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TIME SHIFT-PERIOD-AMPLITUDE RELATION FOR PULSATION VARIABLES

1. Introduction

The phenomenon, that several pulsation variables show a delay in time (time shift) between the instants of maximum light, as one goes from shorter to longer wavelenghts, is wellknown.
The effect has been observed in AI Velorum stars, β Canis Majoris type pulsators, cepheids and long period Mira stars.
The aim of the present investigation is to find out, if there exist a relation between the mean value of the time shift, the period and the amplitude of a pulsation variable.

2. A linear time shift-period-amplitude relation

From our observations at the European Southern Observatory (ESO), during 1970-1977, we have estimated by means of a cubic spline fit procedure, the instants of maximum light for the pulsation variables SX Phe, AI Vel, ~~V70~~3 Sco and BS Aqr (AI Velorum stars). By comparing the values of the U and V filter, we were able to deduce a mean value for the time shift between U and V maximum light.
Table 1 gives a review of some intrinsic properties of the investigated stars.

Table 1

Star	Type	Period (min)	Amplitude ΔV (mag)	P/ΔV	Observed mean time shift (sec)		Calc.time shift (sec)
SX Phe	AI Vel	80	0.45	177.8	30	(47)*	30
AI Vel	"	160	0.41	390.2	47	(32)	50
V703 Sco	"	166	0.32	518.7	68	(12)	61
BS Aqr	"	288	0.44	654.5	70	(10)	73

*number of observed maxima

Since we believe, that there exists a linear relation between time shift, period and amplitude, we will write now this relation as follows

$$\text{Time shift (seconds)} = \alpha \times \frac{\text{period (minutes)}}{\text{amplitude V (magnitudes)}} + \beta$$

where α is the slope and β the interception (least square solution).

All observations of Table 1 could be assembled into the following particular TPA relation

$$\Delta T = 0.09056\ P/\Delta V + 14 \qquad (1)$$

where ΔT is the time shift, and the other symbols have their ordinary meaning. The last column of Table 1 shows the calculated value of the time shift with the aid of eq.1.

ERIC W. ELST
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