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# INTERNAL CONSISTENCY TEST ABOUT $\delta m_1$ METALLICITY INDEX FOR SX Phe AND HIGH AMPLITUDE[1] $\delta$ Sct STARS

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RESUMEN. Se ha realizado un estudio sistemático del comportamiento del índice de metalicidad $\delta m_1$ para las estrellas tipo SX Phe y $\delta$ Sct de gran amplitud. Este índice se comporta de forma diferente para las dos muestras de estrellas. El parámetro $\delta m_1$ aumenta o decrece hacia el mínimo de luminosidad para la primera o segunda muestra, respectivamente. La variación del índice $m_1$ es mayor cuanto menor es la abundancia metálica de la estrella.

ABSTRACT. We have carried out a systematic study of the behaviour of the $\delta m_1$ metallicity index for SX Phe and high amplitude $\delta$ Sct stars. It is shown to be different for the two samples of stars. The $\delta m_1$ parameter increases or decreases towards the minimum light for the first or second sample, respectively. The $m_1$ index variation is larger when the metal abundance of the star is smaller.

*Key words:* PHOTOMETRY — STARS-DELTA SCUTI — STARS-VARIABLE

In uvbyβ photometric system the $\delta m_1$ parameter is used to obtain abundances for A-F stars. If the metallicity don't change over the pulsation cycle of the star, $\delta m_1$ must remain constant. It provide us for a test of internal consistency.

We have carried out a systematic study about the behaviour of the $\delta m_1$ index for SX Phe (SX) and high amplitude $\delta$ Sct ($\delta$) stars. In Figure I is shown the observed $\delta m_1$ variations versus β variations over the pulsation cycle for two SX Phe (KZ Hya and CY Aqr) and two high amplitude $\delta$ Sct stars (RS Gru and RY Lep). It is shown that $\delta m_1$ increases towards the minimum light for the first two stars but the behaviour is very different for the last two ones.

Table I reassumes the results obtained for the sample of stars. Column 4 presents mean value for $\delta m_1$ index and in column 5 are listed the observed variation for the $m_1$ index. For homogeneity, we have calculated the values for the $\Delta\delta m_1^*$ parameter. It is defined as the ratio between $\Delta\delta m_1$ and the observed β variation (in tenths of a magnitude) over the cycle ($\Delta\delta m_1^* = \Delta\delta m_1 / \Delta\beta\ (0^m.1)$). These values are listed in the last column in Table I. In this column, the mark (+) means that the observed $m_1$ variation is larger that the expected variation from the change in temperature. The mark (-) have the opposite meaning. (1) is from Rodríguez et al. (1988), (2) is from Breger (1980). The results obtained by Breger (1980) for the stars AD CMi and RS Gru agree with the ones obtained for these two stars by us.

From this table is shown that for the majority of the stars the internal consistency test about $\delta m_1$ fails. On the other hand, the behaviour for $\delta m_1$ is different for the two samples. The $\delta m_1$ parameter increases or decreases towards the minimum light for the SX Phe or high amplitude $\delta$ Sct stars, respectively. Moreover, the $m_1$ index variation is larger when the metal

[1] Partially based on observations collected at European Southern Observatory, La Silla, Chile and by using the 1.5 m telescope from the Observatory Astronómico Nacional (I.G.N.) at Calar Alto Observatory, Almería, Spain.

