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FUNDAMENTAL PARAMETERS AND SPECTROPHOTOMETRIC VARIABILITY OF HE-STRONG STARS

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We present spectroscopic observations of He-strong stars and determine their fundamental parameters using the BCD system and model fittings. We compare our values with others given in the literature and discuss on the accuracy of these estimates and on the influence of the He/H ratio on the Balmer discontinuity and the intensity of He and H lines.

Information on fundamental parameters of He-strong stars is scarce in the literature. The determination of these parameters with different methods is often more complex than for normal stars due to their abundance anomalies and variability.

In this work, we study low resolution spectroscopic observations of 8 He-strong stars acquired at CASLEO (San Juan, Argentina) that cover the spectral range 3400–4600 Å. We use the BCD spectrophotometric system (Barbier & Chalonge 1941; Chalonge & Divan 1952) as a tool to infer fundamental parameters of our program stars. This method has the advantage of being based on direct measurable quantities of the continuum energy distribution near the Balmer Jump (λ_1, D), which are strongly sensitive to the ionization balance of stellar atmospheres and do not need to be corrected for interstellar and/or circumstellar extinction. Then, by measuring the BCD parameters λ_1 and D, we are able to determine simultaneously, spectral type, $T_{\rm eff}$, $\log g$, and absolute magnitudes $M_{\rm V}$ and $M_{\rm bol}$ of each object by using the respective calibrations of (λ_1, D) by Divan & Zorec (1982), Zorec (1986), and Zorec & Briot (1991). We find large discrepancies among the $T_{\rm eff}$ values estimated by different authors: 2000 K$\lesssim \Delta$ T$_{\rm eff} \lesssim$5000 K. In the same way, our BCD temperature determinations show a similar behavior ($|\Delta T_{\rm eff}| \approx$ 3000 K). Instead, the absolute magnitudes derived with the BCD system are in good agreement with those obtained by Gómez et al. (1998), Glagolevskij (2002), Kochukhov & Bagnulo (2006).

Since BCD determinations of $T_{\rm eff}$ for the He-strong stars are systematically higher than those obtained by other authors, we have calculated non-LTE low-resolution synthetic spectra to quantify the influence of the He/H abundance ratio on the emitted visual energy distribution. We have noticed that the BCD parameters, D, derived from the fitted spectra are consistent with those measured in the observed spectra. We can then assert that the actual Balmer jump of the studied He-strong stars is well-represented by the empirical D parameter. Our models predict, however, that there is a decrement δD of the Balmer discontinuity when the abundance ratio He/H increases. The relation between δD, He/H and T$_{\rm eff}$ is: $\delta{\rm D} = -0.056[1-0.233(T_{\rm eff}/10^4)^{0.974}]({\rm He/H})$ [dex]. Since the BCD calibrations $T_{\rm eff} = T_{\rm eff}(\lambda_1, D)$ used to estimate the effective temperatures are made for He/H ≈ 0.1, they systematically lead to an overestimated value of $T_{\rm eff}$ for He-strong stars, where He/H > 0.1. We can then attempt to obtain another independent estimate of $T_{\rm eff}$ using the intergrated flux method. The $T_{\rm eff}^{\rm flux}$ thus obtained can be used to estimate the D_f parameter that the star would have for a standard He/H ratio. The difference between $T_{\rm eff}^{\rm BCD}$ and $T_{\rm eff}^{\rm flux}$, or its equivalent Balmer discontinuity difference: $\delta{\rm D} = D_{\rm obs} - D_f$ gives us a direct estimate of He/H of the He-strong star through the above relation $\delta{\rm D} = f(T_{\rm eff}, He/H)$, which is independent of $\log g$.

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