COMMISSION 27 OF THE I. A. U.
INFORMATION BULLETIN ON VARIABLE STARS
Number 3297

Konkoly Observatory
Budapest
1 March 1989
HU ISSN 0374 - 0676

On the lightcurve of HD27563

The B5III (Cowley, 1972) star HD27563 (= HR1363) has been studied photelectrically by Mathys *et al.* (1986) in the *uvby* system. They concluded that it was probably a multi-periodic object with periods around 4 days. This was essentially based on observations we made during 20 nights in November 1977 (43 measurements) at the ESO observatory on La Silla, with the 50cm telescope. A few additional data came from two other observing runs we carried out in the same system, at the same telescope, in December 1978 (7 measurements) and September 1981 (7 measurements).

More data have been provided by the "Long Term Photometry of Variable" group (Sterken, 1983) during two months of observing at La Silla in October and December 1982 (27 measurements). They are also in the Strömgren system, although the filter set used at that occasion was less than perfectly conform.

In all four observing runs, HD27563 was used as a comparison star for the variable CP star HD29009. Coincidentally the period of that CP star is also close to four days so that it was not immediately obvious that each object did vary. The other comparison star which was measured proved to be variable too, so that we had to rely exclusively on "absolute" reductions to study the lightcurve of HD27563.

Among period searching methods, Deeming's (1975) method is well suited to multiperiodic phenomena. The power spectra obtained for the largest data sets (1977 and 1982) show a clear peak close to $\nu = .25$ d^{-1} (Figures 1 and 2) as well as strong aliases at $1 \pm \nu$. However the central frequencies do not coincide exactly (0.257 d^{-1} in 1977, and 0.275 d^{-1} in 1982). Because of the longer time base, the 1982 data set is able to show separate components in the peaks, and particularly at 0.254 d^{-1}, close to the 1977 value. The frequency splitting ($\Delta\nu \sim 0.021$ d^{-1}) is only 20% wider than the natural splitting shown in the spectral window, indicating some degree of interference. Power peaks appearing around 1.0 d^{-1} are aliases of very low frequency features—not seen entirely on the figures—and are artefacts due to an improper normalization between the data of October and December 82.

After merging all data sets, Deeming's frequency analysis gives a very noisy spectrum with a complex substructure (Figure 3). The strongest peak occurs at $\nu_1 = 0.25503$ d^{-1} (or 3.9211 d) with fine structure components (barely resolved on

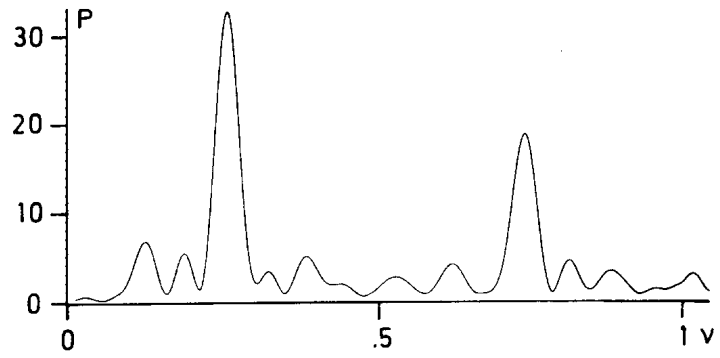

Figure 1: Power spectrum of the observations of HD27563 obtained in November 1977. All colours show very similar behaviours. The geometric mean of u, v, b and y is presented here. Units are mmag^2.

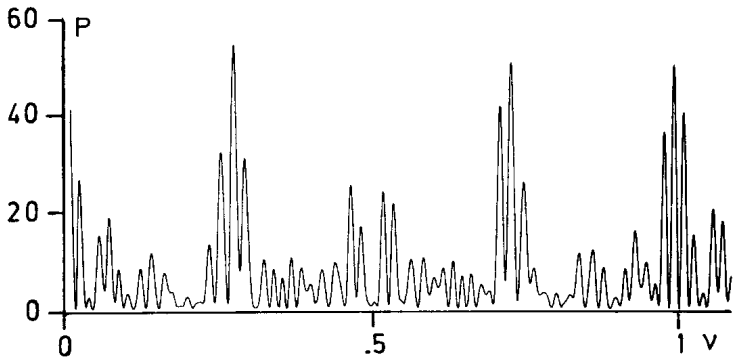

Figure 2: Power spectrum of the observations of HD27563 obtained in October–December 1982.

