N25b SPECTRA AND PHOTOMETRIC COLORS OF LATE-TYPE GIANTS: THEORETICAL PREDICTIONS VERSUS OBSERVATIONS

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The main objective of this study is to assess the current status in the theoretical modeling of the spectral properties of late-type giants. With this aim, we present an extensive compa rison of synthetic broad-band photometric colors of late-type giants (produced with `PHOENIX`, `MARCS` and `ATLAS` model atmospheres) with observations, both at solar and sub-solar metallicities. We show that there is a good agreement between the synthetic and observed photometric colors, and synthetic colors and published $T_{\rm eff}$–color and color–color relations, especially in the $T_{\rm eff}$–$(V-K)$, $T_{\rm eff}$–$(J-K)$ and $(J-K)$–$(V-K)$ planes. Deviations from the observed trends in $T_{\rm eff}$–color planes are generally within $\pm 100-150\,$K in the effective temperature range of $T_{\rm eff}=3500-4800\,$K. The comparison of the observed and synthetic spectra of late-type giants shows that discrepancies result from the differences both in the strengths of various spectral lines/bands (e.g., molecular bands, TiO, H_2O, CO) and the continuum level. Our exploratory 3D modeling of a prototypical late-type giant shows that convection has a noticeable effect on the photometric colors too (e.g., $\Delta(V-K)\sim 0.2\,$mag, or $\sim$70 K), as it alters significantly both the vertical and horizontal thermal structures in the outer atmosphere.