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ASAS 081933-2358.2: RRc-TYPE VARIABLE WITH TWO CLOSELY SPACED FREQUENCIES

ANTIPIN, S. V.[1,2]; JURCSIK, J.[3]

[1] Sternberg Astronomical Institute, 13, University Ave., Moscow 119992, Russia; e-mail: antipin@sai.msu.ru

[2] Institute of Astronomy, Russian Academy of Sciences, 48, Pyatnitskaya Str., Moscow 119017, Russia

[3] Konkoly Observatory of the Hungarian Academy of Sciences, P.O. Box 67, H-1525 Budapest, Hungary; e-mail: jurcsik@konkoly.hu

According to the ASAS3 list of new variables (Pojmanski, 2003), ASAS 081933-2358.2 (= TYC 6556 609 1 = CPD−23°3633 = CD−23°7130) is an RRc-type variable with the period of 0.285668 days. However, this star deserves a more careful investigation because of the exceptionally large scatter of its phased light curve. The classification of variable stars in the ASAS3 project is good enough in general, but in some cases important details are lost. For example, a circumspect analysis of ASAS3 data led to the discovery of four new double-mode Cepheids (Wils & Otero, 2004).

The results of the frequency analysis of ASAS3 observations of ASAS 081933-2358.2 are presented in Fig. 1. It is found, that the scatter of the light curve can be explained by the superposition of two close frequencies corresponding to the following light elements:

$$JD_{max} = 2453440.665 + 0\overset{\mathrm{d}}{.}285665 \times E \text{ and}$$

$$JD_{max} = 2453015.749 + 0\overset{\mathrm{d}}{.}296111 \times E.$$

The phased light curves are shown in Fig. 2. Folded curves of the deviations from the mean light curve of the other oscillation are plotted in the bottom panels.

After prewhitening the data with the two main frequencies the residual spectrum (bottom panel in Fig. 1) indicates that the combination frequency $(f_1 + f_2)$ also appears in the spectrum. The existence of nonlinear interaction between the oscillations rules out the possibility that two RRc-type variables in the same line of sight (i.e., a blend) are observed. According to the duplicity flag of the Tycho data no indication of duplicity was found, which also strengthens our solution.

Closely spaced frequency components of three RRc stars in the globular cluster M55 were first discovered by Olech et al. (1999). This type of variation (showing frequency doublets in the Fourier spectrum) was classified as ν_1 variables by Alcock et al., (2000) utilizing the discovery of 24 additional similar objects in the LMC. Based on the large frequency ratio of the components (larger than 0.9 in every case) the most plausible explanation of the phenomenon is the excitation of a nonradial mode pulsation in the vicinity of the radial mode frequency.

Up to now, no galactic field RRc stars showing similar behaviour has been discovered. This gives an unique opportunity, that by studying this relatively close object we could learn much more about this interesting type of stars.

