# THE STELLAR TEMPERATURE SCALE FOR STARS OF SPECTRAL TYPES FROM O8 TO F6 AND THE STANDARD DEVIATION OF THE MK SPECTRAL CLASSIFICATION

E. THEODOSSIOU and E. DANEZIS

*Section of Astrophysics, Astronomy and Theoretical Mechanics, Department of Physics, University of Athens, Greece*

(Received 19 October, 1990)

**Abstract.** Empirical effective temperatures of 211 early-type stars found in a previous investigation (Kontizas and Theodossiou, 1980; Theodossiou, 1985) are combined with the effective temperatures of other 313 early-type stars found from literature. From these effective temperatures of a total number of 524 early-type stars of spectral types from O8 to F6 we derive a new stellar temperature scale and the standard deviation of the MK spectral classification.

## 1. Introduction

During recent years the ultraviolet flux distribution on an absolute scale has been obtained for a considerable number of stars with the sky telescope onboard the astronomical satellites.

Ultraviolet fluxes are very important for deriving effective temperatures of early-type stars since most of their energy is emitted in this wavelength range.

Since ultraviolet data became available from space telescopes, observed and theoretical energy distributions have been compared in a more extensive and proper wavelength range than previously and consequently better values of effective temperatures have been found (Lamers, 1974; Henry *et al.*, 1975; Nandy and Schmidt, 1975; Kontizas, 1978; Underhill *et al.*, 1979; Kontizas and Theodossiou, 1980; Theodossiou, 1985). Another way to find effective temperatures is by integrating the observed absolute flux over the whole spectrum when the angular diameter of a star is known (Davis and Webb, 1970; Beeckmans *et al.*, 1974; Code *et al.*, 1976; Beeckmans, 1977; Panek, 1977; Underhill *et al.*, 1979).

In a previous investigation (Kontizas and Theodossiou, 1980; Theodossiou, 1985) empirical effective temperatures of 211 O, B, A, and early F stars have been derived by comparing space observations in the ultraviolet with ground-based observations and by fitting the computed fluxes to the observed fluxes in the visible and ultraviolet spectral range.

In this paper the empirical effective temperatures derived from these data are combined with the effective temperatures of other early-type stars found from the literature for which ultraviolet data are available. From these effective temperatures of a total number of 524 early-type stars we derive a new stellar temperature scale.

*Astrophysics and Space Science* **183**: 91–115, 1991.

TABLE I

Effective temperatures of the stars studied

| HD | MK | $V$ | $E_{B-V}$ | $Q$ | $\log g$ | $T_{\mathrm{eff}}(1)$ | $T_{\mathrm{eff}}(2)$ | $T_{\mathrm{eff}}(3)$ |
|---|---|---|---|---|---|---|---|---|
| 432 | F2IV | 2.27 | −0.03 | −0.144 | 4 | 6500 | | |
| 886 | B2IV | 2.84 | 0.05 | −0.694 | 4 | 21500 | | 21987 |
| 1280 | A2V | 4.61 | 0.01 | 0.007 | 4 | 8800 | | |
| 2262 | A7V | 3.93 | −0.03 | −0.032 | 4 | 7500 | | |
| 5448 | A5V | 3.87 | −0.03 | 0.063 | 4 | 7500 | | |
| 5737 | B8IIIp | 4.33 | −0.08 | −0.390 | 3 | 11500 | | |
| 6882 | B7V | 3.94 | 0.04 | −0.355 | 4 | 13500 | | |
| 10144 | B3Vp | 0.47 | 0.05 | −0.562 | 4 | 17000 | 14510 | 17565 |
| 11415 | B3V | 3.38 | 0.05 | −0.512 | 4 | 15500 | | 15353 |
| 14055 | A1Vnn | 4.01 | 0.00 | 0.005 | 4 | 9200 | | |
| 15008 | A3V | 4.09 | −0.05 | 0.028 | 4 | 8300 | | |
| 15130 | B9.5Vn | 4.88 | 0.00 | −0.051 | 4 | 9800 | | |
| 15318 | B9.5III | 4.27 | −0.01 | −0.056 | 3 | 10300 | | |
| 15371 | B5III | 4.25 | 0.02 | −0.399 | 3 | 14000 | | |
| 16582 | B2IV | 4.06 | 0.01 | −0.684 | 4 | 22000 | | 23571 |
| 16970 | A3V | 3.46 | 0.01 | 0.005 | 4 | 8600 | | |
| 16978 | B9III | 4.10 | 0.01 | −0.080 | 3 | 11000 | | |
| 17081 | B7V | 4.24 | −0.01 | −0.329 | 4 | 13000 | | 13256 |
| 20150 | A1V | 4.93 | 0.00 | −0.014 | 4 | 9500 | | |
| 20902 | F5Ib | 1.79 | 0.22 | 0.054 | 2 | 7000 | | |
| 21278 | B5V | 4.98 | 0.06 | −0.478 | 4 | 16000 | | 15858 |
| 21364 | B9Vn | 3.72 | −0.01 | −0.282 | 4 | 11800 | | |
| 22928 | B5III | 3.01 | 0.04 | −0.423 | 3 | 14500 | | 14041 |
| 23466 | B3V | 5.34 | 0.08 | −0.513 | 4 | 19000 | | |
| 23480 | B6IV | 4.18 | 0.08 | −0.376 | 4 | 14000 | | 13360 |
| 23793 | B3V | 5.06 | 0.04 | −0.516 | 4 | 17000 | | |
| 24398 | B1Ib | 2.85 | 0.31 | −0.866 | 2.5 | 20000 | | 19867 |
| 24760 | B0.5III | 2.89 | 0.10 | −0.870 | 3.5 | 30000 | | |
| 25267 | A0IIIp | 4.66 | −0.11 | −0.289 | 3 | 9500 | | |
| 25490 | A1V | 3.91 | 0.00 | 0.065 | 4 | 9000 | | |
| 25940 | B3Ve | 4.03 | 0.17 | −0.558 | 4 | 17500 | | 16297 |
| 28319 | A7III | 3.41 | 0.06 | 0.050 | 3 | 8500 | | |
| 29248 | B2III | 3.90 | 0.03 | −0.728 | 3 | 22000 | | 23503 |
| 29305 | A0IIIp | 3.26 | 0.08 | −0.270 | 3 | 13500 | | |
| 29388 | A5IV | 4.27 | −0.03 | 0.043 | 4 | 7500 | | |
| 30211 | B5IV | 4.02 | 0.00 | −0.484 | 4 | 15000 | | 14951 |
| 30739 | A1V | 4.35 | −0.01 | 0.022 | 4 | 9000 | | |
| 30836 | B2III | 3.68 | 0.07 | −0.697 | 3 | 21500 | | 21874 |
| 31237 | B2III | 3.70 | 0.05 | −0.683 | 3 | 21000 | | 21302 |
| 31295 | A0V | 4.67 | 0.09 | 0.032 | 4 | 9700 | | |
| 32630 | B3V | 3.18 | 0.02 | −0.540 | 4 | 18000 | | |
| 33111 | A3V | 2.80 | 0.05 | 0.006 | 4 | 8600 | | |
| 33328 | B2IVn | 4.24 | 0.04 | −0.756 | 4 | 22500 | | 22895 |
| 34085 | B8Ia | 0.15 | −0.02 | −0.638 | 2 | 11500 | 11550 | 11778 |
| 34503 | B5III | 3.59 | 0.04 | −0.373 | 3 | 14500 | | 14246 |
| 34816 | B0.5IV | 4.28 | 0.01 | −0.825 | 4 | 29000 | | 29609 |
| 35439 | B1Vn | 4.94 | 0.04 | −0.741 | 4 | 25000 | | 24661 |
| 35468 | B2III | 1.64 | 0.02 | −0.736 | 3 | 21500 | 21580 | 21944 |
| 35497 | B7III | 1.65 | −0.01 | −0.396 | 3 | 13000 | | 13824 |

*Table I (continued)*

| HD | MK | $V$ | $E_{B-V}$ | $Q$ | log $g$ | $T_{eff}(1)$ | $T_{eff}(2)$ | $T_{eff}(3)$ |
|---|---|---|---|---|---|---|---|---|
| 36267 | B5V | 4.21 | 0.01 | −0.422 | 4 | 15500 | | |
| 36486 | O9.5I | 2.23 | 0.05 | −0.891 | 3.5 | 31000 | | 31082 |
| 36779 | B2.5V | 6.20 | 0.06 | −0.694 | 4 | 22500 | | |
| 36819 | B2.5IV | 5.36 | 0.13 | −0.555 | 4 | 22500 | | |
| 37128 | B0Ia | 1.70 | 0.05 | −0.883 | 3 | 25000 | 24820 | 25091 |
| 37202 | B4IIIp | 3.03 | −0.01 | −0.483 | 3 | 18500 | | 21237 |
| 37795 | B7IV | 2.64 | 0.01 | −0.383 | 4 | 12700 | | 12207 |
| 38678 | A3Vn | 3.54 | 0.02 | 0.018 | 4 | 8700 | | |
| 38899 | B9.5V | 4.91 | −0.03 | −0.109 | 4 | 10500 | | 10693 |
| 39060 | A3V | 3.84 | 0.10 | −0.039 | 4 | 9200 | | |
| 40494 | B2.5IV | 4.36 | 0.04 | −0.530 | 4 | 18000 | | |
| 41692 | B5IV | 5.37 | 0.02 | −0.429 | 4 | 14500 | | |
| 41753 | B3IV | 4.42 | 0.05 | −0.562 | 4 | 18000 | | 17407 |
| 42560 | B3IV | 4.48 | 0.03 | −0.537 | 4 | 18000 | | 17781 |
| 44402 | B2.5IV | 3.02 | 0.04 | −0.590 | 4 | 21500 | | 21968 |
| 44743 | B1II–III | 1.98 | 0.02 | −0.790 | 3 | 25000 | 25180 | 25825 |
| 45348 | F0Ia | −0.71 | 0.01 | −0.075 | 2 | 7500 | 7460 | |
| 46328 | B1III | 4.33 | 0.02 | −0.807 | 3 | 25000 | | |
| 47105 | A1IV | 1.93 | 0.00 | 0.030 | 4 | 9000 | 9260 | |
| 47839 | O8IIIf | 4.65 | 0.06 | −0.880 | 3.5 | 35000 | | 35427 |
| 48915 | A1V | −1.46 | −0.02 | −0.050 | 4 | 9000 | 9970 | |
| 50013 | B1.5IVne | 3.95 | 0.02 | −0.764 | 4 | 25000 | | 25294 |
| 50241 | A5V | 3.26 | 0.07 | −0.038 | 4 | 8200 | | |
| 50707 | B1III | 4.83 | 0.05 | −0.808 | 3 | 26000 | | 25493 |
| 52089 | B2II | 1.50 | 0.00 | −0.778 | 2.5 | 21000 | 20990 | 22668 |
| 53138 | B3Ia | 3.01 | 0.05 | −0.742 | 2 | 15000 | | 14764 |
| 53244 | B8II | 4.12 | −0.01 | −0.400 | 2 | 13000 | | 13596 |
| 53974 | B0.5III | 5.38 | 0.33 | −0.896 | 3 | 26000 | | |
| 56014 | B3IIIp | 4.65 | 0.00 | −0.550 | 3 | 18000 | | |
| 56139 | B2IV–Ve | 3.82 | 0.06 | −0.610 | 4 | 21000 | | 21019 |
| 56986 | F3IV | 3.53 | −0.05 | −0.204 | 4 | 6500 | | |
| 57060 | O8.5If | 4.95 | 0.13 | −1.042 | 3.5 | 35000 | | 33511 |
| 58343 | B2.5IVe | 5.33 | 0.17 | −0.564 | 4 | 22000 | | |
| 58350 | B5Ia | 2.44 | 0.00 | −0.645 | 2 | 13000 | 13310 | 12981 |
| 58715 | B7V | 2.90 | 0.04 | −0.215 | 4 | 12200 | | 11511 |
| 61421 | F5IV–V | 0.34 | 0.02 | −0.278 | 4 | 6500 | 6510 | |
| 63922 | B0III | 4.11 | 0.12 | −0.880 | 3 | 30000 | | |
| 65575 | B3IVp | 3.47 | 0.02 | −0.520 | 4 | 18000 | | 18823 |
| 68980 | B1.5IIIe | 4.77 | 0.14 | −0.900 | 3.5 | 30000 | | |
| 73390 | B3V | 5.26 | 0.06 | −0.519 | 4 | 19000 | | |
| 74071 | B5V | 5.50 | 0.01 | −0.472 | 4 | 16000 | | |
| 74280 | B4V | 4.29 | −0.02 | −0.596 | 4 | 17000 | | 18792 |
| 74560 | B3IV | 4.89 | 0.03 | −0.537 | 4 | 21000 | | |
| 74575 | B1.5III | 3.69 | 0.07 | −0.740 | 3 | 23000 | | 23723 |
| 75311 | B3Vne | 4.49 | 0.02 | −0.604 | 4 | 19000 | | |
| 76644 | A7V | 3.14 | 0.00 | −0.066 | 4 | 7800 | | |
| 78316 | B8IIIp | 5.23 | −0.01 | −0.350 | 3 | 11800 | | |
| 79351 | B2IV–V | 3.44 | 0.05 | −0.553 | 4 | 21500 | | 21744 |
| 79469 | B9.5V | 3.88 | −0.03 | −0.070 | 4 | 10000 | | |
| 83979 | B5V | 5.11 | 0.02 | −0.469 | 4 | 16000 | | |

