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# ON DELTA SCUTI STARS IN OPEN CLUSTERS

29 Delta Scuti stars are already known as members of different open clusters. Data for these variables are given in Table I.

Table I

Praesepe $m_o - M = 6.20$ $A_v = 0.0$ $\log t = 8.54$ $\bar{P} = 0^d.055$ (BT,BV Cnc excluded)

$\bar{M}_V = +2.0$ (BT Cnc excluded)

| | | | | | |
|---|---|---|---|---|---|
| 1. BT Cnc = KW 204 | $P = 0^d.102$ | FOIII | V = 6.68 | $M_v$ = | +0.5 |
| 2. BR Cnc = KW 45 | 0.038 | FOVn | 8.26 | | +2.1 |
| 3. BS Cnc = KW 154 | 0.051 | A9Vn | 8.51 | | +2.3 |
| 4. BU Cnc = KW 207 | 0.053 | A7Vn | 7.68 | | +1.5 |
| 5. BN Cnc = KW 323 | 0.039 | A8V | 7.80 | | +1.6 |
| 6. BQ Cnc = KW 292 | $0^h.074$ | F2Vn | 8.18 | | +2.0 |
| 7. BV Cnc = KW 318 | $5^h$:: | FOV | 8.66 | | +2.5 |
| 8. BW Cnc = KW 340 | 0.072 | FOVn | 8.48 | | +2.3 |
| 9. BX Cnc = KW 445 | 0.053 | A7V | 7.97 | | +1.8 |
| 10. BY Cnc = KW 449 | 0.058 | A7Vn | 7.92 | | +1.7 |

Pleiades $m_o - M = 5.64$ $A_V = 0.06$ $\log t = 7.2$ $\bar{P} = 0^d.032$ $\bar{M}_V = +2.5$

| | | | | |
|---|---|---|---|---|
| 1. V 534 Tau = HII 1266 | $P = 0^d.032$ | A9V | V = 8.27 | $M_V$ = +2.6 |
| 2. V 624 Tau = HII 158 | 0.020 | A7V | 8.50 | +2.8 |
| 3. V 647 Tau = HII 1362 | 0.047 | A7V | 8.10 | +2.4 |
| 4. V 650 Tau = HII 1425 | 0.031 | A3V | 7.78 | +2.1 |

Coma $m_o - M = 4.55$ $A_V = 0.0$ $\log t \approx 8.6$ $P = 0^d.055$ $M_V = +1.9$

| | | | | |
|---|---|---|---|---|
| 1. FM Com = HR 4684 | $P = 0^d.05515028$ | A7V | V = 6.44 | $M_V$ = +1.9 |

Hyades $m_o - M = 3.29$ $A_V = 0.0$ $\log t = 8.83$ $\bar{P} = 0^d.080$ $\bar{M}_V = +1.7$

| | | | | |
|---|---|---|---|---|
| 1. $\nu_2$ Tau = VB 60 | $P = 0^d.133$ | A8Vn | V = 4.29 | $M_V$ = +1.0 |
| 2. $\theta^2$ Tau = VB 72 | 0.080 | A5V | 4.85 | +1.6 |
| 3. $\rho$ Tau = VB 95 | 0.067 | A8Vn | 4.66 | +1.4 |
| 4. V 480 Tau = VB 123 | 0.042 | A7IV | 5.10 | +1.8 |
| 5. V 483 Tau = VB 30 | 0.054 | FOV | 5.58 | +2.3 |
| 6. V 696 Tau = VB 33 | 0.036 | A9V | 5.23 | +1.9 |
| 7. V 775 Tau = VB 38 | 0.062 | FOm | 5.72 | +2.4 |
| 8. V 777 Tau = VB 141 | 0.162 | A8Vn | 4.48 | +1.2 |

$\alpha$ Per $m_o - M = 5.94$ $A_V = 0.30$ $\log t = 7.1$ $\bar{P} = 0^d.034$ $\bar{M}_V = +2.7$

| | | | | |
|---|---|---|---|---|
| 1. V 459 Per = H 501 | $P = 0^d.037$ | FOIV | V = 9.14 | $M_V$ = +2.9 |
| 2. V 461 Per = H 606 | 0.035 | A8 V | 8.98 | +2.7 |
| 3. V 465 Per = H 906 | 0.030 | A6Vn | 8.78 | +2.5 |

Table I (cont.)

