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λ Boo stars among the γ Dor-type pulsators: the cases of HD 218427 and HD 239276

E. Rodríguez,[1] J. C. Suárez,[1,2] A. Moya,[1,2] M. A. Dupret,[2] A. Grigahcène,[3] V. Costa,[1] M. J. López-González,[1] A.-Y. Zhou,[4] P. J. Amado,[1] E. Poretti,[5] J.-Y. Wei,[4] Y. Fan[4]

[1] Instituto de Astrofísica de Andalucía, CSIC, P.O. Box 3004, E-18080 Granada, Spain, E-mail:eloy@iaa.es
[2] LESIA, Observatoire de Paris-Meudon, UMR 8109, 92190 Meudon, France
[3] CRAAG, Algiers Observatory, BP 63 Bouzareah 16340, Algiers, Algeria
[4] National Astronomical Observatories, Chinese Academy of Sciences, Beijing 100012, China
[5] INAF-Osservatorio Astronomico di Brera, Via E. Bianchi 46, 23807 Merate, Italy

The γ Dor-type variables constitute a relatively recently recognized class of pulsating variables in the zone where the red edge of the δ Sct region intersects with the main sequence. λ Boo stars are metal-poor Population I stars that show significant underabundances of metals, except for the elements C, N, O and S. These stars are also characterized by showing broad, but often shallow, hydrogen-line wings and weak MgII λ 4481 lines. A number of λ Boo stars are known to be δ Sct pulsators, but this question is still open concerning the γ Dor-type pulsators. To date, HR 8799 is the unique case known of a γ Dor-type variable being a λ Boo star too. However, some of these variables seem to be metal-deficient. This has important implications in asteroseismology of γ Dor stars concerning the distinction between the two possibilities or, vice versa, if a star is already known to be of the λ Boo-type, this can be used to constrain asteroseismic models.

In this work, we study the cases of HD 218427 and HD 239276. Both variables were discovered as multiperiodic γ Dor-type pulsators (Rodríguez et al. 2006a,b), by means of simultaneous *uvbyβ* photometry, while they were used a check stars for observations devoted to other already well-known pulsators in the Lower Instability Strip, AC And and XX Cyg.

HD 218427 and HD 239276 present very similar photometric characteristics to the multiperiodic γ Dor HR 8799, including a slight deficiency in metal content. This could be a sign of a λ Boo nature as was already found for HR 8799 by Gray & Kaye (1999). Indeed, the three stars are located inside the λ Boo region of both $(m_1, b-y)$ and $([m_1], \beta)$ diagrams (Gray 1988, Gray & Corbally 1993).

The Time-Dependent Convection (TDC) treatment for multicolour photometry (Dupret et al. 2005, Grigahcéne et al. 2005) and the Frequency Ratio Method (FRM) are used to discriminate the angular orders ℓ of the three main modes excited in these two stars. However, no definitive conclusions are obtained concerning the true nature of the observed metal deficiency, such as: (a) they really are metal-deficient stars or (b) they are λ Boo stars.

In the case of HD 239276, by means of the TDC study, the two main modes are identified as $\ell = 1$ and the third mode is suggested to be $\ell = 1$ or 2. However, our results do not allow us to discriminate between a λ Boo or a truly metal-poor nature for this star. On the other hand, the FRM suggests low metallicity for this star, but a λ Boo nature cannot be ruled out.

References

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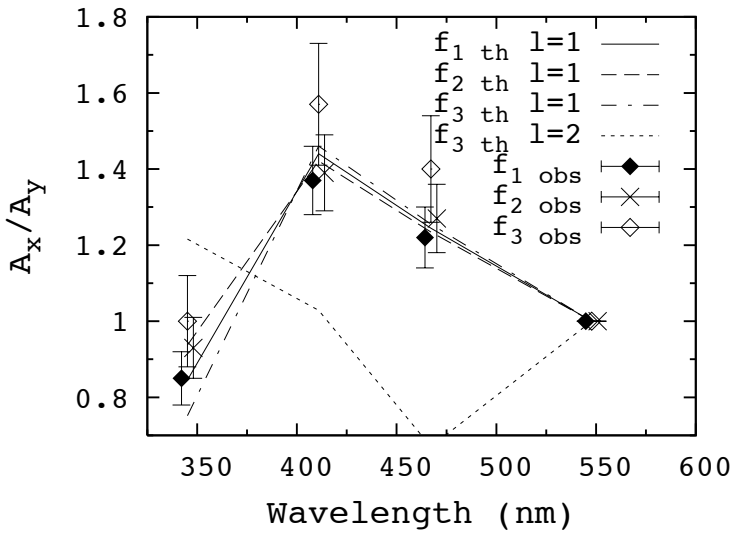

Figure 1: Strömgren photometric amplitude ratios obtained for HD 239276 with the TDC treatment for a model with M=1.3 $M_\odot$, Z=0.01, log T_e=3.8569, α=2.

Juan Carlos Suarez, Pedro Amado, Rafa Garrido and Eric Michel.