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PARAMETERS T_{eff} AND log g FOR LATE B AND EARLY A TYPE STARS

M. GERBALDI and J. ZOREC
Institut d'Astrophysique de Paris, 98^{bis}, Bd. Arago, 75014 Paris, France

ABSTRACT: We compare the log g parameters of early A and late B type stars determined from model atmospheres with those issued from models of stellar evolution. There is a systematic deviation between both determinations for log g < 3.7 .

PARAMETERS T_{eff} AND log g OBTAINED FROM STELLAR BOLOMETRIC FLUX AND ATMOSPHERE MODELS

As there is no measured stellar angular diameters of stars from B5 to early A type studied in this paper, we used an indirect procedure to determine T_{eff} based on: a) an iterative, Blackwell and Shallis' (1977) like method described in Zorec and Mercado (1987); b) visible and near-IR ground based flux observations (mainly 13-colour photometry of Johnson and Mitchel (1975)), and far-UV fluxes obtained by TD1 or ANS space observations; c) classical LTE line-blanketed model atmospheres for normal abundances (Kurucz 1979).

The main error on the T_{eff} determination is due to uncertainties of the adopted ISM-absorption colour excess E(B-V). We have compared the E(B-V), derived from the uvby photometry and using the Moon's (1985) code, to that adopted in this paper, determined mainly from the ISM λ2000 absorption bump and from the method of neighbouring stars. We saw that the uncertainty on E(B-V) is $|\delta E(B\text{-}V)| \simeq 0.02$ mag, which implies errors $\delta T_{eff}/T_{eff}$ ranging unsymmetrically from 5 % to 0.7 % according to the sign of δE(B-V).

To give a test of our T_{eff} determinations, we compared the parameters obtained by this method for *Vega* (HD 172167) to those generally admitted for this star. We found $T_{eff} = 9467$ K, log g $= 4.10$, while Kurucz gives $T_{eff} =$ 9400 K and log g $= 3.95$. Vega is considered by some authors as a mild λ Boo type. We give then the values of T_{eff} obtained for some other stars belonging to the λ Boo group: HD 31295, $T_{eff} = 9300$ K; HD 1104111, $T_{eff} = 9260$ K; HD 125162, $T_{eff} = 9215$ K; HD 192640, $T_{eff} = 8780$ K. Comparing these values with those given by Venn and Lambert (1990), we see that ours are about 500 K higher. We remind that the temperature determined by this method, does not sensitively depend on the log g value chosen to perform the computation. It may however depend on the chemical abundances. Underabundant models lead for $T_{eff} < 10000$ K to higher values of θ, and so, lower values of T_{eff} of 200 to 300 K when log (metal abundance) ~ -1.0.

To derive the log g parameter, two approaches were used: 1) The first one depends on the Strõmgren's Hβ Balmer line photometric index β taken from the Hauck and Mermilliod's (1990) compilation and its calibration in terms of log g done by Lester et al. (1986). Let us note that the stars used in this study have $T_{eff} \geq 10000$ K for which the β index is still a gravity sensitive parameter;

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2) The second determination comes from the Moon and Dvoretsky's (1985) grid and its extension computed by Castelli (1991). The adopted log g parameter is the mean of both determinations. We have checked that both determinations are almost the same but they present a slight systematic difference. This difference may be probably due to calibration effects in the grids produced by Lester et al. (1984) and those by Moon and Dworetsky (1985), which were already discussed by Castelli (1991).

PARAMETERS log g OBTAINED FROM STELLAR EVOLUTION COMPUTATIONS

The log g parameter can be derived from the stellar evolution models using the (observed) bolometric luminosity $L/L_\odot$ and T_{eff}. The most important errors affecting $L/L_\odot$ are due to the distance d and E(B-V) determinations. For d we used the mean value obtained from ground based trigonometrical parallaxes and the distances reported in the literature derived by several independent methods. Our sample is made of stars having distances smaller than 200 pc and more than 60 % of them have d $\leq$ 100 pc. The mean dispersion of compilated distances for each star is $\sigma(d) \simeq 25$ %. We could finally use the relation $\log g = \log g_\odot + \log (M/M_\odot) - 2 \log (R/R_\odot)$ where the masses $M/M_\odot$ were interpolated in the Maeder and Meynet's (1988) evolutionary tracks using our ($L/L_\odot$, T_{eff}) parameters. For each star the $R/R_\odot$ was calculated combining the angular diameter θ determined at the T_{eff} iteration with the adopted stellar distance d .

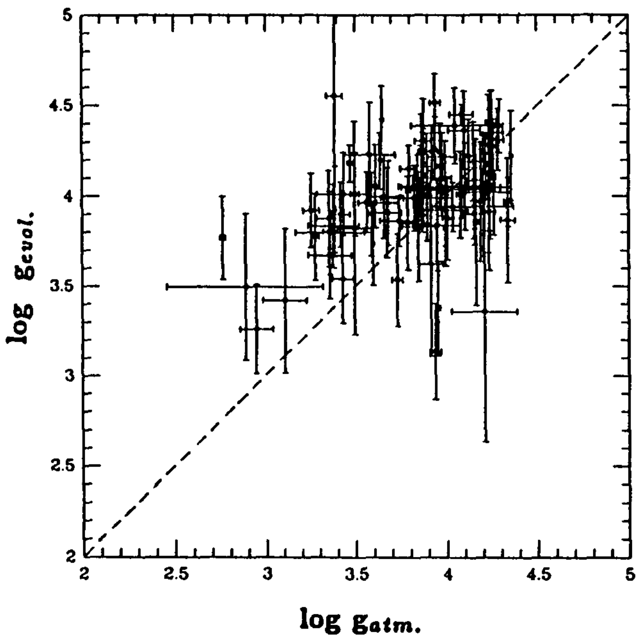

Figure 1: Comparison of log g parameters determined from stellar evolution calculations ($\log g_{evol.}$) with those obtained from stellar atmospheric parameters ($\log g_{atm.}$).

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RESULTS AND DISCUSSION

In Figure 1 we compare both determinations of log g for the sample of stars studied in this paper. We see that there is a systematic deviation when log g < 3.7 which cannot be attributed only to distance uncertainties and to log g determinations using stellar atmospheric parameters. The vertical error bars are due both to distance δd and absorption δE(B-V) uncertainties. The horizontal ones, represent the difference to the mean value of log g obtained by the two determinations issued only from atmospheric parameters.

To account for the systematic deviation $\delta(\log g) \simeq 0.5$ seen in Figure 1 of somewhat evolved stars, we should admit a mass overestimation of a factor 3. Perhaps, difficulties of the stellar structure calculation at the Helium ionization region, could possible produced underluminous models, which should be partially responsible for this result (Maeder, pivate communication).

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