*Table I (continued)*

| HD | MK | $V$ | $E_{B-V}$ | $Q$ | $\log g$ | $T_{\text{eff}}(1)$ | $T_{\text{eff}}(2)$ | $T_{\text{eff}}(3)$ |
|---|---|---|---|---|---|---|---|---|
| 84999 | F2IV | 3.82 | −0.08 | −0.108 | 4 | 6500 | | |
| 87901 | B8V | 1.35 | 0.00 | −0.280 | 4 | 12000 | 12210 | 12389 |
| 88955 | A2V | 3.84 | 0.01 | 0.026 | 4 | 9000 | | |
| 89021 | A2IV | 3.45 | −0.03 | 0.038 | 4 | 8400 | | |
| 89025 | F0III | 3.44 | −0.01 | −0.023 | 3 | 7000 | | |
| 91465 | B4Vne | 3.32 | 0.09 | −0.645 | 4 | 17500 | | 17048 |
| 93194 | B4IVn | 4.82 | 0.05 | −0.526 | 4 | 17500 | | |
| 95418 | A1V | 2.37 | −0.04 | 0.014 | 4 | 8800 | | |
| 103287 | A0V | 2.44 | 0.01 | 0.030 | 4 | 9500 | | |
| 103884 | B3V | 5.58 | 0.05 | −0.562 | 4 | 20000 | | |
| 105435 | B2IVne | 2.65 | 0.15 | −0.815 | 4 | 22500 | | |
| 105937 | B3V | 3.96 | 0.05 | −0.502 | 4 | 19000 | | |
| 106490 | B2IV | 2.80 | 0.01 | −0.744 | 4 | 22500 | | 22906 |
| 106591 | A3V | 3.31 | 0.00 | 0.012 | 4 | 8500 | | |
| 110956 | B3V | 4.65 | 0.04 | −0.514 | 4 | 19000 | | |
| 112078 | B4Vn | 4.62 | 0.03 | −0.492 | 4 | 17000 | | |
| 114330 | A1V | 4.36 | −0.02 | −0.020 | 4 | 8800 | | |
| 120307 | B2IV | 3.41 | 0.02 | −0.691 | 4 | 23500 | | 23785 |
| 120315 | B3V | 1.86 | 0.01 | −0.543 | 4 | 17000 | | 16823 |
| 122408 | A3V | 4.26 | 0.02 | 0.058 | 4 | 8300 | | |
| 125823 | B7IIIp | 4.42 | −0.06 | −0.610 | 4 | 11500 | | |
| 132200 | B2IV | 3.13 | 0.04 | −0.636 | 3 | 22500 | | 22893 |
| 136504 | B2IV–V | 3.37 | 0.06 | −0.600 | 4 | 22500 | | |
| 139365 | B2.5V | 3.65 | 0.04 | −0.560 | 4 | 20000 | | 20911 |
| 143275 | B0.5IV | 2.32 | 0.16 | −0.813 | 4 | 31000 | 31460 | 28929 |
| 144206 | B9III Hg | 4.76 | −0.03 | −0.240 | 3 | 11000 | | 11124 |
| 144470 | B1V | 3.97 | 0.21 | −0.784 | 4 | 28000 | | 28064 |
| 144661 | B7IIIp | 6.33 | 0.06 | −0.466 | 3 | 14500 | | |
| 147165 | B1III | 2.88 | 0.39 | −0.783 | 3.5 | 30000 | | 29035 |
| 147394 | B5IV | 3.90 | 0.01 | −0.462 | 4 | 15000 | | 15012 |
| 148703 | B2III | 4.23 | 0.08 | −0.684 | 3 | 23500 | | |
| 149757 | O9.5V(e) | 2.58 | 0.31 | −0.877 | 4 | 33000 | 31910 | 34100 |
| 151890 | B1.5IV | 3.03 | 0.03 | −0.701 | 4 | 22500 | | |
| 154494 | A4IV | 4.91 | 0.00 | −0.026 | 4 | 8300 | | |
| 155763 | B6III | 3.17 | 0.03 | −0.350 | 3 | 13500 | | 12957 |
| 156164 | A3Vn | 3.13 | 0.00 | 0.022 | 4 | 8500 | | |
| 157056 | B2IV | 3.26 | 0.01 | −0.684 | 4 | 22500 | | 22857 |
| 158926 | B1.5IV | 1.63 | 0.03 | −0.731 | 4 | 25000 | | 26292 |
| 159561 | A5III | 2.07 | 0.00 | −0.008 | 3 | 8000 | 8020 | |
| 161868 | A0V | 3.75 | 0.05 | 0.011 | 4 | 9800 | | |
| 162374 | B8V | 5.89 | −0.01 | 1.356 | 4 | 13500 | | |
| 164852 | B3IV | 5.25 | 0.09 | −0.560 | 4 | 19000 | | |
| 165174 | B0IIIn | 6.12 | 0.30 | −0.920 | 3.5 | 30000 | | |
| 166014 | B9.5V | 3.83 | 0.02 | −0.055 | 4 | 9800 | | |
| 168797 | B3Ve | 6.13 | 0.16 | −0.641 | 4 | 21000 | | |
| 169022 | A0V | 1.85 | −0.02 | −0.108 | 4 | 9000 | 9460 | |
| 169467 | B3IV | 3.51 | 0.03 | −0.527 | 4 | 18500 | | 19025 |
| 170073 | A3V | 5.02 | 0.02 | −0.012 | 4 | 9000 | | |
| 170465 | B7IV | 4.95 | 0.01 | −0.353 | 4 | 13000 | | |
| 172167 | A0V | 0.03 | 0.01 | 0.000 | 4 | 9500 | 9660 | |

*Table I (continued)*

| HD | MK | $V$ | $E_{B-V}$ | $Q$ | log $g$ | $T_{eff}(1)$ | $T_{eff}(2)$ | $T_{eff}(3)$ |
|---|---|---|---|---|---|---|---|---|
| 173880 | A5III | 4.36 | −0.03 | −0.006 | 3 | 8000 | | |
| 173948 | B2II–III | 4.22 | 0.08 | −0.779 | 3 | 24000 | | |
| 175362 | B8IV Si | 5.38 | −0.05 | −0.585 | 4 | 12500 | | |
| 176437 | B9III | 3.24 | 0.03 | −0.044 | 3 | 10000 | | |
| 176871 | B5V | 5.68 | 0.08 | −0.492 | 4 | 16000 | | |
| 177003 | B2.5IV | 5.37 | 0.03 | −0.623 | 4 | 19500 | | |
| 177724 | A0Vn | 2.99 | 0.02 | −0.017 | 4 | 9500 | | |
| 177756 | B9Vn | 3.43 | −0.02 | −0.205 | 4 | 11000 | | 11414 |
| 178524 | F2II–III | 2.87 | 0.00 | 0.003 | 2 | 6500 | | |
| 179761 | B8II–III | 5.13 | 0.03 | −0.359 | 3 | 12500 | | |
| 180554 | B4IV | 4.77 | 0.14 | −0.521 | 4 | 17000 | | 16996 |
| 182640 | F0IV | 3.36 | 0.03 | −0.187 | 4 | 7300 | | |
| 183362 | B2Vne | 6.32 | 0.10 | −0.649 | 4 | 21000 | | |
| 184915 | B0.5IIIn | 4.96 | 0.28 | −0.870 | 3.5 | 30000 | | 30784 |
| 184930 | B5III | 4.36 | 0.07 | −0.375 | 3 | 15000 | | 14552 |
| 185872 | B9III | 5.40 | 0.00 | −0.162 | 3 | 10500 | | |
| 187567 | B2.5IVe | 6.50 | 0.12 | −0.628 | 4 | 21000 | | |
| 187642 | A7IV–V | 0.80 | −0.03 | −0.076 | 4 | 7500 | 8010 | |
| 187811 | B2.5V | 4.96 | 0.10 | −0.603 | 4 | 22500 | | 21696 |
| 188260 | B9.5III | 4.58 | −0.01 | −0.086 | 3 | 10200 | | |
| 189103 | B2.5IV | 4.35 | 0.06 | −0.544 | 4 | 20000 | | |
| 189687 | B3IV | 5.22 | 0.03 | −0.560 | 4 | 18000 | | |
| 190993 | B3V | 5.07 | 0.02 | −0.570 | 4 | 18000 | | |
| 191610 | B2.5V | 4.92 | 0.10 | −0.693 | 4 | 20000 | | 19478 |
| 191692 | B9.5III | 3.22 | −0.02 | −0.069 | 3 | 10000 | | |
| 192640 | A2V | 4.99 | 0.07 | −0.096 | 4 | 9200 | | |
| 192685 | B3V | 4.77 | 0.02 | −0.600 | 4 | 18000 | | |
| 193924 | B2.5V | 1.94 | 0.02 | −0.566 | 4 | 19000 | 17880 | 19592 |
| 194335 | B2Ven | 5.90 | 0.02 | −0.651 | 4 | 20000 | | |
| 196180 | A3V | 4.69 | 0.03 | 0.030 | 4 | 8700 | | |
| 196724 | A0V | 4.82 | −0.01 | −0.055 | 4 | 10000 | 10618 | |
| 196867 | B9IV–V | 3.77 | 0.01 | −0.166 | 4 | 11000 | | 10681 |
| 197345 | A2Ia | 1.25 | 0.04 | −0.295 | 2 | 8500 | | |
| 197419 | B2IV–Ve | 6.68 | 0.08 | −0.564 | 4 | 22500 | | |
| 198820 | B3III | 6.44 | 0.06 | −0.559 | 3 | 18000 | | |
| 200120 | B1.5Venn | 4.75 | 0.21 | −0.911 | 4 | 24000 | | 23302 |
| 202627 | A1V | 4.70 | 0.04 | −0.033 | 4 | 9300 | | |
| 202904 | B2Ve | 4.42 | 0.14 | −0.748 | 4 | 22500 | | 21960 |
| 203280 | A7IV–V | 2.45 | 0.02 | −0.048 | 4 | 7600 | | |
| 203467 | B3IVe | 5.14 | 0.17 | −0.578 | 4 | 20000 | | |
| 204403 | B3IV | 5.28 | 0.04 | −0.564 | 4 | 17000 | | |
| 205021 | B1III | 3.23 | 0.04 | −0.801 | 3.5 | 26000 | | 25775 |
| 206672 | B3IV | 4.67 | 0.08 | −0.600 | 4 | 18000 | | 17839 |
| 207971 | B8III | 3.00 | −0.02 | −0.293 | 3 | 11500 | | 11800 |
| 208057 | B3V | 5.07 | 0.01 | −0.563 | 4 | 16500 | | |
| 209409 | B7IVe | 4.70 | 0.03 | −0.368 | 4 | 13000 | | 13464 |
| 212061 | A0V | 3.84 | −0.05 | −0.056 | 4 | 9300 | | |
| 212120 | B6V | 4.56 | 0.04 | −0.428 | 4 | 15000 | | |
| 212571 | B1Ve | 4.64 | 0.22 | −0.931 | 4 | 27000 | | 27094 |
| 212978 | B1.5V | 6.14 | 0.11 | −0.669 | 4 | 25000 | | |

*Table I (continued)*

| HD | MK | $V$ | $E_{B-V}$ | $Q$ | $\log g$ | $T_{\text{eff}}(1)$ | $T_{\text{eff}}(2)$ | $T_{\text{eff}}(3)$ |
|---|---|---|---|---|---|---|---|---|
| 213420 | B2IV | 4.46 | 0.14 | −0.752 | 4 | 21000 | 20836 | |
| 213998 | B9IV–Vn | 4.03 | −0.02 | −0.155 | 4 | 11000 | 11218 | |
| 214748 | B8V | 4.17 | 0.01 | −0.308 | 4 | 12000 | | |
| 214994 | A1IV | 4.82 | −0.02 | 0.054 | 4 | 9000 | | |
| 215191 | B1.5V | 6.43 | 0.16 | −0.745 | 4 | 25000 | | |
| 216057 | B5Vn | 6.12 | 0.09 | −0.360 | 4 | 16500 | | |
| 217782 | A3Vn | 5.10 | 0.00 | 0.042 | 4 | 8500 | | |
| 218045 | B9III | 2.48 | 0.04 | −0.071 | 3 | 10500 | | |
| 219688 | B5Vn | 4.39 | 0.00 | −0.434 | 4 | 14500 | 15212 | |
| 222173 | B8V | 4.26 | 0.00 | −0.280 | 4 | 11500 | 11865 | |
| 222603 | A7V | 4.48 | 0.00 | −0.064 | 4 | 7800 | | |
| 224990 | B5V | 5.00 | 0.00 | −0.454 | 4 | 14500 | | |

$T_{\text{eff}}(1)$ = Effective temperatures derived here.
$T_{\text{eff}}(2)$ = Effective temperatures derived by Code *et al.* (1976).
$T_{\text{eff}}(3)$ = Effective temperatures derived by Underhill *et al.* (1979).

