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Pulsating components of eclipsing binaries from the ASAS-3 data

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Abstract

We report detection of pulsating components in 14 eclipsing binaries as a result of the search among over 10 000 stars from the public ASAS-3 database. In addition, we found evidence for eclipses in the VV Cephei-type star FR Sct.

Introduction

It is well known that the combination of the light curve of an eclipsing binary with its double-lined spectroscopic orbit provides direct way to the determination of masses and radii of the components. These parameters are crucial in modelling stars and are extremely useful when a component is pulsating.

Semi-detached and detached systems that could already have undergone mass-transfer episodes are especially interesting in this context. If the mass-gainer is pulsating, its internal structure and pulsation properties might be different from those of a single star. This is the case of mass-accreting pulsating components in Algols, called 'oscillating EA' (oEA) systems (Mkrtichian et al. 2004) which are now intensively studied. If the components are close enough, we may also investigate the influence of tidal effects on pulsations.

In this paper we present the results of a search for pulsating components among over 10 000 stars from the public ASAS-3 database (Pojmański 2001) classified as eclipsing binaries.

The results

We found 14 eclipsing binaries which have pulsating components. Six stars with well-defined Algol-type light curves (HD 62571, HD 99612, HD 220687, MX Pav, IZ Tel, and VY Mic) show also changes with periods shorter than 0.11 d. They are therefore very good candidates for oEA systems in which the primary star is a δ Scuti-type pulsator while the late-type secondary fills its Roche lobe. This classification of the primary as δ Scuti-type pulsator is in accordance with the published spectral types ranging from A2 to F0. For two stars, HD 62571 and HD 220687, more than one periodicity was detected.

In the ASAS-3 photometry of the next four systems with almost equal depths of eclipses, we found changes with periods ranging from 0.12 to 0.21 d. They could be also attributed to δ Scuti-type variability. For two stars, CPD-60°871 and HD 94529, this is confirmed by their spectral types. However, the two other stars, CPD-41°5106 and CPD-31°6830, have no spectral type available and therefore they might be β Cephei pulsators as well.

Another system in our list, ALS 1135, is a member of the OB association Bochum 7. The system consists of an O6.5[(f)] and a B1V component (Fernández Lajus & Niemela 2006). In addition to the eclipses, we found variations with a period of 0.4327 d. The period seems to be too long for a β Cephei star, unless the pulsations originate in the O-type primary. In such stars, modes with longer periods are predicted by theory.

Three stars with sinusoidal variations with periods of 0.6 – 1.1 d, typical for SPB-type pulsations, were also found among eclipsing binaries. For two of them, HD 251168 and V4396 Sgr, this is confirmed by their late B spectral types. The third star, Y Cir, is slightly

different, because it shows an Algol-type light curve and the spectral type of primary is A2. Still, because this spectral type is uncertain, the SPB classification is the most likely one.

We have also found clear evidence for eclipses in FR Sct, a VV Cephei-type binary composed of an M-type supergiant and an O-type star (M3 Iaep + O9.5 V). The orbital period of 3.53393 d, deduced from the eclipses, must not be attributed to this pair. The most suitable explanation is that the hot component is itself a binary and we see eclipses in this system. It is therefore very likely that FR Sct is an hierarchical system consisting of three very massive stars.

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Pawel Moskalik and Gabriela Michalska wandering around the posters.