ANALYSIS OF THE HYADES GIANT STARS ε AND γ TAU

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Abstract. Two hyades giant stars, ε and γ Tau, have been studied from an analysis of strong line profiles. We get for ε Tau, $T_e = 4750$K and $\log g = 2.7$, and for γ Tau, $T_e = 4700$K and $\log g = 2.8$. Hydrogen-to-metal ratio for the two stars is nearly the same as that of solar value.

1. Introduction

An abundance analysis of the hyades giant stars based on the curve of growth approach has been made by Helfer and Wallerstein (1964). The stars γ and θ^1 Tau have also been studied by Griffin (1969). In the present paper we would like to make an analysis of two hyades giant stars, ε and γ Tau using the profiles of strong lines. We find that the effective temperature obtained for the two stars are in reasonable agreement with other determinations and that the hydrogen-to-metal ratio is roughly the same as solar value.

2. Observations

The profiles of Hα, $\lambda\lambda$ 5896 and 5890 of Na I, and λ 5183 of Mg I were based on the tracings of the spectrograms from the Hale observatories. The spectrograms were taken on 103a-D and II-a-F plates at 6.7 Å/mm. The observed line profiles for ε and γ Tau are shown in Figures 1–4. We show in Figures 1–4 only the profiles of Na I and Mg I, because the Hα profile is very weak. They are the reflected mean profiles of lines. All the profiles shown in Figures 1–4 are the average of three plates. The bars denote the maximum and minimum values obtained from the plates, and the dots denote average values.

3. Analysis of the Observations

The method of calculation of the model atmosphere and the line profiles are essentially those discussed in an earlier paper (Krishna Swamy, 1966). To start with, we calculated the surface gravity of the stars using the evolutionary tracks of Iben (1967) and from the absolute visual magnitude and the assumed effective temperature. An iterative procedure was followed until the observed and the computed profiles agreed well for all the lines studied. In Figures 1–2, we show the computed profiles for ε Tau for $T_e = 4750$K, $\log g = 2.7$ and hydrogen-to-metal ratio same as solar value. The computed profiles for γ Tau for $T_e = 4700$K, $\log g = 2.8$ and hydrogen-to-metal ratio same as solar value are shown in Figures 3–4. One can see a reasonable good agreement between the computed and the observed profiles. The uncertainties in T_e and $\log g$

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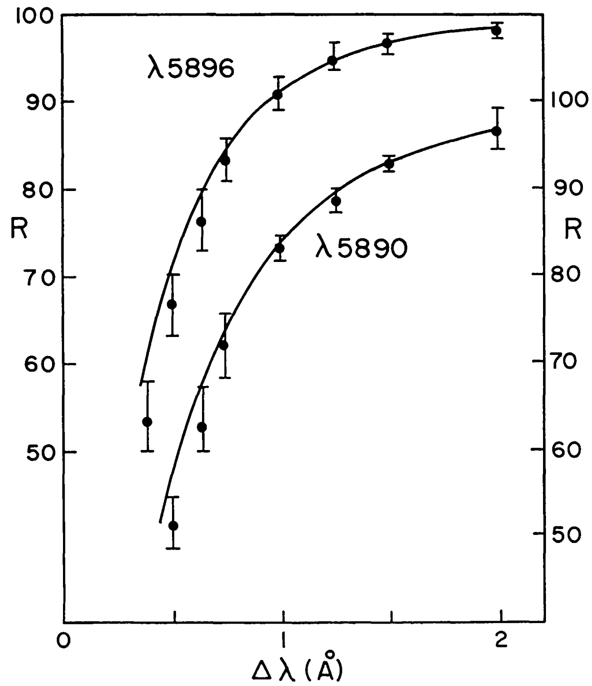

Fig. 1. Calculated (solid line) and observed (dots with bars) profiles of λλ 5896 and 5890 of Na I for ε Tau.

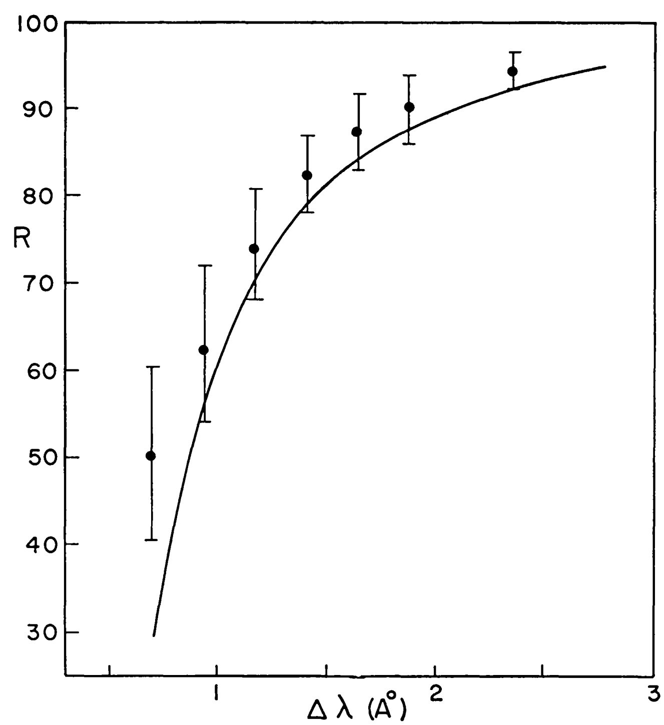

Fig. 2. Calculated (solid line) and observed (dots with bars) profile of λ 5183 of Mg I for ε Tau.