## 2. Used Material and Effective Temperatures

In this paper the flux effective temperatures of the 211 programme stars (Table I) are used to derive a new stellar temperature scale of early-type stars. Since on the whole the flux effective temperatures for the early-type stars agree well with the effective temperatures estimated from the analysis of the line spectrum, our sample has been increased with another sample of 313 early-type stars found from the literature (Table II).

Table II gives for every star more than one effective temperature found from the literature. On inspecting various papers giving temperatures of early-type stars we used these values based on visible and ultraviolet data.

The 211 programme stars from Table I as a function of spectral type and luminosity class are listed in Table III.

Table IV gives the 313 early-type stars from Table II found from the literature as a function of spectral type and luminosity class.

The total number of stars (524) as a function of spectral type and luminosity class is presented in Table V.

Finally, the derived flux effective temperatures of the 211 programme stars (Table I) are combined with the derived effective temperatures of 313 other early-type stars found from the literature. From this compilation of data from a total number of 524 early-type stars, a new stellar temperature scale is constructed, by means of computer-use, for stars of spectral types from O8 to F6 and the standard deviation of the MK spectral classification.

TABLE II

Effective temperatures of stars as a function of spectral type from literature

| HD | Name | Sp. type | $T_{eff}$ (K) | References |
|---|---|---|---|---|
| 14633 | | O8III | 32700 ± 600 | Morossi and Crivellari, 1980 |
| | | | 34500 | Morisson, 1975 |
| 17520 | | O8V | 36100 ± 400 | Morossi and Crivellari, 1980 |
| 36861 | 39 λ Ori | O8VIII$_f$ | 35000 ± 2300 | Morossi and Crivellari, 1980 |
| | | | 35046 | Underhill *et al.*, 1979 |
| 41161 | | O8V | 36200 ± 400 | Morossi and Crivellari, 1980 |
| | | | 36000 | Morisson, 1975 |
| 46966 | | O8III | 33200 ± 600 | Morossi and Crivellari, 1980 |
| | | | 32500 | Morisson, 1975 |
| 48279 | | O8V | 36500 ± 1100 | Morossi and Crivellari, 1980 |
| 60513 | | O8V | 36900 ± 500 | Morossi and Crivellari, 1980 |
| 60586 | | O8III | 37400 ± 1300 | Morossi and Crivellari, 1980 |
| | | | 35000 | Morisson, 1975 |
| 151804 | | O8I$_f$ | 36600 ± 800 | Morossi and Crivellari, 1980 |
| | | | 30000 | Morisson, 1975 |
| | | | 31400 | Remie and Lamers, 1982 |
| | | | 33500 | Remie and Lamers (flux) |
| | | | 32000 | Conti and Alschuler, 1971 |
| | | | 33000 | Conti, 1973 |
| | | | 34326 | Underhill *et al.*, 1979 |
| 167971 | | O8I | 33000 ± 1100 | Morossi and Crivellari, 1980 |
| | | | 39500 | Morisson, 1975 |
| 168504 | | O8III | 37600 ± 900 | Morossi and Crivellari, 1980 |
| 175754 | | O8III$_f$ | 31800 ± 1100 | Morossi and Crivellari, 1980 |
| | | | 37500 | Morisson, 1975 |
| 186980 | | O8III$_f$ | 31000 ± 1100 | Morossi and Crivellari, 1980 |
| | | | 33500 | Morisson, 1975 |
| 188001 | 9 Sge | O8I$_f$ | 37200 ± 600 | Morossi and Crivellari, 1980 |
| | | | 35000 | Remie and Lamers, 1982 |
| | | | 34900 | Remie and Lamers (flux) |
| | | | 34000 | Conti and Alschuler, 1971 |
| | | | 33000 | Conti, 1973 |
| | | | 34527 | Underhill *et al.*, 1979 |
| 203604 | 68 Cyg | O8V | 32600 ± 1200 | Morossi and Crivellari, 1980 |
| | | | 34500 | Morisson, 1975 |
| 214680 | 10 Lac | O8III | 33600 ± 500 | Morossi and Crivellari, 1980 |
| | | | 32500 | Morisson, 1975 |
| | | | 35401 | Underhill *et al.*, 1979 |
| 225160 | | O8I$_f$ | 35600 ± 500 | Morossi and Crivellari, 1980 |
| 12323 | | O8.5V | 35900 ± 800 | Morossi and Crivellari, 1980 |
| | | | 35000 | Morisson, 1975 |
| 14434 | | O8.5I | 32200 ± 160 | Morossi and Crivellari, 1980 |
| | | | 34000 | Morisson, 1975 |
| 15137 | | O8.5III | 32100 ± 700 | Morossi and Crivellari, 1980 |
| | | | 33500 | Morisson, 1975 |
| 17603 | | O8.5I$_f$ | 34200 ± 500 | Morossi and Crivellari, 1980 |
| | | | 32500 | Morisson, 1975 |
| 24431 | | O8.5III | 31800 ± 1000 | Morossi and Crivellari, 1980 |
| | | | 31500 | Morisson, 1975 |

*Table II (continued)*

| HD | Name | Sp. type | $T_{eff}$ (K) | References |
|---|---|---|---|---|
| | $\theta^1$ Ori C | O8.5III | 31600 ± 1700 | Morossi and Crivellari, 1980 |
| | $\iota$ Ori | O8.5I | 31700 ± 900 | Morossi and Crivellari, 1980 |
| 46056 | | O8.5V | 36000 ± 400 | Morossi and Crivellari, 1980 |
| | | | 37500 | Morisson, 1975 |
| 46149 | | O8.5V | 37200 ± 400 | Morossi and Crivellari, 1980 |
| | | | 37000 | Morisson, 1975 |
| 52266 | | O9.5V | 32000 ± 300 | Morossi and Crivellari, 1980 |
| | | | 33500 | Morisson, 1975 |
| 60594 | | O8.5V | 35700 ± 700 | Morossi and Crivellari, 1980 |
| | | | 35000 | Morisson, 1975 |
| 162978 | | O8.5III$_f$ | 32600 ± 1500 | Morossi and Crivellari, 1980 |
| 167771 | | O8.5I | 32100 ± 1000 | Morossi and Crivellari, 1980 |
| | | | 35000 | Morisson, 1975 |
| 193322 | | O8.5III | 34700 ± 600 | Morossi and Crivellari, 1980 |
| | | | 34075 | Underhill *et al.*, 1979 |
| 201345 | | O8.5V | 31600 ± 300 | Morossi and Crivellari, 1980 |
| | | | 34000 | Morisson, 1975 |
| 108 | | O9I | 30700 ± 1800 | Morossi and Crivellari, 1980 |
| 16429 | | O9I | 30700 ± 600 | Morossi and Crivellari, 1980 |
| 19820 | | O9III | 30700 ± 800 | Morossi and Crivellari, 1980 |
| | $\vartheta^2$ Ori A | O9I | 31500 ± 700 | Morossi and Crivellari, 1980 |
| 47839 | 15 Mon | O9V | 34900 ± 1200 | Morossi and Crivellari, 1980 |
| 52533 | | O9V | 34000 ± 800 | Morossi and Crivellari, 1980 |
| | | | 33000 | Morisson, 1975 |
| 57061 | $\tau$ CMa | O9I | 30700 ± 700 | Morossi and Crivellari, 1980 |
| | | | 32500 | Morisson, 1975 |
| | | | 31400 | Remie and Lamers, 1982 |
| | | | 32000 | Conti and Alschuler, 1971 |
| | | | 31000 | Conti, 1973 |
| | | | 33145 | Underhill *et al.*, 1979 |
| 57682 | | O9V | 32400 ± 500 | Morossi and Crivellari, 1980 |
| | | | 34000 | Morisson, 1975 |
| 68273 | $\gamma^2$ Vel | O9I | 30200 | Willis and Wilson, 1978 |
| | | | 32510 ± 2520 | Code *et al.*, 1976 |
| 16852 | | O9V | 34400 ± 700 | Morossi and Crivellari, 1980 |
| 164438 | | O9III | 32200 ± 800 | Morossi and Crivellari, 1980 |
| | | | 35500 | Morisson, 1975 |
| 166546 | | O9III | 32400 ± 400 | Morossi and Crivellari, 1980 |
| 167263 | 16 Sgr | O9III | 31200 ± 700 | Morossi and Crivellari, 1980 |
| | | | 35000 | Morisson, 1975 |
| 207198 | | O9I | 32000 ± 1200 | Morossi and Crivellari, 1980 |
| 209975 | 19 Cep | O9I | 30500 ± 700 | Morossi and Crivellari, 1980 |
| | | | 34500 | Morisson, 1975 |
| 210809 | | O9I | 30400 ± 1000 | Morossi and Crivellari, 1980 |
| | | | 30000 | Morisson, 1975 |
| 216532 | | O9V | 36200 ± 500 | Morossi and Crivellari, 1980 |
| | | | 31500 | Morisson, 1975 |
| 216898 | | O9V | 35400 ± 900 | Morossi and Crivellari, 1980 |
| | | | 33000 | Morisson, 1975 |
| 5005$_c$ | | O9.5V | 32000 ± 600 | Morossi and Crivellari, 1980 |

*Table II (continued)*

| HD | Name | Sp. type | $T_{eff}$ (K) | References |
|---|---|---|---|---|
| 30614 | α Cam | O9.5I | 32400 ± 900 | Morossi and Crivellari, 1980 |
| | | | 31000 | Morisson, 1975 |
| | | | 22900 | Kontizas, 1978 |
| | | | 25600 | Remie and Lamers, 1982 |
| | | | 26300 | Remie and Lamers (flux) |
| | | | 27000 | Conti and Alschuler, 1971 |
| | | | 30000 | Conti, 1973 |
| | | | 24999 | Underhill *et al.*, 1979 |
| | | | 28840 | de Jager, 1980 (p. 61) |
| | AE Aur | O9.5V | 34900 ± 400 | Morossi and Crivellari, 1980 |
| | | | 33000 | Morisson, 1975 |
| 37468 | σ Ori | O9.5V | 33000 | Morisson, 1975 |
| | | | 31400 ± 600 | Morossi and Crivellari, 1980 |
| | | | 31556 | Underhill *et al.*, 1979 |
| 37742 | ζ Ori A | O9.5I | 30200 ± 600 | Morossi and Crivellari, 1980 |
| | | | 29910 ± 2110 | Code *et al.*, 1976 |
| | | | 30000 | Conti and Alschuler, 1971 |
| | | | 31000 | Auer and Mihalas, 1972 |
| | | | 30630 ± 5610 | Beeckmans, 1977 |
| | | | 27583 | Underhill *et al.*, 1979 |
| | | | 24900 | Remie and Lamers, 1982 |
| | | | 25600 | Remie and Lamers (flux) |
| | | | 30200 | de Jager, 1980 (p. 61) |
| 38666 | μ Col | O9.5V | 34500 | Conti, 1973 |
| | | | 34000 | Morisson, 1975 |
| | | | 34000 ± 400 | Morossi and Crivellari, 1980 |
| 46202 | | O9.5V | 32900 ± 500 | Morossi and Crivellari, 1980 |
| | | | 32000 | Morisson, 1975 |
| 47432 | | O9.5I | 32500 | Morisson, 1975 |
| | | | 30500 ± 900 | Morossi and Crivellari, 1980 |
| 60498 | | O9.5V | 32100 ± 800 | Morossi and Crivellari, 1980 |
| | | | 32500 | Morisson, 1975 |
| 152249 | | O9.5I | 34500 | Morisson, 1975 |
| | | | 29900 ± 800 | Morossi and Crivellari, 1980 |
| 152424 | | O9.5I | 33200 ± 800 | Morossi and Crivellari, 1980 |
| 188209 | | O9.5I | 30400 ± 700 | Morossi and Crivellari, 1980 |
| | | | 31500 | Morisson, 1975 |
| | | | 30000 | Conti and Alschuler, 1971 |
| | | | 30000 | Conti, 1973 |
| | | | 26000 | Kontizas, 1978 |
| | | | 31078 | Underhill *et al.*, 1979 |
| | | | 27000 | Remie and Lamers, 1982 |
| | | | 27700 | Remie and Lamers (flux) |
| 195592 | | O9.5I | 38800 ± 800 | Morossi and Crivellari, 1980 |
| | | | 28000 | Morisson, 1975 |
| 202124 | | O9.5I | 29800 ± 900 | Morossi and Crivellari, 1980 |
| | | | 27500 | Morisson, 1975 |
| 207538 | | O9.5V | 31500 | Morisson, 1975 |
| | | | 32200 ± 500 | Morossi and Crivellari, 1980 |
| 218915 | | O9.5I | 30600 ± 700 | Morossi and Crivellari, 1980 |