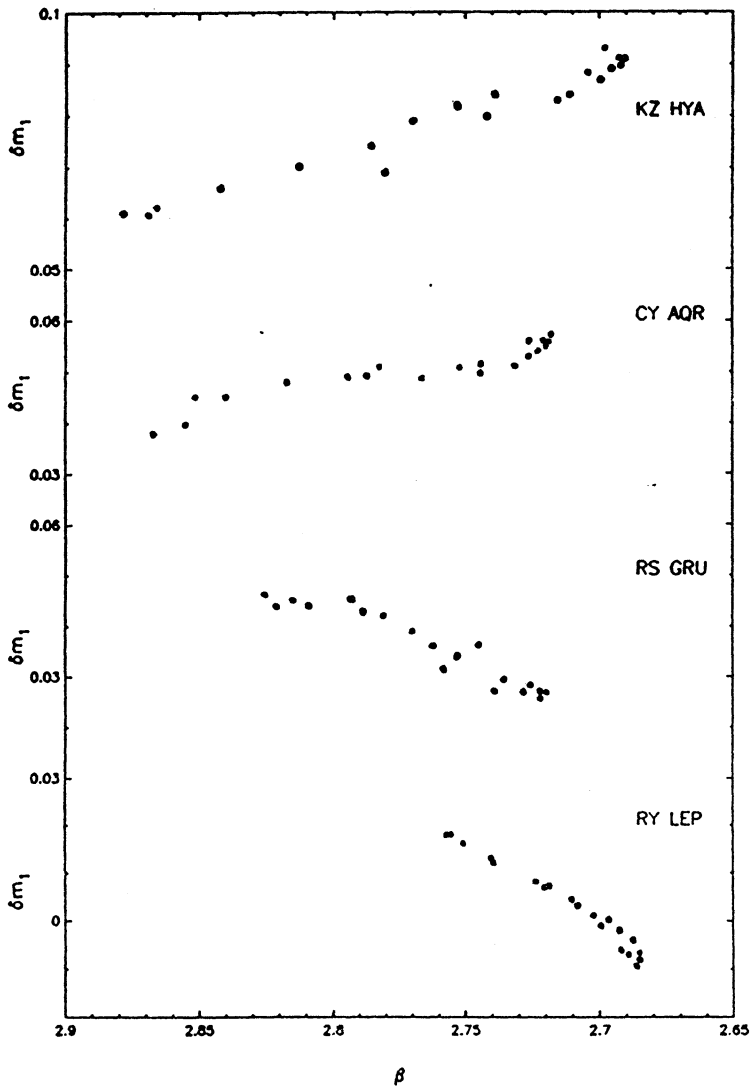


Figure I. Observed variation of $\delta m_1$ versus $\beta$ over the cycle of pulsation

TABLE I. Test for $\delta m_1$ index

| Star | Type | Period (d) | $\delta m_1$ | $\Delta m_o$ | $\Delta\delta m_1^*$ |
|---|---|---|---|---|---|
| BL Cam | SX | 0.0391 | 0.097 | 0.056 | +0.050 |
| SX Phe | SX | 0.0550 | 0.07 | 0.04 | +0.01 |
| KZ Hya | SX | 0.0595 | 0.079 | 0.066 | +0.020 |
| CY Aqr | SX | 0.0610 | 0.050 | 0.050 | +0.010 |
| DY Peg | SX | 0.0729 | 0.046 | 0.030 | +0.000 |
| GP And | δ | 0.0787 | 0.040 | 0.024 | −0.015 |
| HD 79889 | δ | 0.0958 | 0.034 | 0.022 | −0.005 |
| AD CMi | δ | 0.1230 | 0.006(1) | 0.009(1) | −0.02(1) |
| XX Cyg | SX | 0.1349 | 0.053 | 0.034 | −0.001 |
| RS Gru | δ | 0.1470 | 0.035 | 0.013 | −0.020 |
| DY Her | δ | 0.1486 | 0.00(2) | | −0.02(2) |
| VZ Cnc | δ | 0.1784 | 0.01(2) | | −0.02(2) |
| RY Lep | δ | 0.2254 | 0.004 | 0.011 | −0.030 |

abundance of the star is smaller.

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REFERENCES

Breger, M. 1980, Astrophys. J. 235, 153
Rodríguez, E., Rolland, A. and López de Coca, P. 1988, Rev. Mex. Astron. Astrofis. 16, 7

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