IS VW ARIETIS AN ELLIPSOIDAL BINARY?

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The well-known δ Scuti type star VW Arietis, a primary component of the binary system BDS 1269, can be an ellipsoidal binary in its turn. This suggestion follows from the ratio of principal frequencies and is supported by the observed spectral features of the star.

The problem of the visual binary system BDS 1269, in which the primary component HD 15165 has the strong metal-deficient chemical composition whereas the secondary component HD 15164 is a quite normal F type star, is discoursed in the literature repeatedly. Although an angular separation between the components, 74 arcsec, is rather large, it was proved that BDS 1269 is a physical association. A long time the opinion prevailed that two stars of different ages were united in a system. It was considered even the suggestion [9] of the capture an old Population II star by a Population I object. This enigmatic primary component is a well-known δ Scuti star, VW Ari.

We obtained the dual-channel photometry of VW Ari at the Mt. Dushak-Erekdag station of Odesa Astronomical Observatory in Oct. 1993 [2]. The star has been observed on the same season in the Xinglong Observatory (China) and Observatorio del Teide (Spain) in the fifth campaign of STEPHI network [7]. I combined three data sets and proposed five-frequency solution: 6.23 c/d, 6.52 c/d, 9.34 c/d, 10.81 c/d, 12.85 c/d [3].

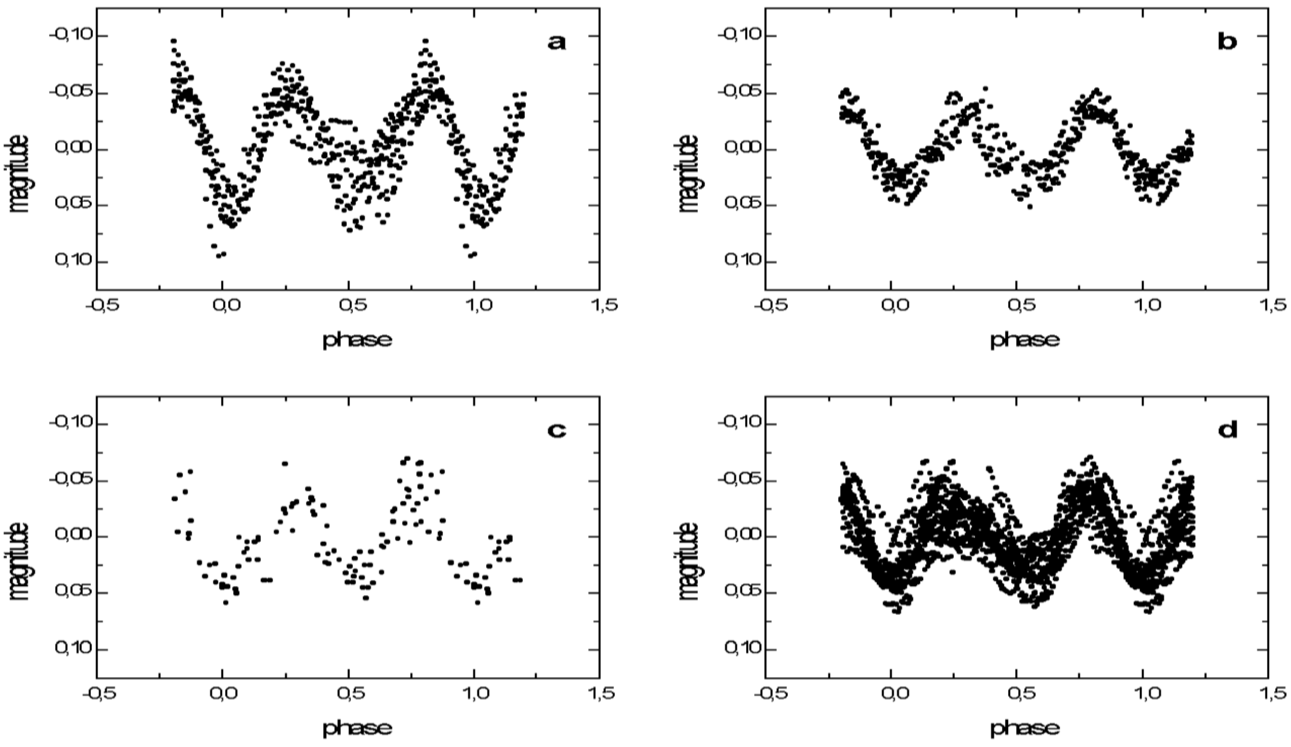

Figure 1: Phase diagrams for different data sets: a - data 1982, McNamara & Horan [8]; b - data 1987, Li & Jiang [6]; c - data 1990–1992, Hipparcos [5]; d - data 1993, STEPHI & Mt. Dushak-Erekdag [3]

Then we collected the previously obtained photometric data of VW Ari and re-analyzed the light curves. We noted that the frequency 9.34 c/d is more pronounced in the data series with the long time spanning (*e.g.*, [8], or [7]), whereas the frequencies close to 10.81 c/d are better seen in the short data runs (*e.g.*, [6]). On the other hand the frequencies 6.23 c/d and 9.34 c/d can be the second and third harmonics of the fundamental frequency 3.11 c/d from the exact relation *3.11 : 6.23 : 9.34=1:2:3*.

One can suppose that we deal with the light curve of a binary with an orbital period approximately $0^d_.321$. We fold the data with this period to see the phase diagram. In Fig. 1 the phase diagrams of the period of $0^d_.321$ are presented for the data from 1982 to 1993. All the double-wave curves have one special feature: one wave has less amplitude and more scatter than another wave, which is more regular. The phase diagrams are very similar to the diagrams of ellipsoidal binaries, for example, V2082 Cyg or DG Dra (see [5]).

By its spectral features VW Ari could be related to λ Bootis stars [1]. It is interesting that Farraggiana and Bonifacio [4] in their detailed review of the peculiar features of λ Bootis stars noticed that such features can arise in composite spectra of close binaries.

This way it is possible that the primary component of the binary system BDS 1269 consists of two normal stars and the previous problem of chemical peculiarity is solved. However, at present we can state, the problem of VW Ari is rather complicate and not solved yet, taking into account that, apparently, one of its components pulsates. Therefore, the measurements of radial velocities can resolve the problem.

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