*Table II (continued)*

| HD | Name | Sp. type | $T_{eff}$ (K) | References |
|---|---|---|---|---|
| | | | 32500 | Morisson, 1975 |
| 36512 | $\upsilon$ Ori | B0V | 29100 | Heintze, 1969 |
| | | | 30900 | Morton and Adams, 1968 |
| | | | 24300 ± 1200 | Nandy *et al.*, 1975 |
| | | | 24500 | Kontizas, 1978 |
| | | | 34347 | Underhill *et al.*, 1979 |
| 53367 | | B0IV | 24000 | Kontizas, 1978 |
| 77581 | | $B0I_a$ | 22100 | Kontizas, 1978 |
| 149038 | $\mu$ Nor | $B0I_a$ | 27100 | Remie and Lamers, 1982 |
| | | | 27800 | Remie and Lamers (flux) |
| 149438 | $\tau$ Sco | B0V | 30900 | Morton and Adams, 1968 |
| | | | 30900 | Conti, 1973 |
| | | | 30000 | Vader *et al.*, 1977 |
| | | | 24400 | Kontizas, 1978 |
| | | | 25800 | Heintze, 1969 |
| | | | 25500 | Heintze, 1969 |
| | | | 28150 ± 750 | Unsöld, 1941 |
| | | | 27000 | Neven and de Jager, 1954 |
| | | | 32800 | Traving, 1955 |
| | | | 32800 | Aller, 1957 |
| | | | 32800 | Scholz, 1967 |
| | | | 30900 | Hardorp and Scholz, 1970 |
| | | | 31500 | Lamers and Rogerson, 1978 |
| | | | 31800 | Remie and Lamers, 1982 |
| | | | 31500 | Auer and Mihalas, 1972 |
| | | | 32200 | Lamers and Rogerson, 1984 |
| 164402 | | $B0I_b$ | 33000 | Dufton, 1972 |
| 167264 | 15 Sgr | $B0I_a$ | 31200 | Remie and Lamers, 1982 |
| | | | 32900 | Remie and Lamers (flux) |
| 204172 | 69 Cyg | $B0I_b$ | 24400 | Remie and Lamers, 1982 |
| | | | 25200 | Remie and Lamers (flux) |
| 38771 | $\kappa$ Ori | $B0.5I_a$ | 26390 ± 1270 | Code *et al.*, 1976 |
| | | | 22000 | Kontizas, 1978 |
| | | | 22400 | Remie and Lamers, 1982 |
| | | | 23100 | Remie and Lamers (flux) |
| | | | 26302 | de Jager, 1980 (p. 61) |
| 64760 | | $B0.5I_b$ | 23800 | Remie and Lamers, 1982 |
| | | | 24600 | Remie and Lamers (flux) |
| 93060 | $\vartheta$ Car | $B0.5V_p$ | 26200 | Conti, 1973 |
| | | | 32500, 4 | Vader *et al.*, 1977 |
| | | | 25000, 3 | Vader *et al.*, 1977 |
| 111123 | $\beta$ Cru | B0.5IV | 26600 ± 1100 | Hanbury Brown *et al.*, 1967 |
| | | | 27600 ± 1110 | Code *et al.*, 1976 |
| | | | 24500 | Heintze, 1969 |
| 150898 | | $B0.5I_a$ | 23600 | Remie and Lamers, 1982 |
| | | | 24400 | Remie and Lamers (flux) |
| 167756 | | $B0.5I_a$ | 24700 | Remie and Lamers, 1982 |
| | | | 25600 | Remie and Lamers (flux) |
| 218376 | 1 Cas | B0.5III | 27474 | Underhill *et al.*, 1979 |
| 2905 | $\kappa$ Cas | $B1I_a$ | 21100 | Remie and Lamers, 1982 |

*Table II (continued)*

| HD | Name | Sp. type | $T_{eff}$ (K) | References |
|---|---|---|---|---|
| | | | 21600 | Remie and Lamers (flux) |
| 10561 | $\varphi$ Per | B1IV$_e$ | 31681 | Underhill *et al.*, 1979 |
| | | | 25000 | Goraya, 1984 |
| 37209 | | B1V | 19800 ± 900 | Nandy *et al.*, 1975 |
| 40111 | 139 Tau | B1I$_b$ | 21100 | Remie and Lamers, 1982 |
| | | | 21400 | Remie and Lamers (flux) |
| | | | 20892 | de Jager, 1980 (p. 61) |
| 47240 | | B1I$_a$ | 20000 | Kontizas, 1978 |
| 52918 | 19 Mon | B1V$_{(e)}$ | 25725 | Underhill *et al.*, 1979 |
| 64760 | | B1I$_b$ | 18200 ± 800 | Nandy *et al.*, 1975 |
| 91316 | $\rho$ Leo | B1I$_{ab}$ | 22600 | Morton and Adams, 1968 |
| | | | 25000 | Vader *et al.*, 1977 |
| | | | 20892 | de Jager, 1980 (p. 61) |
| 116658 | $\alpha$ Vir | B1V | 23000 | Heintze, 1969 |
| | | | 23930 ± 840 | Code *et al.*, 1976 |
| | | | 23830 ± 300 | Relya and Kurucz, 1978 |
| | | | 22300 ± 1400 | Henry *et al.*, 1975 |
| | | | 22600 | Blackwell and Shallis, 1977 |
| | | | 22600 | Morton and Adams, 1968 |
| | | | 23400 | Watson, 1972 |
| | | | 25000 | Vader *et al.*, 1977 |
| 118716 | $\varepsilon$ Cen | B1III | 25740 ± 1190 | Code *et al.*, 1976 |
| 122451 | $\beta$ Cen | B1III | 22600 | Morton and Adams, 1968 |
| | | | 24200 | Watson, 1972 |
| | | | 25000, 3 | Vader *et al.*, 1977 |
| | | | 30000, 4 | Vader *et al.*, 1977 |
| 129056 | $\alpha$ Lup | B1V | 21200 | Heintze, 1969 |
| 143018 | $\pi$ Sco | B1V | 29600 | Schild *et al.*, 1971 |
| 157246 | $\gamma$ Ara | B1I$_b$ | 19706 | Underhill *et al.*, 1979 |
| | | | 20500 | Remie and Lamers, 1982 |
| | | | 20600 | Remie and Lamers (flux) |
| | | | 20892 | de Jager, 1980 (p. 61) |
| HR 8252 | 73 $\rho$ Cyg | B1I$_a^+$ | 21000 | Lamers and Waters, 1984 |
| 224572 | $\sigma$ Cas | B1V | 22600 | Morton and Adams, 1968 |
| | | | 23800 | Kontizas, 1978 |
| 28497 | | B1.5V$_e$ | 21500 | Morton and Adams, 1968 |
| | | | 30000, 4 | Vader *et al.*, 1977 |
| | | | 22500, 3 | Vader *et al.*, 1977 |
| 136298 | $\delta$ Lup | B1.5IV | 26216 | Underhill *et al.*, 1979 |
| | | | 23400 | Remie and Lamers, 1982 |
| 160578 | $\kappa$ Sco | B1.5III | 21200 | Heintze, 1969 |
| | | | 25780 | Underhill *et al.*, 1979 |
| | | | 24000 | Remie and Lamers, 1982 |
| | | | 24400 | Remie and Lamers (flux) |
| 3360 | $\zeta$ Cas | B2IV | 22205 | Underhill *et al.*, 1979 |
| 31327 | | B2I$_a$ | 17000 | Kontizas, 1978 |
| 32249 | $\psi$ Eri | B2V | 19100 | Kontizas, 1978 |
| | | | 19033 | Underhill *et al.*, 1979 |
| 33988 | | B2V | 25000 | Kontizas, 1978 |
| 41117 | $\chi^2$ Ori | B2I$_a$ | 17463 | Underhill *et al.*, 1979 |

*Table II (continued)*

| HD | Name | Sp. type | $T_{eff}$ (K) | References |
|---|---|---|---|---|
| 45546 | 10 Mon | B2V | 22064 | Underhill *et al.*, 1979 |
| 58131 | | B2V | 18900 | Kontizas, 1978 |
| 96446 | | B2V | 25250 ± 350 | Wolff, 1973 |
| 109668 | $\alpha$ Mus | B2IV–V | 23883 | Underhill *et al.*, 1979 |
| 132058 | $\beta$ Lup | B2III | 22800 | Remie and Lamers, 1982 |
| 142669 | $\rho$ Sco | B2IV–V | 22798 | Underhill *et al.*, 1979 |
| 148184 | $\chi$ Oph | $B2V_e$ | 22500 | Goraya, 1984 |
| | | | 18000 | Goraya, 1984 |
| 151985 | $\mu^2$ Sco | B2IV | 20100 | Heintze, 1969 |
| | | | 23113 | Underhill *et al.*, 1979 |
| 158408 | $\upsilon$ Sco | B2IV | 20500 | Morton and Adams, 1968 |
| | | | 22500, 4 | Vader *et al.*, 1977 (L$\alpha$) |
| | | | 25000, 4 | Vader *et al.*, 1977 (L$\alpha$) |
| | | | 25000, 4 | Vader *et al.*, 1977 (L$\beta$) |
| | | | 22831 | Underhill *et al.*, 1979 |
| 158427 | $\alpha$ Ara | B2V | 21885 | Underhill *et al.*, 1979 |
| 164284 | 66 Oph | $B2V_e$ | 23149 | Underhill *et al.*, 1979 |
| 165024 | $\vartheta$ Ara | $B2I_b$ | 17231 | Underhill *et al.*, 1979 |
| 206165 | 9 Cep | $B2I_b$ | 15729 | Underhill *et al.*, 1979 |
| HR 985 | 1H Cam | $B2.5V_e$ | 20260 | Underhill *et al.*, 1979 |
| 42087 | 3 Gem | $B2.5I_a$ | 15600 | Kontizas, 1978 |
| 52382 | | $B2.5I_a$ | 15800 | Kontizas, 1978 |
| 142096 | $\lambda$ Lib | B2.5V | 21990 | Underhill *et al.*, 1979 |
| 143118 | $\eta$ Lup | B2.5IV | 22189 | Underhill *et al.*, 1979 |
| 166182 | 102 Her | B2.5III | 20320 | Underhill *et al.*, 1979 |
| 180163 | $\eta$ Lyr | B2.5IV | 17954 | Underhill *et al.*, 1979 |
| 195565 | $\omega^1$ Cyg | B2.5IV | 18143 | Underhill *et al.*, 1979 |
| 37490 | $\omega$ Ori | $B3III_e$ | 18000 | Goraya, 1984 |
| 43384 | 9 Gem | $B3I_a$ | 14400 | Kontizas, 1978 |
| 79186 | | $B3I_a$ | 14400 | Kontizas, 1978 |
| 142983 | 48 Lib | $B3V_e$ | 18665 | Underhill *et al.*, 1979 |
| 160762 | $\iota$ Her | B3V | 17814 | Underhill *et al.*, 1979 |
| | | | 16800 | Heintze, 1969 |
| | | | 20200 | Kodaira and Scholz, 1970 |
| | | | 18000 | Peters, 1970 |
| 175191 | $\sigma$ Sgr | B3IV | 18000 | Heintze, 1969 |
| | | | 19100 | Morton and Adams, 1968 |
| | | | 20000, 4 | Vader *et al.*, 1977 (L$\alpha$) |
| | | | 22500, 4 | Vader *et al.*, 1977 (L$\alpha$) |
| | | | 22500, 4 | Vader *et al.*, 1977 (L$\beta$) |
| | | | 18987 | Underhill *et al.*, 1979 |
| 182568 | 2 Cyg | B3IV | 19416 | Underhill *et al.*, 1979 |
| 184171 | 8 Cyg | B3IV | 18855 | Underhill *et al.*, 1979 |
| 198478 | 55 Cyg | $B3I_a$ | 14266 | Underhill *et al.*, 1979 |
| 200775 | | $B3V_e$ | 17000 ± 1000 | Baschek *et al.*, 1982 |
| 11415 | $\varepsilon$ Cas | B4IV | 15900 | Schild *et al.*, 1971 |
| | | | 15353 | Underhill *et al.*, 1979 |
| 21428 | 34 Per | B4V | 16534 | Underhill *et al.*, 1979 |
| 27396 | 53 Per | B4IV | 16797 | Underhill *et al.*, 1979 |
| 51309 | $\iota$ CMa | $B4I_b$ | 14861 | Underhill *et al.*, 1979 |