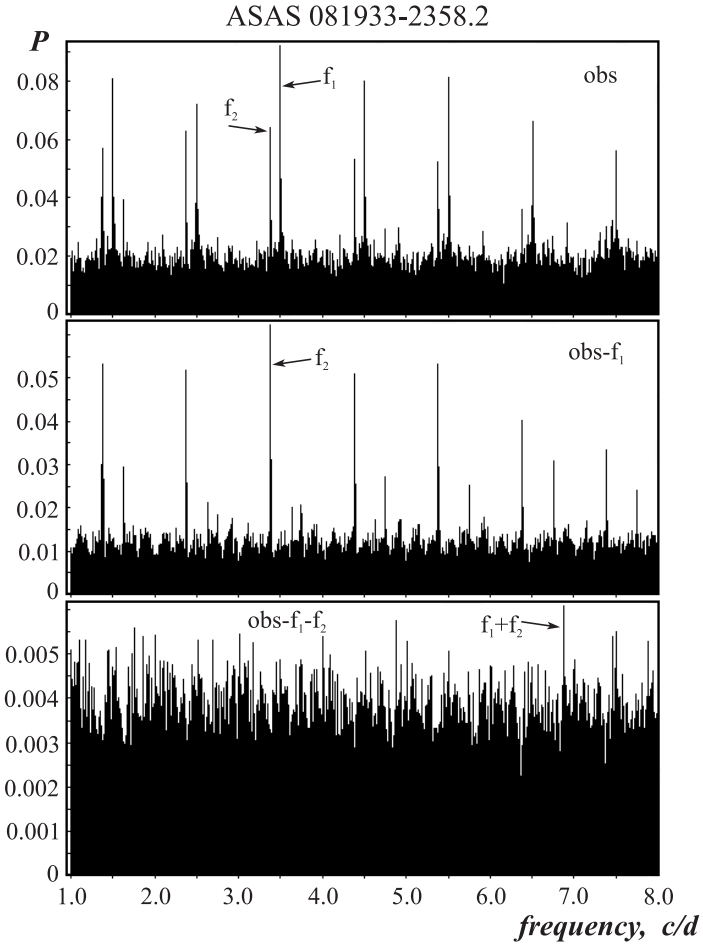

Figure 1. The power spectra.

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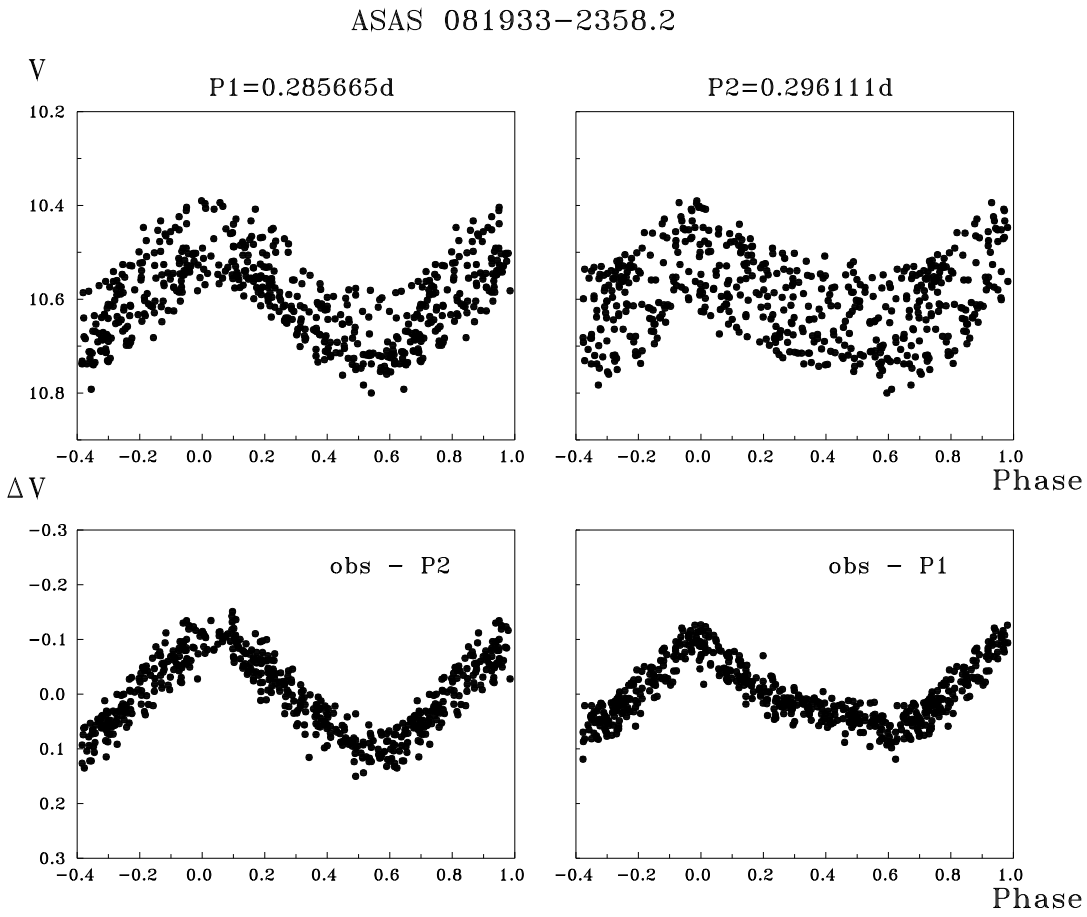

Figure 2. ASAS 081933-2358.2. The phased light curves based on ASAS3 observations.

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