RevMexAA (Serie de Conferencias), **35**, 148–149 (2009)

ON THE VARIABILITY OF HD 170699 – A POSSIBLE COROT TARGET

M. Álvarez,[1] J. P. Sareyan,[2] L. Parrao,[3] J. H. Peña,[3] L. Fox-Machado,[1] E. Poretti,[4] S. Martin-Ruiz,[5] P. Amado,[5] R. Garrido,[5] C. Aerts,[6] Z. Csurby,[7] and M. Paparo[7]

RESUMEN

Se presenta el análisis de la variabilidad de HD 170699, una estrella del programa COROT que muestra características de una estrella tipo δ Scuti no evolucionada con alta velocidad de rotación. Muestra una variabilidad con un claro período de 10.45 c/d con 5.29 mmag de amplitud en el filtro y. De las observaciones, podemos ver que la estrella es multi-periódica y que se requiere añadir más frecuencias para ajustar las observaciones.

ABSTRACT

We present the analysis of the variability of HD 170699, a COROT star showing the characteristics of a non evolutionary δ Scuti star with high rotational velocity. There is a clear period of 10.45 c/d with 5.29 mmag amplitude in the y filter. From the data, it can be seen that the star shows multi-periodicity and it is necessary to add more frequencies to adjust the observations.

Key Words: delta Scuti — stars: individual (HD 170699)

1. GENERAL

The study of the interior of the stars is a well established branch of *asteroseismology*. Photometric studies of δ Scuti stars, γ Dor, β Ceph among others has shown to be a very good tool to determine the oscilatory behaviour of these interesting objects. Recently, within the framework of COROT's program, a group of stars were observed from different ground based observatories to select some of the *primary* and *secondary* targets, both in the *Galactic* and *Antigalactic Center* direction within the field of view of the satellite. Preliminary results of COROT's program, are in the electronic page `http://exoplanet.eu/corot.html`.

HD 170699 is an A2 star in a double system with magnitude B=7.44 and V=6.956; it was reported as a possible multiperiodic variable by Poretti et al. (2003) after one night of observations in 2002. The position of HD 170699 within the field of view of COROT's satellite, makes it a very promissing object to study. Its high rotational velocity of $v\sin_i > 200\ \mathrm{km\ s^{-1}}$, makes it an interesting object to understand its behavior within the pulsation treatment.

2. OBSERVATIONS – PHOTOMETRY

2.1. *Differential photometry*

As a continuation of monitoring some δ Scuti and γ Dor objects, HD 170699 (HIP 90728, SAO 123585), a *secondary target* of COROT's program was observed at San Pedro Mártir Mexican observatory (SPM) and Sierra Nevada observatory (OSN), Granada, Spain with the *uvby* Strömgren system during 34 nights on 2007, 2005, 2004 and 2002, making more than 180 hours of observation. During the 2007 season, we included the Hβ filter in our measurements. The star was also observed at Hungary and by the MERCATOR team.

Figure 1 shows the differential photometry of HD 170699-HD 173369, during one night at SPM Mexican observatory. A clear variation with three maxima and possible multiperiodicity is seen in filters (v, b, y), during the almost 6 hours of observation.

As comparison stars, we observed HD 173369 and HD 172046 and finally we chose the first HD 173369, for all the program, except for the first night in 2002, were HD 166991 was the only comparison star of the observing run.

In Figure 2 we show the average daily values of Strömgren filters u, v, b, y for the length of the campaign, we arbitrary displaced in time to show the different epochs of observation. The daily change

[1]Instituto de Astronomía, Universidad Nacional Autónoma de México, Apdo. Postal 877, Ensenada 22860, B. C., México (alvarez@astrosen.unam.mx).

[2]Observatoire de la Cote dAzur, GEMINI, UMR 6203, BP 4229, 06304 Nice Cedex 4, France.

[3]Instituto de Astronomía, Universidad Nacional Autónoma de México, México.

[4]INAF Osservatorio Astronomico di Brera, Via Bianchi 46, 23807 Merate, Italy.

[5]Instituto de Astrofísica de Andalucía, Consejo Superior de Investigaciones Científicas, Apdo. 3004, 18080 Granada, Spain.

[6]Instituut voor Sterrenkunde, KatholiekeUniversiteit Leuven, Celestijnenlaan 200 B, 3001 Leuven, Belgium.

[7]Konkoly Observatory, Hungary.