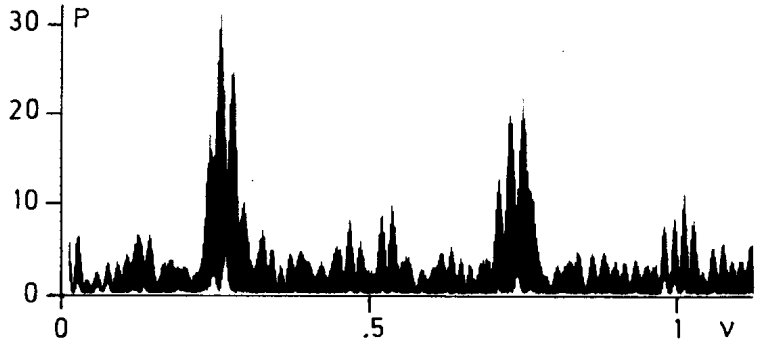

Figure 3: Power spectrum of all observations of HD27563.

Figure 3) around $\nu_1 \pm 0.0022$ d^{-1}. The broader splitting seen in the 1982 data shows itself with main components around $\nu_2 = 0.27502$ d^{-1} (3.6361 d) and around $\nu_2 \pm 0.0022$ d^{-1}. Strong aliases are present close to $1 \pm \nu_1$ and $1 \pm \nu_2$ and so are the combs around multiples of .5 d^{-1}.

After prewhitening by ν_1 or any of its main secondary components, the peaks around ν_2 subsist although with slightly different frequencies and amplitudes. At the same time the $1 \pm \nu$ aliases becomes more important. Prewhitening of the data with several of those frequencies is always less than satisfactory, suggesting the presence of additional frequencies. The main frequency at $\nu_1 = 0.25503$ d^{-1} or 0.25284 d^{-1} is apparently stable over several years. Our analysis favours the presence of at least another frequency ν_2, with the most likely pairings (ν_1, ν_2) being either of the following combinations: (0.25503,0.27785), (0.25503,0.29403), (0.25284,0.27723), (0.25284,0.27504). Because of the complexity of the power spectrum, it is difficult to decide conclusively on the presence or stability of the periodicities. However we notice that a quadruplet of frequencies (for instance 0.228734, 0.255027, 0.277850, 0.289394) yields a very clean prewhitening, and we suggest that such a multiperiodicity is effectively present.

The relatively bad accuracy of the data due to the lack of comparison stars, as well as the closeness of the periods to 4 days, make further analysis of HD27563 desirable.

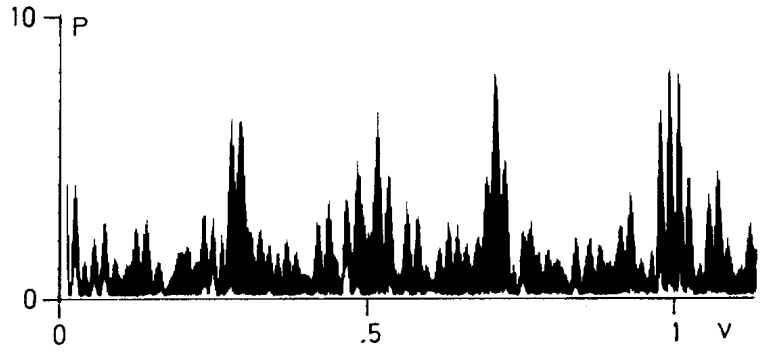

Figure 4: Power spectrum of the observations of HD27563 prewhitened for $\nu_1 = 0.25503\ \mathrm{d}^{-1}$.

Acknowlegments: The author is grateful to Dr. P. Renson for helpful comments. He also thanks Drs. O. Stahl and M. De Groot for their contribution as observers of the "Long Term Photometry of Variables" project.

J. MANFROID
Institut d'Astrophysique
Université de Liège
B-4200 Liège
Belgium

References

COWLEY, A.: 1972, *Astron. J.* **77**, 750.

DEEMING, D.J.: 1975, *Astrophys. Space Sc.* **36**, 137.

MATHYS, G., MANFROID, J., RENSON, P.: 1986, *Astron. Astrophys. Suppl. Ser.* **63**, 403.

STERKEN, C.: 1983, *The Messenger* **33**, 10.