Radial and Nonradial Pulsations as Probes of Stellar Physics
ASP Conference Series, Vol. 259, 2002
C. Aerts, T.R. Bedding, & J. Christensen-Dalsgaard, eds.

Mode Identification in the δ Scuti Star 20 CVn

M. Chadid[1], P. Mathias

Observatoire de la Côte d'Azur, UMR 6528, Nice, France

J. De Ridder, C. Aerts

Instituut voor Sterrenkunde, Katholieke Universiteit Leuven, Belgium

Abstract. We present a new spectroscopic study of the δ Scuti star 20 CVn in order to solve the controversy on the type of pulsation mode of this object.

1. Introduction

We have taken the initiative to gather spectra for the seemingly monoperiodic δ Scuti star 20 CVn to find out in what kind of mode it pulsates. Up to now all mode identifications obtained via spectra point towards a non-radial mode for the main frequency, while photometric methods favour a radial mode. The most recent spectroscopic mode identification was done by Mathias & Aerts (1996) who obtained a non-radial primary mode. They also suggested that 20 CVn has at least 2 pulsation periods, but they were unable to find a frequency for the second one. However, from a photometric study, Rodríguez et al. (1998) concluded that 20 CVn is definitely monoperiodic. The spectroscopic observations used in this study were made with the cross-dispersed spectrograph ELODIE of the 1.93 m telescope of the Observatoire de Haute-Provence, with a resolution of R=37000 and an average signal-to-noise ratio of 150.

2. Results

We performed a frequency analysis on the data with 4 different methods: Fourier, CLEAN (Roberts et al., 1987), Vanicek (1971) and PDM (Stellingwerf, 1978) – see Fig. 1. The photometric frequency is also clearly present in our new spectroscopic variations. Prewhitening with this frequency leads to flat periodograms. Hence, we confirm the monoperiodic character of 20 CVn in the radial velocity data. A sine-fit performed with the photometric frequency accounts for more than 99.6% of the variability of the radial-velocity data. Mathias & Aerts (1996) obtained a different result, because of their small data set and since the moments of a cross-correlation profile have to be interpreted differently than those of a real spectral line.

[1]Postdoctoral Fellow, ESO/Paranal; e-mail: chadid@obs-nice.fr & mchadid@eso.org

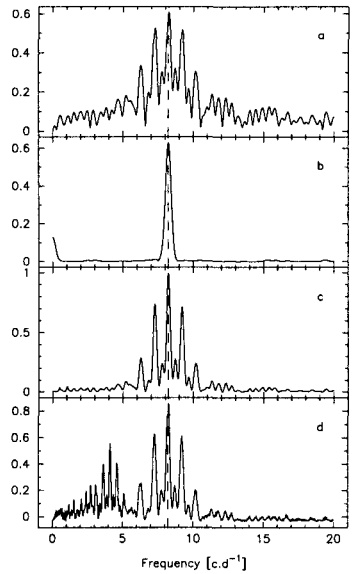

Figure 1. Frequency analysis for the velocities obtained in 1998. The vertical dashed line represents 8.2168 c.d^{-1} (Rodríguez et al., 1998). a: Fourier, b: CLEAN, c: Vanicek, d: PDM.

3. Conclusions

We conclude that only the radial mode is able to fit both the observed moment variations and the observed line profile variations. Our study thus solves the controversy between the photometric and spectroscopic behaviour of 20 CVn, since we fully agree with the identification of a radial mode, as proposed by Rodríguez et al. (1998).

References

Mathias, P., Aerts, C. 1996, A&A, 312, 905
Roberts, D.H., Lehár, J., & Dreher, J.W. 1987, AJ, 93, 968
Rodríguez, E., Rolland, A., Garrido, R., et al. 1998, A&A, 331, 171
Stellingwerf, R.F. 1978, ApJ, 224, 953
Vanicek, P. 1971, Ap&SS, 12, 10

https://doi.org/10.1017/S0252921100016407 Published online by Cambridge University Press