*Table II (continued)*

| HD | Name | Sp. type | $T_{\text{eff}}$ (K) | References |
|---|---|---|---|---|
| HR 4140 | PP Car | $B4V_e$ | 17048 | Underhill *et al.*, 1979 |
| 120709/10 | 3 Cen A | $B4V_p$ | 17800 | Heintze, 1969 |
| | | | 17800 | Hardorp, 1966 |
| | | | 18150 | Hardorp and Strittmatter, 1968 |
| 22192 | $\psi$ Per | $B5V_e$ | 16053 | Underhill *et al.*, 1979 |
| | | | 17000 | Goraya, 1984 |
| 36371 | $\chi$ Aur | $B5I_a$ | 12900 | Kontizas, 1978 |
| 40967 | 3 Mon | B5III | 16558 | Underhill *et al.*, 1979 |
| 42545 | 69 Ori | $B5V_e$ | 15627 | Underhill *et al.*, 1979 |
| 67797 | 16 Lup | B5IV | 15460 | Underhill *et al.*, 1979 |
| 83754 | $\kappa$ Hya | B5V | 15398 | Underhill *et al.*, 1979 |
| 109026 | $\gamma$ Mus | B5V | 15506 | Underhill *et al.*, 1979 |
| 109387 | $\kappa$ Dra | $B5IV_e$ | 13811 | Underhill *et al.*, 1979 |
| 164353 | 67 Oph | $B5I_b$ | 13182 | de Jager, 1980 (p. 61) |
| 188892 | 22 Cyg | B5IV | 15542 | Underhill *et al.*, 1979 |
| 209952 | $\alpha$ Gru | B5IV | 13263 | Underhill *et al.*, 1979 |
| | | | 13400 ± 300 | Relya and Kurucz, 1978 |
| | | | 14050 ± 540 | Code *et al.*, 1976 |
| | | | 13350 ± 360 | Henry *et al.*, 1975 |
| | | | 13050 ± 400 | Nandy and Schmidt, 1975 |
| | | | 13700 ± 400 | Nandy *et al.*, 1975 |
| | | | 14600 ± 950 | Hanbury Brown *et al.*, 1967 |
| | | | 15800 | Hayes, 1967 |
| | | | 13500 | Heintze, 1969 |
| | | | 14000 | Heintze, 1969 |
| 45542 | $\nu$ Gem | $B6III_e$ | 13757 | Underhill *et al.*, 1979 |
| 138749 | $\vartheta$ CrB | $B6V_e$ | 14023 | Underhill *et al.*, 1979 |
| 195810 | $\varepsilon$ Del | B6III | 13614 | Underhill *et al.*, 1979 |
| 217675 | $o$ And | $B6III_e$ | 14326 | Underhill *et al.*, 1979 |
| 23630 | $\eta$ Tau | $B7III_e$ | 12753 | Underhill *et al.*, 1979 |
| 57821 | | B7IV | 13011 | Underhill *et al.*, 1979 |
| 19356 | $\beta$ Per | B8V | 11500 | Johnson, 1966 |
| | | | 11700 | Johnson, 1966 |
| 27295 | 53 Tau | B8V | 12000 | Heintze, 1969 |
| | | | 12400 | Heintze, 1969 |
| | | | 12300 | Mihalas and Henshaw, 1966 |
| | | | 12200 | Auer *et al.*, 1966 |
| 47670 | $\nu$ Pup | B8III | 11609 | Underhill *et al.*, 1979 |
| 76728 | | B8III | 11880 | Underhill *et al.*, 1979 |
| 106625 | $\gamma$ CrV | B8III | 12450 ± 530 | Code *et al.*, 1976 |
| 158094 | $\delta$ Ara | B8V | 12007 | Underhill *et al.*, 1979 |
| 159975 | $\mu$ Oph | B8III | 11645 | Underhill *et al.*, 1979 |
| 166937 | $\mu$ Sgr | $B8I_{ap}$ | 11142 | Underhill *et al.*, 1979 |
| 184606 | 9 Vul | B8III | 12738 | Underhill *et al.*, 1979 |
| 214923 | $\zeta$ Peg | B8V | 11700 | Schild *et al.*, 1971 |
| 224926 | 29 Psc | B8III | 14700 | Schild *et al.*, 1971 |
| 358 | $\alpha$ And | $B9III_p$ | 11300 | Blackwell *et al.*, 1979 |
| 24479 | | $B9V_e$ | 10668 | Underhill *et al.*, 1979 |
| 32549 | 11 Ori | B9V | 10198 | Underhill *et al.*, 1979 |
| 33802 | $\iota$ Lep | B9V | 11864 | Underhill *et al.*, 1979 |

*Table II (continued)*

| HD | Name | Sp. type | $T_{eff}$ (K) | References |
|---|---|---|---|---|
| 40589 | | B9$I_a$ | 10100 | Kontizas, 1978 |
| 43445 | | B9V | 10689 | Underhill *et al.*, 1979 |
| 100841 | $\lambda$ Cen | B9III | 10471 | Underhill *et al.*, 1979 |
| 100889 | $\vartheta$ Crt | B9V | 11200 | Schild *et al.*, 1971 |
| 145389 | $\phi$ Her | B9III | 10864 | Underhill *et al.*, 1979 |
| 149212 | 15 Dra | B9IV | 10509 | Underhill *et al.*, 1979 |
| 192907 | $\kappa$ Cep | B9III | 10653 | Underhill *et al.*, 1979 |
| 209819 | $\iota$ Aqr | B9IV | 11284 | Underhill *et al.*, 1979 |
| 212593 | 4 Lac | B9$I_b$ | 9932 | Underhill *et al.*, 1979 |
| 32309 | | B9.5V | 10203 | Underhill *et al.*, 1979 |
| 40312 | $\vartheta$ Aur | B9.$5_p$V | 10900 | Schild *et al.*, 1971 |
| | | | 10500 | Van Rensbergen, 1984 |
| 112413 | $\alpha^2$ CVn | B9.$5_p$V | 10500 | Wolff, 1967 |
| | | | 11606 | Stift, 1973 |
| | | | 12 – 13000 | Cohen, 1970 |
| | | | 13000 | Durrant, 1970 |
| | | | 13263 | Searle and Sargent, 1964 |
| | | | 14000 | Jugaku and Sargent, 1968 |
| | | | 10830 | Blackwell and Shallis, 1979 |
| 186882 | $\delta$ Cyg | B9.5III | 9670 | Blackwell *et al.*, 1979 |
| 222661 | $\omega^2$ Aqr | B9.5V | 11000 | Heintze, 1969 |
| | | | 11100 | Heintze, 1969 |
| 6829 | 31 Cas | A0$V_n$ | 9430 – 9560 | Böhm-Vitense, 1982 |
| 7583 | | A0$I_a^+$ | 8960 ± 300 | de Jager, 1980 (p. 38) |
| 21389 | 3H Cam | A0$I_a$ | 11000 | Aydin, 1972 |
| 29722 | 59 Per | A0V | 9150 | Böhm-Vitense, 1982 |
| 31592 | 98 Tau | A0V | 9170 – 9790 | Böhm-Vitense, 1982 |
| 36473 | 10 Lep | A0V | 9420 – 9460 | Böhm-Vitense, 1982 |
| 42818 | | A0V | 9300 – 9100 | Böhm-Vitense, 1982 |
| 45557 | | A0V | 9700 – 9170 | Böhm-Vitense, 1982 |
| 46300 | 13 Mon | A0$I_b$ | 8940 – 8800 | Böhm-Vitense, 1982 |
| 61931 | | A0$III_n$ | 9560 – 9480 | Böhm-Vitense, 1982 |
| 87737 | $\eta$ Leo | A0$I_a$ | 8900 | Kontizas, 1978 |
| | | | 9460 – 8920 | Böhm-Vitense, 1982 |
| 87887 | 15 $\alpha$ Sex | A0III | 9800 – 9600 | Böhm-Vitense, 1982 |
| 94367 | | A0$I_a$ | 12500 ± 800 | Nandy and Schmidt, 1975 |
| 110304 | $\gamma$ Cen | A0III | 9220 – 9000 | Böhm-Vitense, 1982 |
| 112185 | $\varepsilon$ UMa | A$0_p$V | 8920 | Shallis *et al.*, 1979 |
| 123299 | 11 $\alpha$ Dra | A0III | 9900 – 9500 | Böhm-Vitense, 1982 |
| 130109 | 109 Vir | A0V | 10000 | Heintze, 1969 |
| | | | 9830 | Hayes, 1967 |
| | | | 9700 | Schild *et al.*, 1971 |
| 141513 | $\mu$ Ser | A0V | 10700 | Heintze, 1969 |
| 9132 | 48 Cet | A1V | 9000 – 9240 | Böhm-Vitense, 1982 |
| 27616 | | A1V | 9230 – 9400 | Böhm-Vitense, 1982 |
| 27962 | 68 Tau | A1$V_m$ | 8770 – 8730 | Böhm-Vitense, 1982 |
| 29722 | 59 Per | A1$V_n$ | 9100 | Malagnini *et al.*, 1982 |
| 31278 | 7 Cam | A1V | 9440 – 9470 | Böhm-Vitense, 1982 |
| 40446 | 60 Ori | A1$V_s$ | 9500 – 9470 | Böhm-Vitense, 1982 |
| 41695 | $\vartheta$ Lep | A1V | 8950 – 9110 | Böhm-Vitense, 1982 |

*Table II (continued)*

| HD | Name | Sp. type | $T_{eff}$ (K) | References |
|---|---|---|---|---|
| | | | 9100 | Malagnini *et al.*, 1982 |
| 62832 | 11 CMi | A1$V_{nn}$ | 9200 | Malagnini *et al.*, 1982 |
| 66664 | 8 Cnc | A1V | 9000 | Malagnini *et al.*, 1982 |
| 73262 | 4 $\delta$ Hya | A1$V_{nn}$ | 9300 | Malagnini *et al.*, 1982 |
| 74198 | 43 $\gamma$ Cnc | A1IV | 8800 | Malagnini *et al.*, 1982 |
| 77327 | 12 $\kappa$ UMa | A1$V_n$D | 9600 | Malagnini *et al.*, 1982 |
| 80007 | $\beta$ Car | A1IV | 9240 ± 220 | Code *et al.*, 1976 |
| 135382 | $\gamma$ Tra | A1V | 9400 | Malagnini *et al.*, 1982 |
| 140159 | $\iota$ Ser | A1V | 9400 | Heintze, 1969 |
| 166205 | 23 $\delta$ UMi | A1$V_n$ | 9000 | Malagnini *et al.*, 1982 |
| 176984 | 14 Aql | A1V | 9600 | Malagnini *et al.*, 1982 |
| 188728 | 61 $\varphi$ Aql | A1IV | 8900 | Malagnini *et al.*, 1982 |
| 198001 | $\varepsilon$ Aqr | A1V | 9400 | Heintze, 1969 |
| | | | 9100 | Heintze, 1969 |
| | | | 9164 | Hayes, 1967 |
| | | | 9600 | Schild *et al.*, 1971 |
| 213558 | 7 $\alpha$ Lac | A1V | 9200 | Malagnini *et al.*, 1982 |
| 1404 | $\sigma$ And | A2V | 8800 – 8860 | Böhm-Vitense, 1982 |
| | | | 8800 | Malagnini *et al.*, 1982 |
| 2421 | | A2$V_s$ | 9300 | Malagnini *et al.*, 1982 |
| | | | 9480 – 9430 | Böhm-Vitense, 1982 |
| 18411 | 22 $\pi$ Per | A2$V_s$ | 8900 | Malagnini *et al.*, 1982 |
| 19275 | | A2$V_{nn}$ | 9100 | Malagnini *et al.*, 1982 |
| | | | 8990 – 9100 | Böhm-Vitense, 1982 |
| 23401 | $\gamma$ Cam | A2$IV_n$ | 8700 – 8930 | Böhm-Vitense, 1982 |
| | | | 8900 | Malagnini *et al.*, 1982 |
| 26764 | | A2$V_n$ | 8700 | Malagnini *et al.*, 1982 |
| | | | 8720 – 8950 | Böhm-Vitense, 1982 |
| 27820 | 66 Tau | A2V | 8580 – 8840 | Böhm-Vitense, 1982 |
| 27861 | $\xi$ Eri | A2V | 8790 – 8980 | Böhm-Vitense, 1982 |
| 27962 | 68 Tau | A2IV | 8500 | Malagnini *et al.*, 1982 |
| 39283 | $\xi$ Aur | A2V | 9000 | Malagnini *et al.*, 1982 |
| | | | 8840 – 8970 | Böhm-Vitense, 1982 |
| 39866 | | A2$I_b$ | 10500 | Aydin, 1972 |
| 40183 | $\beta$ Aur | A2V | 10000 | Johnson, 1966 |
| | | | 9800 | Kuiper, 1938 |
| | | | 10500 | Harris, 1963 |
| | | | 10500 | Popper, 1959 |
| 43378 | 2 Lyn | A2$V_s$ | 9240 – 9130 | Böhm-Vitense, 1982 |
| | | | 9200 | Malagnini *et al.*, 1982 |
| 50973 | 16 Lyn | A2$V_n$ | 9000 | Malagnini *et al.*, 1982 |
| 67006 | 27 Lyn | A2V | 9100 | Malagnini *et al.*, 1982 |
| 82621 | 26 UMa | A2V | 9200 | Malagnini *et al.*, 1982 |
| 85558 | $\gamma$ Sex | A2V | 9460 – 9130 | Böhm-Vitense, 1982 |
| 97277 | 11 $\beta$ Crt | A2III | 8700 | Malagnini *et al.*, 1982 |
| 97632 | $\vartheta$ Leo | A2V | 9750 | Schild *et al.*, 1971 |
| 109787 | $\tau$ Cen | A2V | 9100 | Malagnini *et al.*, 1982 |
| 115892 | $\iota$ Cen | A2V | 8800 | Malagnini *et al.*, 1982 |
| 116656 | $\zeta$ UMa | A2VD | 9100 | Malagnini *et al.*, 1982 |
| 135502 | $\chi$ Boo | A2V | 9000 | Malagnini *et al.*, 1982 |

