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LINE-DEPTH INDICES AND ATMOSPHERIC PARAMETERS OF SOLAR-LIKE STARS IN M67

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We present a progress report on the determination of effective temperature and surface gravity of an extended sample of solar analogs (G0-G3 V), through theoretical line-depth indices ($3800 < \lambda < 4700$ Å, FWHM=2.5 Å spectral resolution). We applied a set diagnostic diagrams to a selected sample of stars of M67 and found that, under the assumption of solar chemical composition, we obtain a set of atmospheric parameters compatible with those determined from high resolution studies.

This work constitutes the early stages of an ambitious project, whose goal is to collect and analyze panchromatically, from the mid-UV to millimeter wavelengths, a sample of more than 1200 early G-type main sequence stars out to 1 Kpc on the northern hemisphere. The starting point of this project is the determination of the leading atmospheric parameters ($T_{\rm eff}/\log g$) of a sample of solar analogs in M67, assuming solar metallicity.

The observed sample consisted of two stellar sets. The first is composed of 28 members of M67 selected from SIMBAD database based upon their spectral classification (G0–G3 and luminosity class V) and the second set contains about 80 template stars, whose atmospheric parameters are listed in Cayrel de Strobel et al. (2001) and will be used for the calibration of theoretical indices. The spectroscopic observations were conducted at the Guillermo Haro Observatory, Mexico, at a spectral resolution of 2.5 Å FWHM along the 3800–4700 Å interval.

To determine the stellar atmospheric parameters we adopted the line-depth ratio indices technique (see, e.g., Gray & Johanson 1991; Rose 1994). In particular, we make use of the indicators defined by Rose (1994), which mainly consist of line-depth ratios of several pairs of features, to which we added many more defined by us (using a total of 49 features). We first calculated this set of indices for a suitable subset of synthetic spectra of Munari et al. (2005), degraded in resolution to match our observations. We then calculated indices in the observed spectra of the template stars and on the corresponding theoretical spectra obtained by linear interpolation within the theoretical grid for the stellar parameters ascribed to our sample. The comparison of synthetic and empirical indices allows to define the transformation equations to transport the synthetic indices to the observed system.

Based upon calibrated synthetic indices, we explored all possible index vs. index combinations to identify the features that better separate the effects of effective temperature and gravity: a total of 61 diagnostic diagrams were adopted to compute the average values of $T_{\rm eff}$ and $\log g$ of the 27 solar analogs in M67, plus the parameters of the Sun from two different sources: the spectrum of the asteroid Ceres, which we observed, and the very high S/N Kurucz et al. (1984) solar atlas, appropriately degraded in resolution. The accepted parameters for the Sun are $T_{\rm eff}$=5777 K and $\log g$=4.44 dex. Some of the resulting parameters are reported in Table 1.

TABLE 1

SOME OBJECTS OF M67 AND THE SUN

Object	$T_{\rm eff}$ (K)	rms (K)	$\log g$	rms
Sun	5820	94	4.47	0.23
Ceres	5760	75	4.43	0.20
621	6180	110	4.40	0.27
766	6108	59	4.13	0.20
1003	6278	86	3.98	0.36
1017	6241	83	4.24	0.21
1047	6163	86	4.22	0.38
1053	5974	84	4.25	0.22
1242	5830	120	4.09	0.31

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