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A new multiperiodic γ Doradus variable in Andromedae

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Abstract. γ Dor-type oscillations have been discovered in the star HD 218427 through simultaneous *uvby* photometric observations carried out in the year 2003. A few H$_\beta$-Crawford measurements were also collected for calibration purposes which place this star well-located inside the γ Dor instability region. Frecuency analysis was carried out for different filters, the combined “vby” filter was also used and five frequencies were found as significant with periods ranging between 0.3 and 0.8 days. The recently developed Frequency Ratio Method (FRM, Moya et al. 2005) is used in order to perform a modal identification of the peaks.

Key words. Stars: variables: SX Phe – Stars: individual: BL Cam – Stars: oscillations – Techniques: photometric

1. Introduction

The γ Dor variables constitute a relatively recent recognized class of pulsating variables in the zone where the red edge of the δ Sct region intersects with the main sequence. In fact, both regions are partially overlapped. The discovery of new γ Dor-type pulsators is of crucial interest in order to increase the sample of *bona fide* members, performing a reliable definition of the observational borders of this region and improving our knowledge on the constraints taking place in these variables.

2. Observations and results

The observations were carried out in 2003 using the 90 cm telescope at Sierra Nevada Observatory (Spain) and 1.5 m telescope at San Pedro Mártir Observatory (Mexico). Both telescopes are equipped with identical six-channel *uvbyβ* spectrograph photometers for simultaneous measurements in *uvby* or the narrow and wide H$_\beta$ channels.

During this run, HD 218427 (V=8.^{m}17, ST=F0) revealed a slight variability with peak-to-peak amplitude of ΔV$\sim$0.^{m}01 and main period of $\sim$0.8 days. This, together with its multiperiodic behaviour and photometric information available in the bibliography, let us assume

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Table 1. Results from the Fourier analysis applied to the four *uvby* filters including the corresponding amplitude S/N ratios.

	u			*v*			*b*			*y*		
Frequency (cd^{-1})	A (mmag)	φ (rad)	S/N	A (mmag)	φ (rad)	S/N	A (mmag)	φ (rad)	S/N	A (mmag)	φ (rad)	S/N
	±0.73			±0.35			±0.31			±0.34		
f_1=1.3326	5.98	3.171	6.6	8.48	3.125	14.1	7.24	3.136	14.5	5.53	3.080	11.5
		113			38			40			56	
f_2=1.3591	3.17	5.744	3.5	6.57	6.158	11.0	6.24	6.181	12.5	4.97	6.236	10.4
		225			51			48			65	
f_3=1.4779	2.91	0.948	3.2	3.46	1.531	5.8	3.00	1.701	6.0	3.04	1.892	6.3
		235			83			86			91	
f_4=3.7164	2.27	4.089	3.0	2.23	4.354	4.2	2.20	4.335	4.8	1.79	4.270	3.7
		242			118			108			143	
f_5=2.2813	-	-	-	2.28	4.078	3.8	2.01	4.081	4.1	1.75	4.257	3.6
		-			118			121			149	
residuals (mmag)	10.7			5.3			4.8			5.2		

this star as a new multiperiodic γ Dor variable and, hence, a good target to study.

The analysis of the pulsational content was performed using the method described in Rodríguez et al. (1998) and the results checked with the new available package of computer program PERIOD04 (Lenz & Breger 2005), providing identical results. Five frequencies were found significant and the results are consistent, in all cases, with γ Dor-type pulsation. The results are listed in Table 1. The Frequency Ratio Method (FRM, Moya et al. 2005) has been applied to HD 218427 in order to obtain information on: 1) possible identification of the radial order *n* and degree *l* of the excited modes and 2) an estimate of the integral of the buoyancy frequency (Brunt–Väisälä) ($\mathcal{I}$) weighted over the stellar radius along the radiative zone. Considering the photometric error boxes and additional constraints on $\mathcal{I}_{\rm obs}$, log g and T_e, a short list of representative models are obtained for M=1.30 and 1.40 $M_\odot$ assuming an uncertainty of 1% in obtaining the theoretical value of $\mathcal{I}$ ($\mathcal{I}_{\rm th}$). The results indicate as the most representative models those corresponding to the following mode identification (l=2, m=0), for models with M=1.30 $M_\odot$: f_n=(43,42,39), (44,43,40), (45,44,40) and for models with M=1.40 $M_\odot$: f_n=(43,42,39), (44,43,40) with f_n=(n_1,n_2,n_3). If f_4 and f_5 are included in our study, the list of solutions is reduced to: f_n=(43,42,39,15,25) for M=1.30 or 1.40 $M_\odot$ and f_n=(45,44,40,16,26) for M=1.30 $M_\odot$.

References

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