*Table II (continued)*

| SerHD | Name | Sp. type | $T_{eff}$ (K) | References |
|---|---|---|---|---|
| 141653 | | A2IV | 8800 | Malagnini *et al.*, 1982 |
| 148857 | 10 $\lambda$ Oph | A2VD | 9300 | Malagnini *et al.*, 1982 |
| 152127 | 21 Oph | A2VS | 9200 | Malagnini *et al.*, 1982 |
| 155125 | $n$ Oph | A2VS | 8500 | Malagnini *et al.*, 1982 |
| 156729 | 69 Her | A2V | 9000 | Malagnini *et al.*, 1982 |
| 156928 | $\nu$ Ser | A2VD | 9100 | Malagnini *et al.*, 1982 |
| 162579 | 30 Dra | A2V | 9000 | Malagnini *et al.*, 1982 |
| 164577 | | A2V | 9500 | Malagnini *et al.*, 1982 |
| 176687 | $\zeta$ Sgr | A2IIID | 8850 – 8400 | Böhm-Vitense, 1982 |
| | | | 8400 | Malagnini *et al.*, 1982 |
| 178253 | $\alpha$ CrA | A2IV | 8800 | Malagnini *et al.*, 1982 |
| 182564 | $\pi$ Dra | A2III$_s$ | 8500 | Malagnini *et al.*, 1982 |
| 192425 | $\rho$ Aql | A2V | 8600 | Malagnini *et al.*, 1982 |
| 207155 | $\vartheta$ PsA | A2V | 9100 | Malagnini *et al.*, 1982 |
| 207673 | | A2I$_b$ | 8800 | Aydin, 1972 |
| | | | 9000 | Mihalas, 1965 |
| 215789 | $\varepsilon$ Cru | A2V | 9070 | Morton and Adams, 1968 |
| 221760 | $\iota$ Phe | A2V | 8400 | Malagnini *et al.*, 1982 |
| 222095 | | A2V | 8500 | Malagnini *et al.*, 1982 |
| 18622/3 | $\vartheta$ Eri | A3V | 8260 – 8530 | Böhm-Vitense, 1982 |
| 33679 | | A3I$_a$$^+$ | 8130 $\pm$ 300 | de Jager, 1980 (p. 38) |
| 48250 | 12 Lyn | A3VD | 8800 – 8920 | Böhm-Vitense, 1982 |
| | | | 8700 | Malagnini *et al.*, 1982 |
| 50019 | $\vartheta$ Gem | A3III | 8300 | Malagnini *et al.*, 1982 |
| 56537 | $\lambda$ Gem | A3VSB | 8400 | Malagnini *et al.*, 1982 |
| 61497 | 24 Lyn | A3IV$_n$ | 8520 – 8850 | Böhm-Vitense, 1982 |
| 64145 | $\varphi$ Gem | A3V | 8100 | Malagnini *et al.*, 1982 |
| 74988 | | A3V | 9100 | Malagnini *et al.*, 1982 |
| 102647 | $\beta$ Leo | A3V | 8850 $\pm$ 340 | Code *et al.*, 1976 |
| | | | 8750 $\pm$ 200 | Relya and Kurucz, 1978 |
| | | | 8900 | Schild *et al.*, 1971 |
| | | | 8400 | Kontizas, 1978 |
| | | | 8840 | Morton and Adams, 1968 |
| 130841 | $\alpha^2$ Lib | A3IV$_m$ | 9310 | Shallis *et al.*, 1979 |
| | | | 8100 | Malagnini *et al.*, 1982 |
| | | | 8200 – 8230 | Böhm-Vitense, 1982 |
| 135379 | $\beta$ Cir | A3V | 8420 – 8530 | Böhm-Vitense, 1982 |
| | | | 8600 | Malagnini *et al.*, 1982 |
| 137422 | $\gamma$ UMi | A3II–III | 8160 – 8700 | Böhm-Vitense, 1982 |
| 142105 | $\zeta$ UMi | A3V$_n$ | 8700 | Malagnini *et al.*, 1982 |
| 142629 | $\xi^{1/2}$ Lup | A3VD | 8700 | Malagnini *et al.*, 1982 |
| 145570 | $\psi$ Sco | A3IV | 8500 | Malagnini *et al.*, 1982 |
| 169702 | $\mu$ Lyr | A3IV | 9000 | Malagnini *et al.*, 1982 |
| 187362 | $\zeta$ Sge | A3VD | 8900 | Malagnini *et al.*, 1982 |
| 192696 | 33 Cyg | A3IV–V$_n$ | 8300 | Malagnini *et al.*, 1982 |
| 195943 | $\eta$ Del | A3IV$_s$ | 8600 | Malagnini *et al.*, 1982 |
| 203562 | $\beta$ Equ | A3V | 9000 | Malagnini *et al.*, 1982 |
| 210221 | | A3I$_b$ | 9800 | Aydin, 1972 |
| 214734 | 30 Cep | A3IV | 8700 | Malagnini *et al.*, 1982 |
| 216956 | $\alpha$ PsA | A3V | 9300 $\pm$ 400 | Hanbury Brown *et al.*, 1967 |

*Table II (continued)*

| HD | Name | Sp. type | $T_{eff}$ (K) | References |
|---|---|---|---|---|
| | | | 8800 ± 300 | Code *et al.*, 1976 |
| | | | 8870 ± 200 | Relya and Kurucz, 1978 |
| 223385 | 6 Cas | $A3I_a$ | 9300 | Aydin, 1972 |
| 18622 | $\vartheta^{1/2}$ Eri | A4IIID | 8200 | Malagnini *et al.*, 1982 |
| 56169 | | $A4III_n$ | 8400 | Malagnini *et al.*, 1982 |
| | | | 8360 – 8750 | Böhm-Vitense, 1982 |
| 97603 | $\delta$ Leo | A4V | 8300 | Schild *et al.*, 1971 |
| 165777 | 72 Oph | $A4IV_s$ | 8200 | Malagnini *et al.*, 1982 |
| 8538 | $\delta$ Cas | A5V | 9000 | Schild *et al.*, 1971 |
| 9132 | 48 Cet | A5VSB | 9100 | Malagnini *et al.*, 1982 |
| 11636 | $\beta$ Ari | A5IIISB | 8200 | Malagnini *et al.*, 1982 |
| | | | 8600 | Schild *et al.*, 1971 |
| 13161 | $\beta$ Tri | A5IIISB | 8180 – 8250 | Böhm-Vitense, 1982 |
| | | | 8100 | Malagnini *et al.*, 1982 |
| 44769 | 8 Mon | A5IVD | 8000 | Malagnini *et al.*, 1982 |
| 79439 | 18 UMa | A5V | 8080 – 8350 | Böhm-Vitense, 1982 |
| 118232 | 24 CVn | A5V | 8000 | Malagnini *et al.*, 1982 |
| | | | 7920 – 8410 | Böhm-Vitense, 1982 |
| 175638 | $\vartheta^1$ Cer | A5VD | 8100 | Malagnini *et al.*, 1982 |
| 184006 | $\iota$ Cyg | $A5V_n$ | 8300 | Malagnini *et al.*, 1982 |
| 197051 | $\beta$ Pav | A5IV | 8100 | Malagnini *et al.*, 1982 |
| 200499 | $\eta$ Cap | A5VD | 8200 | Malagnini *et al.*, 1982 |
| 102249 | $\lambda$ Mus | A7III | 8100 | Malagnini *et al.*, 1982 |
| 172555 | | A7V | 8000 | Malagnini *et al.*, 1982 |
| 195725 | $\vartheta$ Cep | A7III | 8000 | Malagnini *et al.*, 1982 |
| 147547 | $\gamma$ Her | A9III | 7500 | Malagnini *et al.*, 1982 |
| 181577 | 44 $p^1$ Sgr | F0IV – V | 7700 | Malagnini *et al.*, 1982 |
| | $\varepsilon$ ( = 7) Aur | F0Ia | 7800 | Castelli, 1978 |
| 30652 | 1 $\pi^3$ Ori | F6V | 6700 | Malagnini *et al.*, 1982 |
| 142860 | $\gamma$ Ser | F6IV–V | 6380 | Blackwell *et al.*, 1979 |

## 3. Discussion

Our results are listed in Table VI, where the mean effective temperature of the stars, their standard deviation (as a function of spectral type), the number of stars, and the comparison with the mean effective temperatures of previous workers are given.

From these results it can be seen that the derived stellar temperature scale on the basis of literature data is expected to be an improvement over previously available values.

The analysis of the obtained stellar temperature scale and the standard deviation of the MK spectral classificatin has shown that this scale is sufficiently reliable for many statistical investigations.

There is no doubt that the effective temperatures of the O8–B9 supergiants are lower than those of the Main-Sequence and giant stars of the same sub-type. The effective temperatures of supergiants are significantly lower than for Main-Sequence stars of the same sub-type; the difference is about 6500 K at type B0.5, but diminishes as we go from

TABLE III

Total number of programme stars as a function of spectral type and luminosity class

| Spectral type | Luminosity classes I | II | III | IV | V | Number of programme stars |
|---|---|---|---|---|---|---|
| O8 | – | – | 1 | – | – | 1 |
| O8.5 | 1 | – | – | – | – | 1 |
| O9.5 | 1 | – | – | – | 1 | 2 |
| B0 | 1 | – | 2 | – | – | 3 |
| B0.5 | – | – | 3 | 2 | – | 5 |
| B1 | 1 | 1 | 4 | – | 3 | 9 |
| B1.5 | – | – | 2 | 3 | 3 | 8 |
| B2 | – | 2 | 5 | 13 | 3 | 23 |
| B2.5 | – | – | – | 7 | 5 | 12 |
| B3 | 1 | – | 2 | 10 | 16 | 29 |
| B4 | – | – | 1 | 2 | 3 | 6 |
| B5 | 1 | – | 4 | 3 | 8 | 16 |
| B6 | – | – | 1 | 1 | 1 | 3 |
| B7 | – | – | 3 | 3 | 3 | 9 |
| B8 | 1 | 2 | 3 | 1 | 4 | 11 |
| B9 | – | – | 5 | 2 | 2 | 9 |
| B9.5 | – | – | 3 | – | 4 | 7 |
| A0 | – | – | 2 | – | 8 | 10 |
| A1 | – | – | – | 2 | 8 | 10 |
| A2 | 1 | – | – | 1 | 3 | 5 |
| A3 | – | – | – | – | 11 | 11 |
| A4 | – | – | – | 1 | – | 1 |
| A5 | – | – | 2 | 1 | 2 | 5 |
| A7 | – | – | 1 | 2 | 3 | 6 |
| F0 | 1 | – | 1 | 1 | – | 3 |
| F2 | – | 1 | – | 2 | – | 3 |
| F3 | – | – | – | 1 | – | 1 |
| F5 | 1 | – | – | 1 | – | 2 |
| Number of stars | 10 | 6 | 45 | 59 | 91 | 211 |

B0.5 to late B stars. Thus the difference is about 1000 K at type B9. At types A, F the difference is not valid anymore and the supergiants has slightly higher temperature than the Main-Sequence stars.

