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ON THE PERIOD-LUMINOSITY RELATION FOR DELTA SCUTI STARS

In our previous paper (Frolov, Irkaev, 1982) different parameters for Delta Scuti stars in open clusters were given, in particular, reliable luminosities based only on cluster membership. In Table I we give for each variable the

Table I

Praesepe (A_V=0)	lg P	M_V	B-V	$(B-V)_o$	b-y	$(b-y)_o$
BR Cnc = KW 45	-1.420	2.06		0.231		0.131
BS Cnc = KW 154	-1.292	2.31		0.251		0.149
BU Cnc = KW 207	-1.276	1.48		0.197		0.104
BN Cnc = KW 323	-1.409	1.60		0.224		0.130
BQ Cnc = KW 292	-1.131	1.98		0.304		0.198
BW Cnc = KW 340	-1.143	2.28		0.259		0.147
BX Cnc = KW 445	-1.276	1.77		0.208		0.120
BY Cnc = KW 449	-1.237	1.72		0.201		0.115
Pleiades (A_V=0.06)						
V 534 Tau=HII 1266	-1.495	2.57	0.36	0.34	0.229	0.214
V 624 Tau=HII 158	-1.699	2.80	0.235	0.215	0.149	0.134
V 647 Tau=HII 1362	-1.328	2.40	0.26	0.24	0.153	0.138
V 650 Tau=HII 1425	-1.509	2.08	0.153	0.133	0.090	0.075
Coma (A_V=0)						
FM Com=HR 4684	-1.260	1.89		0.181		0.099
Hyades (A_V=0)						
υ_2 Tau=VB 60	-0.876	1.00		0.268		0.165
θ^2 Tau=VB 72	-1.097	1.56		0.179		0.099
ρ Tau=VB 95	-1.174	1.37		0.240		0.144
V 480 Tau=VB 123	-1.377	1.81		0.21		0.122
V 483 Tau=VB 30	-1.268	2.29		0.278		0.170
V 696 Tau=VB 33	-1.444	1.94		0.223		0.126
V 775 Tau=VB 38	-1.208	2.43		0.320		0.196
V 777 Tau=VB 141	-0.790	1.19		0.253		0.150
α Per (A_V=0.30)						
V 459 Per=H 501	-1.432	2.90	0.351	0.251	0.212	0.138
V 461 Per=H 606	-1.456	2.74	0.330	0.230	0.207	0.133
V 465 Per=H 906	-1.523	2.54	0.276	0.176	0.167	0.093
NGC 7789 (A_V=0.84)						
V 521 Cas=K 573	-0.833	1.56	0.64	0.36		

colour-indices (B-V) and (b-y) from various sources and reddening free ones, M_V and P values were taken from our cited paper. $(B-V)_o$ and $(b-y)_o$ were calculated on the basis of absorption values A_V for each cluster according to our cited paper and the following relations:

$E_{B-V} = 1/3\ A_V$, $E_{b-y} = 0.74\ E_{B-V}$ (Crawford, Mandwewala, 1976).

Using the least squares solution we have calculated both the PL and the PLC relations for cluster Delta Scuti stars. Two unusual variables in NGC 2264, V 588 Mon = W2 (A7 III-IV) and V 589 Mon = W 20 (F2 III), may still be at gravitational contraction phase, and the evolved giant BT Cnc=KW 204 (FO III) in Praesepe were not used either. Therefore, these relations were obtained practically only for main-sequence variables of the Delta Scuti-type:

$$M_V = \underset{\pm 0.34}{-1.66}\ \lg P \underset{\pm 0.44}{-\ 0.11},\quad \sigma_o = \pm 0.37,$$

$$M_V = \underset{\pm 0.32}{-2.06}\ \lg P + \underset{\pm 1.32}{4.14}\ (B-V)_o \underset{\pm 0.61}{-1.61},\quad \sigma_o = \pm 0.31,$$

$$M_V = \underset{\pm 0.35}{-2.02}\ \lg P + \underset{\pm 2.09}{5.39}\ (b-y)_o \underset{\pm 0.60}{-1.33},\quad \sigma_o = \pm 0.33.$$

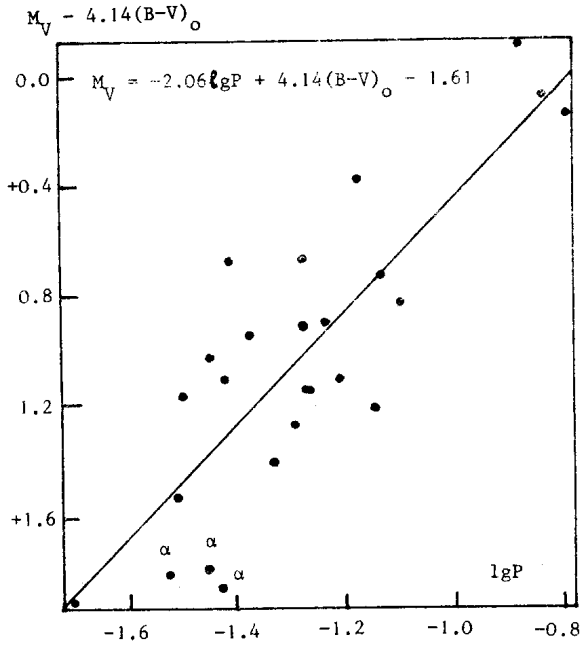

Figure 1

For V 521 Cas = K 573 in NGC 7789 M_V = +1.56 and P = $0^d.147$ were taken from Breger (1983), this star was not used for the P-L-$(b-y)_o$ relation due to absence of (b-y) -observations. The second relation is shown in Figure 1.

We note that co-efficients for lg P in all our relations are much smaller than the co-efficient -3.052 of the Breger's PLC relation (Breger, 1979), which was derived by the maximum - likelihood method. Our coefficients for $(b-y)_o$ and $(B-V)_o$ are also smaller compared with 8.456 (Breger, 1979) and 5.285 (Halprin, Moon, 1983), correspondingly.

We feel that the reason for this difference is not only an effect of different method used but it indicates the reality of a smaller slope of the PL and PLC relations for main-sequence pulsators compared with the bulk of Delta Scuti variables. We have calculated the value of $\sigma_o = \pm 0.40$ for open cluster Delta Scuti stars with the Breger's PLC relation which is indeed larger than that for our relations.

It is of interest to note that all the α Per cluster variables, i.e. the youngest objects, lie below the line of our PL and PLC relations (these stars are marked in the Figure 1 by symbols "α").

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