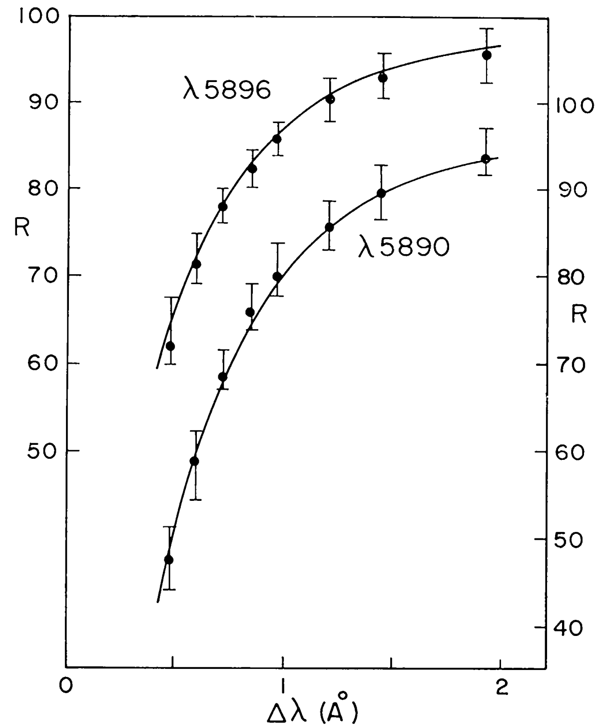

Fig. 3. Same as Figure 1, except for γ Tau.

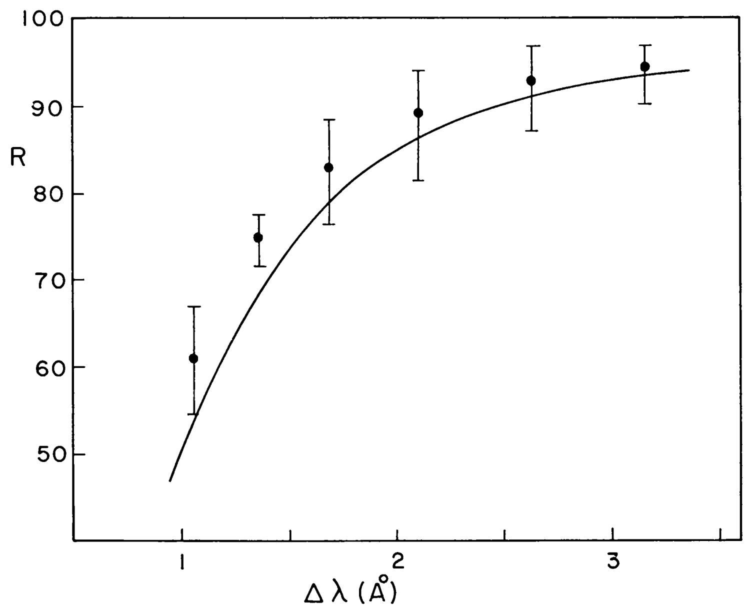

Fig. 4. Same as Figure 2, except for γ Tau.

are of the order of ± 100K and ± 0.2 respectively. Therefore, we take for ε Tau, $T_e = 4750 \pm 100$K and $\log g = 2.7 \pm 0.2$ and for γ Tau, $T_e = 4700 \pm 100$K and $\log g = 2.8 \pm 0.2$. Oke and Conti (1966) obtain $T_e = 4800$ and 4890K for the stars ε and γ Tau from photoelectric observations while according to Johnson's (1964, 1966) spectral calibration, one gets $T_e = 4720$ K for both the stars. We also find from the present study that the hydrogen-to-metal ratio for the stars, ε and γ are roughly the same as solar value. This is in agreement with the study of Griffin (1969), who finds from the analysis of γ and θ^1 Tau that their composition is in general the same as solar composition. It may be noted that the radiation damping and the damping due to collisions with hydrogen are the main contributors to the broadening of metallic lines in both the stars. We find that the mean optical depth of formation (i.e. $t_v = 1$) for $\lambda\lambda$ 5890 and 5896 of Na I at $\Delta\lambda = 1$ and 2 Å are of the order of 0.46 and 0.60 respectively.

Acknowledgements

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