The temperatures are plotted versus spectral type in Figure 1. The standard deviation about each mean value is given in Table VI. It is of the order of the size of the symbols in most cases and it is eliminated to avoid confusion.

TABLE IV

Number of stars as a function of spectral type and luminosity class from literature

| Spectral type | Luminosity classes | | | | | Number of stars |
|---|---|---|---|---|---|---|
| | I | II | III | IV | V | |
| O8 | 4 | – | 8 | – | 5 | 17 |
| O8.5 | 4 | – | 6 | – | 5 | 15 |
| O9 | 8 | – | 4 | – | 6 | 18 |
| O9.5 | 9 | – | – | – | 7 | 16 |
| B0 | 5 | – | – | 1 | 2 | 8 |
| B0.5 | 4 | – | 1 | 1 | 1 | 7 |
| B1 | 7 | – | 2 | 1 | 6 | 16 |
| B1.5 | – | – | 1 | 1 | 1 | 3 |
| B2 | 4 | – | 1 | 5 | 8 | 18 |
| B2.5 | 2 | – | 1 | 3 | 2 | 8 |
| B3 | 3 | – | 1 | 3 | 3 | 10 |
| B4 | 1 | – | – | 2 | 3 | 6 |
| B5 | 2 | – | 1 | 4 | 4 | 11 |
| B6 | – | – | 3 | – | 1 | 4 |
| B7 | – | – | 1 | 1 | – | 2 |
| B8 | 1 | – | 6 | – | 4 | 11 |
| B9 | 2 | – | 4 | 2 | 5 | 13 |
| B9.5 | – | – | 1 | – | 4 | 5 |
| A0 | 5 | – | 4 | – | 9 | 18 |
| A1 | – | – | – | 3 | 17 | 20 |
| A2 | 2 | – | 3 | 4 | 31 | 40 |
| A3 | 3 | 1 | 1 | 7 | 12 | 24 |
| A4 | – | – | 2 | 1 | 1 | 4 |
| A5 | – | – | 2 | 2 | 7 | 11 |
| A7 | – | – | 2 | – | 1 | 3 |
| A9 | – | – | 1 | – | – | 1 |
| F0 | 1 | – | – | 1 | – | 2 |
| F6 | – | – | – | 1 | 1 | 2 |
| Number of stars | 67 | 1 | 56 | 43 | 146 | 313 |

TABLE V

Total number of stars as a function of spectral type and luminosity class

| Spectral type | Luminosity classes | | | | | Total number of stars |
|---|---|---|---|---|---|---|
| | I | II | III | IV | V | |
| O8 | 4 | – | 9 | – | 5 | 18 |
| O8.5 | 5 | – | 6 | – | 5 | 16 |
| O9 | 8 | – | 4 | – | 6 | 18 |
| O9.5 | 10 | – | – | – | 8 | 18 |
| B0 | 6 | – | 2 | 1 | 2 | 11 |
| B0.5 | 4 | – | 4 | 3 | 1 | 12 |
| B1 | 8 | 1 | 6 | 1 | 9 | 25 |
| B1.5 | – | – | 3 | 4 | 4 | 11 |
| B2 | 4 | 2 | 6 | 18 | 11 | 41 |
| B2.5 | 2 | – | 1 | 10 | 7 | 20 |
| B3 | 4 | – | 3 | 13 | 19 | 39 |
| B4 | 1 | – | 1 | 4 | 6 | 12 |
| B5 | 3 | – | 5 | 7 | 12 | 27 |
| B6 | – | – | 4 | 1 | 2 | 7 |
| B7 | – | – | 4 | 4 | 3 | 11 |
| B8 | 2 | 2 | 9 | 1 | 8 | 22 |
| B9 | 2 | – | 9 | 4 | 7 | 22 |
| B9.5 | – | – | 4 | – | 8 | 12 |
| A0 | 5 | – | 6 | – | 17 | 28 |
| A1 | – | – | – | 5 | 25 | 30 |
| A2 | 3 | – | 3 | 5 | 34 | 45 |
| A3 | 3 | 1 | 1 | 7 | 23 | 35 |
| A4 | – | – | 2 | 2 | 1 | 5 |
| A5 | – | – | 4 | 3 | 9 | 16 |
| A7 | – | – | 3 | 2 | 4 | 9 |
| A9 | – | – | 1 | – | – | 1 |
| F0 | 2 | – | 1 | 1 | 1 | 5 |
| F2 | – | 1 | – | 2 | – | 3 |
| F3 | – | – | – | 1 | – | 1 |
| F5 | 1 | – | – | 1 | – | 2 |
| F6 | – | – | – | 1 | 1 | 2 |
| Number of stars | 77 | 7 | 101 | 100 | 239 | 524 |

TABLE VI

The average effective temperatures as a function of spectral type and the comparison with previous workers

| Spectral type | Luminosity classes | $T_{eff}$ (K) | s.d. (K) | No. | Others | | |
|---|---|---|---|---|---|---|---|
| | | | | | $T_{eff}$ (K) | s.d. (K) | No. |
| O8 | IV, V | 35660 | 1738 | 5 | 35000[a] | – | – |
| | II, III | 34350 | 2335 | 9 | 35290 | 120 | 3[d] |
| | I | 35600 | 1854 | 4 | 34420 | 70 | 2[d] |
| O8.5 | IV, V | 35280 | 2139 | 5 | – | – | – |
| | II, III | 32360 | 904 | 6 | 34075 | – | 1[d] |
| | I | 33040 | 1463 | 5 | 33510 | – | 1[d] |
| O9 | IV, V | 34550 | 1304 | 6 | 34220 | 130 | 2[d] |
| | II, III | 31625 | 809 | 4 | – | – | – |
| | I | 31430 | 1030 | 8 | 33140 | – | 1[d] |
| O9.5 | IV, V | 32830 | 1129 | 8 | 31560 | – | 1[d] |
| | II, III | – | – | – | – | – | – |
| | I | 30640 | 1443 | 10 | 29910 | 950 | 3[d] |
| B0 | IV, V | 29230 | 208 | 3 | 30780 | – | 1[d] |
| | II, III | 30000 | 0 | 2 | – | – | – |
| | I | 27130 | 4202 | 6 | 25090 | – | 1[d] |
| B0.5 | IV, V | 30025 | 2160 | 4 | 29270 | 240 | 2[d] |
| | II, III | 28370 | 1977 | 4 | 27470[e] | – | 1[d] |
| | I | 23525 | 1123 | 4 | 24500 | – | – |
| B1 | IV, V | 25570 | 3652 | 10 | 26900 | 830 | 2[d] |
| | II, III | 26105 | 1779 | 7 | 26320 | 730 | 4[d] |
| | I | 20860 | 1925 | 8 | 19790 | 60 | 2[d] |
| B1.5 | IV, V | 25340 | 2164 | 8 | 25720 | 440 | 3[d] |
| | II, III | 26260 | 3524 | 3 | 24750 | 730 | 2[d] |
| | I | – | – | – | – | – | – |
| B2 | IV, V | 22400 | 1393 | 28 | 22820 | 170 | 14[d] |
| | II, III | 22160 | 1145 | 8 | 22270 | 380 | 7[d] |
| | I | 16855 | 779 | 4 | 16480 | 530 | 2[d] |
| B2.5 | IV, V | 20530 | 1637 | 17 | 20380 | 560 | 8[d] |
| | II, III | 20320 | – | 1 | 20320 | – | 1[d] |
| | I | 15700 | 141 | 2 | – | – | – |
| B3 | IV, V | 18445 | 1426 | 32 | 18530 | 190 | 11[d] |
| | II, III | 18000 | 0 | 3 | – | – | – |
| | I | 14520 | 328 | 4 | 14520 | 180 | 2[d] |
| B4 | IV, V | 17100 | 386 | 10 | 16340 | 190 | 8[d] |
| | II, III | – | – | – | – | – | – |
| | I | 16680 | 2573 | 2 | 14860 | – | 1[d] |
| B5 | IV, V | 15310 | 750 | 19 | 15170 | 180 | 9[d] |
| | II, III | 14910 | 987 | 5 | 14850 | 500 | 4[d] |
| | I | 13030 | 142 | 3 | 12980 | – | 1[d] |

*Table VI (continued)*

| Spectral type | Luminosity classes | $T_{eff}$ (K) | s.d. (K) | No. | Others | | |
|---|---|---|---|---|---|---|---|
| | | | | | $T_{eff}$ (K) | s.d. (K) | No. |
| B6 | IV, V | 14340 | 570 | 3 | 13740 | 160 | 3[d] |
| | II, III | 13810 | 383 | 4 | 13660 | 200 | 5[d] |
| | I | – | – | – | – | – | – |
| B7 | IV, V | 12915 | 393 | 7 | 12980 | 180 | 4[d] |
| | II, III | 12940 | 1230 | 4 | 12750 | – | 1[d] |
| | I | – | – | – | – | – | – |
| B8 | IV, V | 12120 | 623 | 9 | 11900 | 130 | 4[d] |
| | II, III | 12300 | 945 | 11 | 11930 | 180 | 5[d] |
| | I | 11320 | 253 | 2 | 11460 | 220 | 2[d] |
| B9 | IV, V | 11020 | 509 | 11 | 10920 | 480 | 10[d] |
| | II, III | 10700 | 385 | 9 | 10780 | 120 | 4[d] |
| | I | 10020 | 118 | 2 | 9930 | – | 1[d] |
| B9.5 | IV, V | 10340 | 465 | 8 | 10200 | – | 1[d] |
| | II, III | 10040 | 277 | 4 | 10545[c] | – | – |
| | I | – | – | – | – | – | – |
| A0 | IV, V | 9530 | 432 | 17 | 9470 | – | 1[d] |
| | II, III | 10240 | 1611 | 6 | 10000[c] | – | – |
| | I | 10170 | 1549 | 5 | – | – | – |
| A1 | IV, V | 9150 | 241 | 30 | 9200 | 200 | 21[b] |
| | II, III | – | – | – | – | – | – |
| | I | – | – | – | – | – | – |
| A2 | IV, V | 8990 | 347 | 39 | 8900 | 280 | 35[b] |
| | II, III | 8530 | 152 | 3 | 8790[c] | – | – |
| | I | 9260 | 1078 | 3 | 9120[c] | – | – |
| A3 | IV, V | 8625 | 281 | 30 | 8600 | 280 | 24[b] |
| | II, III | 8230 | 99 | 2 | 8510[c] | – | – |
| | I | 9070 | 857 | 3 | – | – | – |
| A4 | IV, V | 8260 | 57 | 3 | – | – | – |
| | II, III | 8300 | 141 | 2 | – | – | – |
| | I | – | – | – | – | – | – |
| A5 | IV, V | 8170 | 481 | 12 | 8500[a] | – | – |
| | II, III | 8075 | 95 | 4 | 8205[c] | – | – |
| | I | – | – | – | – | – | – |
| A7 | IV, V | 7700 | 200 | 6 | 8200[a] | – | – |
| | II, III | 8200 | 264 | 3 | – | – | – |
| | I | – | – | – | – | – | – |
| A9 | IV, V | – | – | – | – | – | – |
| | II, III | 7500 | 0 | 1 | – | – | – |
| | I | – | – | – | – | – | – |

*Table VI (continued)*

| Spectral type | Luminosity classes | $T_{eff}$ (K) | s.d. (K) | No. | Others | | |
|---|---|---|---|---|---|---|---|
| | | | | | $T_{eff}$ (K) | s.d. (K) | No. |
| F0 | IV, V | 7500 | 282 | 2 | 7520[a] | – | – |
| | II, III | 7000 | 0 | 1 | – | – | – |
| | I | 7650 | 212 | 2 | 7800[c] | – | – |
| F2 | IV, V | 6500 | 0 | 2 | – | – | – |
| | II, III | 6500 | 0 | 1 | – | – | – |
| | I | – | – | – | – | – | – |
| F3 | IV, V | 6500 | 0 | 1 | – | – | – |
| | II, III | – | – | – | – | – | – |
| | I | – | – | – | – | – | – |
| F5 | IV, V | 6500 | 0 | 1 | 6810[a] | – | – |
| | II, III | – | – | – | – | – | – |
| | I | 7000 | 0 | 1 | 7000[c] | – | – |
| F6 | IV, V | 6540 | 226 | 2 | 6580[a] | – | – |
| | II, III | – | – | – | – | – | – |
| | I | – | – | – | – | – | – |

[a] From Morton and Adams, 1968.
[b] From Malagnini *et al.*, 1982.
[c] From de Jager, 1980, p. 30.
[d] From Underhill *et al.*, 1979.
[e] From Remie and Lamers, 1982.