NGC 2264 $m_o - M = 9.10$ $A_V = 0.21$ $\log t \approx 6$ $\bar{P} = 0^d.117$: $\bar{M}_V = +0.7$

| | | | | | |
|---|---|---|---|---|---|
| 1. V 588 Mon = W 2 | $P = 0^d.11$: | A7III-IV | V = 9.68 | $M_V$ = | +0.4 |
| 2. V 589 Mon = W 20 | 0.124 | F2III | 10.27 | | +1.0 |

NGC 7789 $m - M = 12.20$ $A_V = 0.84$ $\log t \approx 9.7$ $P = 0^d.17$: $M_V = +0.7$

| | | | |
|---|---|---|---|
| 1. V 521 Cas | $P = 0^d.17$: | $M_V = +0.7$ | V = 13.76 |

Distance moduli $(m_o-M)$ for Pleiades, Praesepe, Hyades, α Per and NGC 2264 are from Kholopov (1980); those for Coma cluster and NGC 7789 are from Becker and Fenkart (1971); ages of the clusters are directly from Lindoff, (1968) or in the same system of ages; spectral types, V-magnitudes, periods for individual variables are from different modern sources; absolute magnitudes $M_V$ are based on adopted values of distance moduli, V and interstellar absorption $A_V$. In the case of $\theta^2$ Tau V, Sp and $M_V$ are given for companion (Peterson et al., 1981) though it is unknown which star is unstable. It is interesting to note that two stars in the Hyades cluster, V 775 Tau and V 777 Tau are X-ray sources, according to recent published data.

There is a difference between the known open cluster variables and field stars: Delta Scuti stars having large light amplitudes (more than about $0^m.1$) are absent in the clusters, excluding only one possible outlying (about $10^o$ from the cluster) member of the Hyades cluster VZ Cnc (Eggen, 1979). Besides 29 small amplitude variables which are all Delta Scuti type stars, one can find five more suspected open cluster variables of this type in Rufener (1981). These stars are probably also small amplitude variables. Therefore, about one sixth of all known Delta Scuti stars are small amplitude members of different open clusters.

Two correlations for open cluster Delta Scuti stars are shown in Figure 1 and Figure 2: mean period and mean $M_V$ of the cluster variables versus the age of the cluster; NGC2264 was omitted by the reason of its extremely young age and peculiar evolutionary status of its two known Delta Scuti stars. The two Figures show that, the greater the age, the longer the mean period of cluster variables and the higher their mean luminosity.

The present statistics unfortunately holds almost fully on dwarf Delta Scuti stars, which themselves cannot have large pulsational amplitudes. More statistics on giant stars is needed to confirm (or disprove) the result on small amplitudes of open cluster members. It is interesting to note here that several large amplitude Delta Scuti stars along with short-periodic SX Phe type variable (Jørgensen, 1982) can be typical for globular clusters with different metal abundances (RS Gru, XX Cyg).

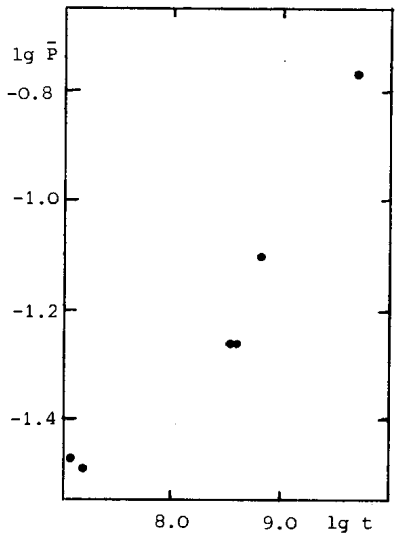


Figure 1

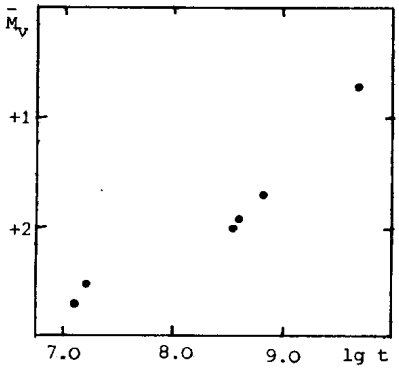


Figure 2

More serious attention must be paid to the search for these variables in open clusters, old open clusters and globular clusters for better understanding of population type range, age range, mass range etc. for the whole Delta Scuti complex.

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