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Physical parameters of NGC6705 (M11) open cluster using Strömgren photometry

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Abstract

NGC 6705 (M11) is a middle-age well-studied open cluster. Its location in an area where the interstellar extinction is relatively low, its exceptional stellar density and richness, and the presence of both early type and evolved stars makes this cluster an interesting target for many scientific issues. Although NGC 6705 has been widely studied, Strömgren photometry was missing. The observations by our team have yielded $uvbyH$ photometry for 51293 stars in an area of $34' \times 34'$ and with $V_{lim} \sim 21$. Observed stars with complete photometry (9308) are classified into photometric regions and their physical parameters are determined using standard relations among color indices for each of the photometric regions of the HR diagram. That allows us to provide an astrophysical characterization of the cluster: $E\,(b-y) = 0.31 \pm 0.05$ ($E\,(B-V) = 0.42$); $V_0 - M_V = 11.9 \pm 0.7$ ($d \sim 2000pc$); $[Fe/H] = -0.2 \pm 0.4$ ($Z = 0.009$).

In addition, we discuss the accuracy of the physical parameters through comparison with those recently determined by Beaver et al. (2013) with Strömgren photometry. We find mean systematic differences of $\Delta V = -0.015 \pm 0.038$, $\Delta\,(b-y) = -0.017 \pm 0.046$, $\Delta m_1 = -0.014 \pm 0.092$, $\Delta c_1 = +0.014 \pm 0.131$, and $\Delta\beta = -0.036 \pm 0.042$. These are caused by different selection of reference stars for the instrumental-to-standard transformation.

We also compare our results with those from the spectroscopic Gaia-ESO Survey (GES) to assess the quality of the photometric determinations. This work can be useful to give input astrophysical parameters to the spectral analyses being made by GES. We find out clear different trends for the stars bluer and redder than $(b-y) = 0.4$ ($T_{eff} \sim 8000$ K), due to the different instrumental setups used for the GIRAFFE observations (HR3 and HR15N). We find that mean differences in effective temperatures and gravities for both works are compatible within the errors. However, mean difference in metallicity for stars with $(b-y) > 0.4$ is discrepant by -0.65 dex.