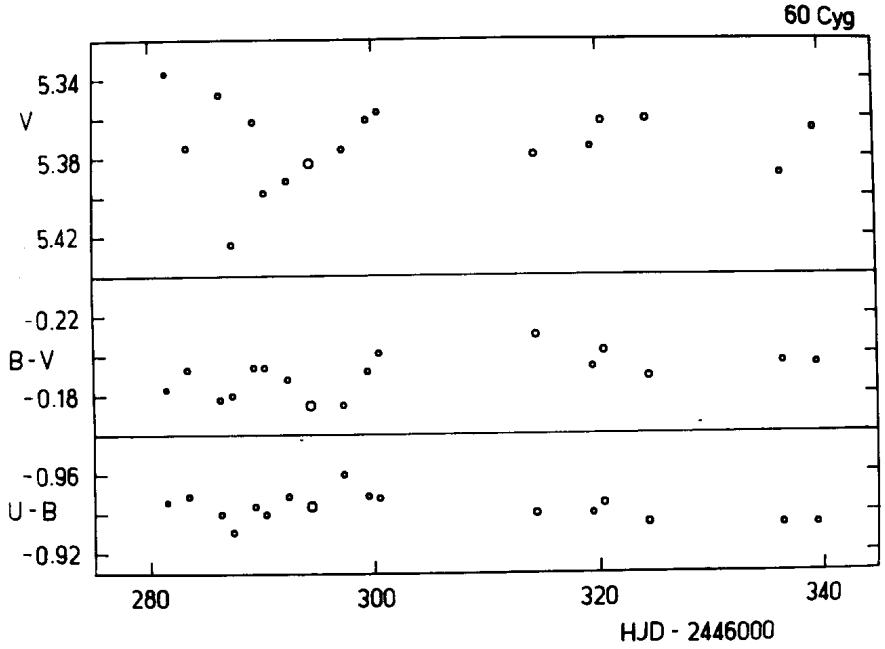

Figure 1/a

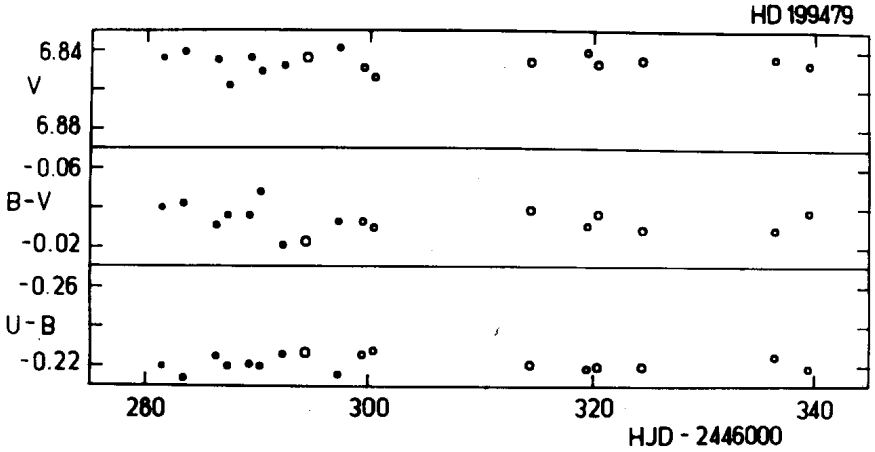

Figure 1/b

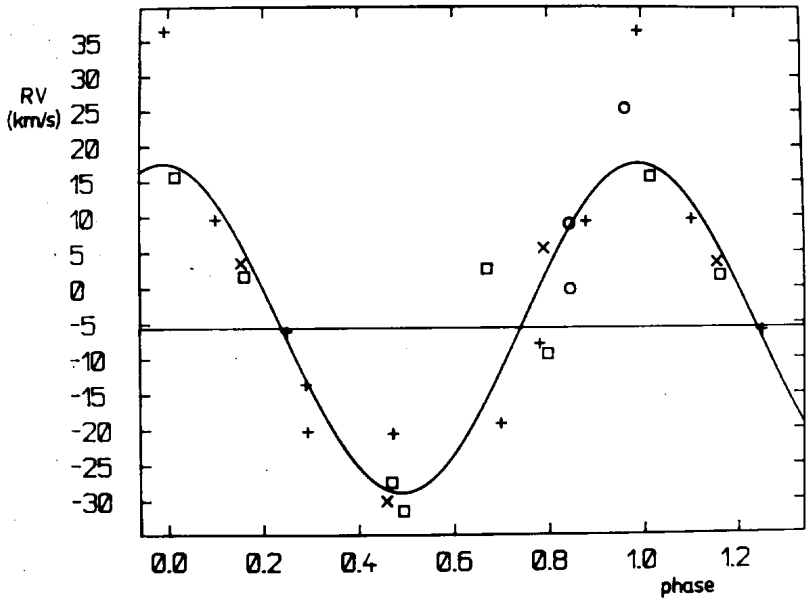

Figure 2

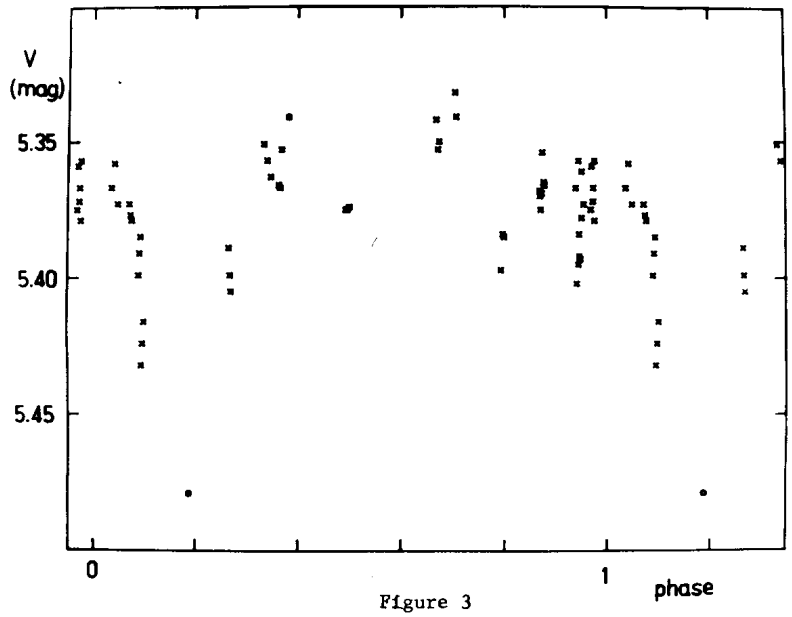

Figure 3

P = 2.48257 ± 0.00002 days as the most probable period. The orbit is probably circular, with K = 23 ± 2 km/s, $T_{inf.conj.}$ = JD 2424411.298 ± 0.039, f/M/ = 0.00320 solar masses, and a sin i = 1.14 solar radii. Reasonable fits were also obtained for some other of the above-listed values of the period. The radial-velocity curve for the 2.48-day period is shown in Fig. 2.

Considering this result, we repeated the period search in the neighbourhood of the 2.48-day in the photometric data, including now also the two differential observations by Haupt and Schroll. We have indeed found significant periods 2.48347^d, 2.48242^d, 2.48138^d, and 2.48032^d. The light curve for the period of 2.48242^d /which is close to the spectroscopically determined value/ is shown in Fig. 3. It is reminiscent of a light curve of an eclipsing binary, though with some scatter. It is clear, however, that the evidence rests mainly on one observation by Haupt and Schroll. It is easy to verify that neither the parameters of the orbital solution nor the amplitude of the light curve contradict to the binary interpretation.

The following conclusions can be drawn:

1. 60 Cyg is certainly variable in light on a time scale of days or shorter.
2. The possibility that 60 Cyg is a spectroscopic binary with an orbital period of 2.48^d /certainly not longer than 22.55 days/ appears quite plausible. The data presented here indicated that it even can be an eclipsing binary, the extra scatter of the light curve being possibly caused by the intrinsic light variations of the B1e primary. We warn, however, that this result must be considered a fortuitous coincidence only - unless more numerous data confirm or disprove it.
3. 60 Cyg is an interesting object, easily observable from Northern Hemisphere, and its continuing study is certainly warranted.

Acknowledgement

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