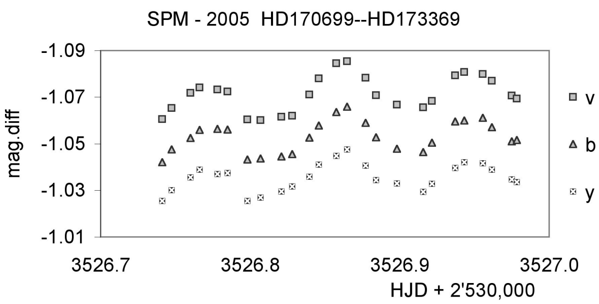

Fig. 1. Differential photometry of HD170699-HD173369 during the HJD 2453,526 at SPM observatory. A period between 1.6 to 2.1 hours can be observed from our measurements.

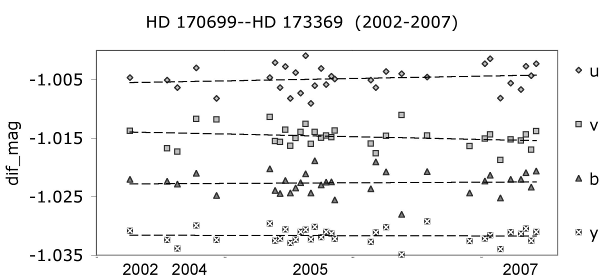

Fig. 2. Average daily values of the differential photometry of HD 170699-HD173369 from 2002 to 2007.

give us a clear indication of the variability in this star. Filter u shows a strong instability in their values and we did not include this filter in our analysis.

2.2. *Absolute photometry*

We report our system photometry observations obtained during the 2007 season, we observed the variable and the comparison stars with the Strömgren system including the Hβ filter. During the campaign, we observed more than 39 standard stars to obtain the absolute calibration of them.

In Table 1 we report our own measurements and those given at the CDS (Simbad) for HD 170699 and the comparison stars used during 2004 to 2007 campaign at SPM and OSN observatories.

Mercator team measured on the *Geneva* system and their results will be given elsewhere. The two nights measurements of M. Paparo and Z. Csurby were done in the V filter and we are not using their results in this work. The averaged instrumental value they obtain from two nights of measurements is V = −1.026.

3. FREQUENCY ANALYSIS

For the frequency analysis, we used PERIOD04 (Lenz & Breger 2005) numerical package and PERANSO software (Vanmunster 2007). We analyzed the whole set of data, we used SPM data (9 nights in 2007, 13 nights in 2005 and 2 nights in 2004) and also include OSN data (7 nights in 2005, 2 nights in 2004).

In Table 2 we report three frequencies found for this star. There is a clear frequency of 10.45 c/d with amplitude of 5 to 6 mmag. Other frequencies at 2.46, 3.48, 4.45 and 3.18 c/d with amplitudes of 2 and 3 mmag may be present, although there is not enough information to discriminate between them. Clearly, it is a good target for COROT's program. The final analysis of this work is under preparation and will be published elsewhere.

TABLE 1

HD 170699 AND PROGRAM STARS

Star	V	b-y	m_1	c_1	Hβ	# mes
170699	6.959	0.127	0.163	0.978	2.796	625/36†
173369	7.989	0.115	0.232	0.887	2.839	650/42†
172046	6.671	0.035	0.071	0.551	2.695	642/38†
170699	6.956	0.127	0.174	0.985	2.820	2/2*
173369	7.970	–	–	–	–	–*
172046	6.676	0.038	0.065	0.611	2.704	12/10*

†This paper – 39 standard stars observed during our June-July 2007 measurements.

*CDS Simbad.

TABLE 2

FREQUENCY OF HD 170699 – 2002 TO 2007

filter	f_1 (A_1)	f_2 (A_2)	f_3 (A_3)
v	10.4509(6.88)	2.4604(3.37)	3.1904(3.14)
b	10.4509(6.54)	3.4844(3.33)	3.1809(3.01)
y	10.4509(5.29)	3.1838(2.26)	4.4539(1.97)

u measurements show a poor signal (not used in the analysis) – freq. in c/d – amp in mmag.

This research was done as part of PAPIIT IN108106 Program of UNAM.

REFERENCES

Lenz, P., & Breger, M. 2005, Commun. Asteroseismol., 146, 53
Poretti, E., et al. 2003, A&A, 406, 203
Vanmunster, T. 2007, Peranso, Lightcurve and period analysis software (http://www.cbabelgium.com)