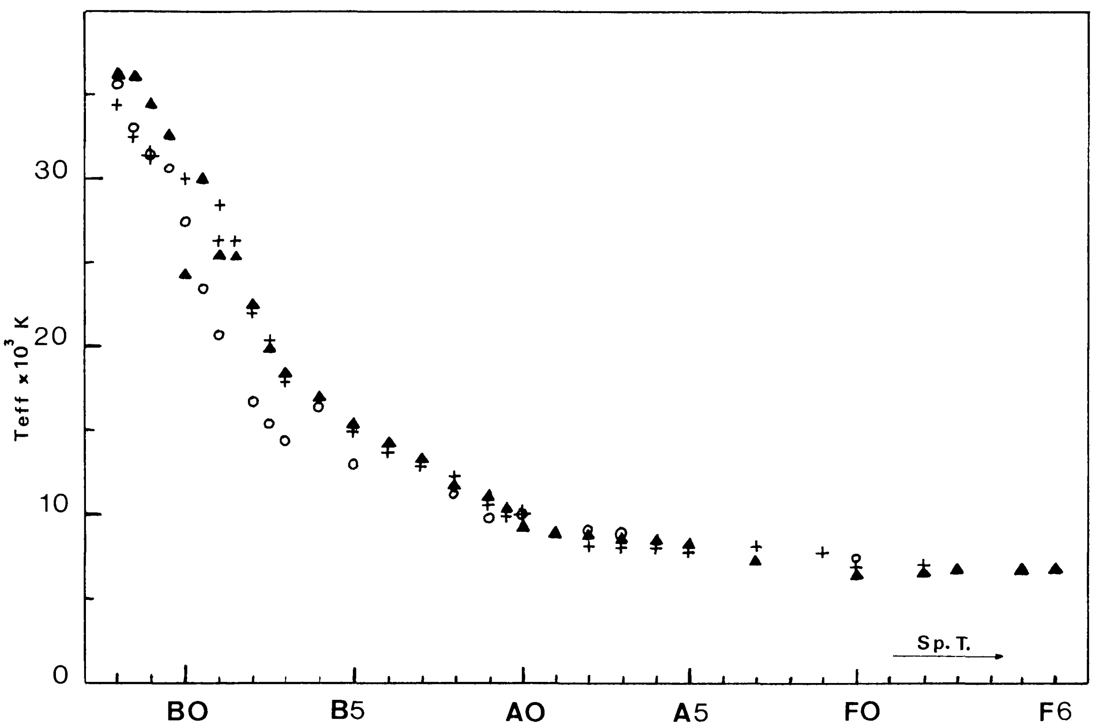


Fig. 1. The relations between average effective temperatures and MK spectral types for O8 to F6 stars. The results for Main-Sequence stars (luminosity classes IV and V) are shown by filled triangles, those for giants (luminosity classes II and III) by crosses, and those for supergiants (luminosity class I) by open circles.

## Acknowledgement

The authors sincerely thank Prof. P. Laskarides for his helpful comments.

## References

Adelman, S. J.: 1973, *Astrophys. J.* **183**, 95.
Aller, L. H.: 1949, *Astrophys. J.* **109**, 244.
Aller, L. H. and Jugaku, J.: 1959, *Astrophys. J. Suppl.* **4**, 109.
Auer, L. H. and Mihalas, D. M.: 1972, *Astrophys. J. Suppl.* **24**, 193.
Auer, L. H., Mihalas, D. M., Aller, L. H., and Ross, J. E.: 1966, *Astrophys. J.* **145**, 153.
Aydin, C.: 1972, *Astron. Astrophys.* **19**, 369.
Baschek, B., Beltrametti, M., Köppen, J., and Traving, G.: 1982, *Astron. Astrophys.* **105**, 300.
Beeckmans, F.: 1977, *Astron. Astrophys.* **60**, 1.
Beeckmans, F., Macau, D., and Malaise, D.: 1974, *Astron. Astrophys.* **33**, 93.
Blackwell, D. E. and Shallis, M. J.: 1977, *Monthly Notices Roy. Astron. Soc.* **180**, 177.
Blackwell, D. E. and Shallis, M. J.: 1979, *Astron. Astrophys.* **82**, 249.
Blackwell, D. E., Shallis, M. J., and Selby, M. J.: 1979, *Monthly Notices Roy. Astron. Soc.* **188**, 847.
Böhm-Vitense, E.: 1982, *Astrophys. J.* **255**, 191.
Castelli, F.: 1978, *Astron. Astrophys.* **69**, 23.
Code, A. D., Davis, J., Bless, R. C., and Hanbury Brown, R.: 1976, *Astrophys. J.* **203**, 417.
Cohen, J. G.: 1970, *Astrophys. J.* **159**, 473.
Conti, P. S.: 1973, *Astrophys. J.* **179**, 181.
Conti, P. S. and Alschuler, W. R.: 1971, *Astrophys. J.* **170**, 325.
Davis, J. and Webb, R. J.: 1970, in L. Houziaux and H. E. Butler (eds.), 'Ultraviolet Stellar Spectra and Ground-Based Observations', *IAU Symp.* **36**, 90.
de Jager, C.: 1980, *The Brightest Stars*, Geophysics and Astrophysics Monographs, D. Reidel Publ. Co., Dordrecht, Holland, pp. 6, 30, 38, 61.
Dufton, P. L.: 1972, *Astron. Astrophys.* **16**, 301.
Durrant, C. J.: 1970, *Monthly Notices Roy. Astron. Soc.* **147**, 75.
Goraya, P. S.: 1984, *Astron. Astrophys.* **138**, 19.
Hack, M.: 1960, *Mem. Soc. Astron. Ital.* **31**, 279.
Hanbury Brown, R., Davis, J., Allen, L. R., and Rome, J. N.: 1967, *Monthly Notices Roy. Astron. Soc.* **137**, 393.
Hanbury Brown, R., Davis, J., and Allen, L. R.: 1974, *Monthly Notices Roy. Astron. Soc.* **167**, 121.
Hardorp, J.: 1966, *Z. Astrophys.* **63**, 127.
Hardorp, J. and Scholz, M.: 1970, *Astrophys. J. Suppl.* **19**, 193.
Hardorp, J. and Strittmatter, P. A.: 1968, *Astrophys. J.* **151**, 1057.
Harris, D. L.: 1963, in K. A. A. Strand (ed.), *Basic Astronomical Data. Stars and Stellar Systems III*, University of Chicago Press, Chicago, III.
Hayes, D. S.: 1967, Ph.D. Thesis, University of California, Los Angeles.
Heap, S. R.: 1975, *Phil. Trans. Roy. Soc. London Series* **A279**, 371.
Heintze, J. R. W.: 1969, *Bull. Astron. Inst. Neth.* **20**, 1.
Henry, R. C., Weinstein, A., Feldman, P. D., Fasti, W. G., and Moos, H. W.: 1975, *Astrophys. J.* **201**, 613.
Hunger, K.: 1955, *Z. Astrophys.* **36**, 42.
Hyland, A. R.: 1969, Owen Gingerich, *Theory and Observations of Normal Stellar Atmospheres*. The M.I.T. Press, p. 271.
Johnson, H. L.: 1966, *Ann. Rev. Astron. Astrophys.* **4**, 193.
Jugaku, J. and Sargent, W. L. W.: 1968, *Astrophys. J.* **151**, 259.
Kodaira, K. and Scholz, M.: 1970, *Astron. Astrophys.* **6**, 93.
Kohl, K.: 1964, *Z. Astrophys.* **60**, 115.
Kontizas, E.: 1978, Ph.D. Thesis, Edinburgh University.
Kontizas, E. and Theodossiou, E.: 1980, *Monthly Notices Roy. Astron. Soc.* **192**, 745.
Kudritzki, R. P. and Reimers, D.: 1978, *Astron. Astrophys.* **70**, 227.
Kuiper, G. P.: 1938, *Astrophys. J.* **88**, 429.

Kurucz, R. L.: 1979, *Astrophys. J. Suppl.* **40**, 1.
Lamers, H. J. G. L. M.: 1974, *Astron. Astrophys.* **37**, 237.
Lamers, H. J. G. L. M. and Rogerson, J.: 1978, *Astron. Astrophys.* **66**, 417.
Lamers, H. J. G. L. M. and Waters, L.: 1984, *Astron. Astrophys.* **136**, 37.
Lesh, J. R.: 1976, *Astrophys. J.* **208**, 135.
Lester, J. B.: 1976, *Astrophys. J.* **210**, 153.
Malagnini, M. L., Faraggiana, R., Morossi, C., and Crivellari, L.: 1982, *Astron. Astrophys.* **114**, 170.
McDonald, J. K.: 1953, *Publ. Dominion Astrophys. Obs. Victoria* **9**, 269.
Mihalas, D. M.: 1965, *Astrophys. J. Suppl.* **9**, 321.
Mihalas, D. M.: 1966, *Astrophys. J. Suppl.* **13**, 1.
Mihalas, D. M. and Henshaw, J. L.: 1966, *Astrophys. J.* **144**, 25.
Morisson, N. D.: 1975, *Astrophys. J.* **200**, 113.
Morossi, C. and Crivellari, L.: 1980, *Astron. Astrophys. Suppl.* **41**, 299.
Morton, D. C. and Adams, T. F.: 1968, *Astrophys. J.* **151**, 611.
Nandy, K. and Schmidt, E. G.: 1975, *Astrophys. J.* **198**, 119.
Nandy, K., Thompson, G. I., Jamar, C., Monfils, A., and Wilson, R.: 1975, *Astron. Astrophys.* **44**, 195.
Neven, L. and de Jager, C.: 1954, *Bull. Astron. Inst. Neth.* **12**, 103.
Panek, R.: 1977, *Astrophys. J.* **216**, 749.
Parsons, S. B.: 1967, *Astrophys. J.* **150**, 263.
Peters, G. J.: 1976, *Astrophys. J. Suppl.* **30**, 551.
Popper, D. M.: 1959, *Astrophys. J.* **129**, 659.
Relya, L. J. and Kurucz, R. L.: 1978, *Astrophys. J. Suppl.* **37**, 45.
Remie, H. and Lamers, H. J. G. L. M.: 1982, *Astron. Astrophys.* **105**, 85.
Schild, R., Peterson, D. M., and Oke, J. B.: 1971, *Astrophys. J.* **166**, 95.
Scholz, M.: 1967, *Z. Astrophys.* **65**, 1.
Searle, L. and Sargent, W. L. W.: 1964, *Astrophys. J.* **139**, 793.
Stencel, R. E., Kondo, Y., Bernat, A. P., and McCluskey, G. E.: 1979, *Astrophys. J.* **233**, 621.
Stift, M. J.: 1973, *Astron. Astrophys.* **22**, 209.
Strom, S. E., Gingerich, O. J., and Strom, K. M.: 1966, *Astrophys. J.* **146**, 880.
Theodossiou, E.: 1985, *Monthly Notices Roy. Astron. Soc.* **214**, 327.
Traving, G.: 1955, *Z. Astrophys.* **36**, 1.
Underhill, A. B.: 1973, *Astron. Astrophys.* **25**, 175.
Underhill, A. B., Divan, L., Prévot-Burnichon, M. L., and Doazan, V.: 1979, *Monthly Notices Roy. Astron. Soc.* **189**, 601.
Unsöld, A.: 1941, *Z. Astrophys.* **21**, 22.
Vader, J. P., Pottasch, S. R., and Bohlin, R. C.: 1977, *Astron. Astrophys.* **60**, 211.
Van Helden, R.: 1972, *Astron. Astrophys.* **21**, 209.
Van Rensbergen, W.: 1984, *Astron. Astrophys.* **136**, 31.
Watson, R. D.: 1972, *Astrophys. J. Suppl.* **24**, 167.
Willis, A. J. and Wilson, R.: 1978, *Monthly Notices Roy. Astron. Soc.* **182**, 559.
Wolff, R. E. A.: 1973, *Astron. Astrophys.* **26**, 127.
Wolff, S. C.: 1967, in R. C. Cameron (ed.), *Magnetic and Related Stars*, Mono Book Publ. Corp., Baltimore, p. 421.