

Analysis of Balmer Profiles of early type stars

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1. Analyzing Profiles to Discriminate among Early Stellar Types

We have analyzed the high resolution profiles presented by González Delgado & Leitherer (1999) for the Balmer and He lines, given for solar metallicity, $4000 \text{ K} \leq \text{Teff} \leq 50000 \text{ K}$, and $0 \leq \log g \leq 5$, and we have studied the potential use of these profiles to discriminate between different type of early stars, which dominate the spectrum of star-forming regions. Here we present our analysis for the H8 line. Details for the whole set of Balmer and He lines will be given elsewhere.

From this analysis we conclude that profiles are deeper for decreasing Teff and constant $\log g$, while keeping the same shape. On the contrary, for increasing $\log g$ but with a same Teff, they show a *widening* of the wings, and a depth almost constant. This way, stars having almost identical EW values, may show very different profiles. We use their characteristics to separate the stellar parameter effects, gravity and effective temperature, by using two simultaneous methods:

1. We use 2 indices to characterize each profile: a) Index D in magnitudes, which does not depend on gravity but depends on Teff; and b) the core equivalent width EW_c , defined as the area limited by $\lambda_c - 3$ and $\lambda_c + 3$ (λ_c is the central wavelength) for each feature, which shows a clear dependence on gravity, due to the widening of the wings, and an almost independence of Teff. With a diagnostic diagram of EW_c vs. D it is possible to separate both effects, gravity and effective temperature.

2. We have constructed growth curves by computing the equivalent width $\text{EW}(j)$ for each $\Delta\lambda(j) = \lambda_c \pm 0.3 \times j$. These growth curves $\text{EW}(j)$ increase smoothly up to the total values EW, which are reached at λ 's more or less close to λ_c , according to the concentration of each profile. As profiles result deeper when Teff decreases, but their shape is the same for constant g , the growth curves, normalized to the total EW, result similar for all Teff. The growth curves for a same Teff and different $\log g$ are almost equal in the core, but $\text{EW}(j)$ increases with increasing gravity as the profiles become wider.

References

González Delgado, R. M. & Leitherer, C. ApJS, 125, 479