THE COOL GIANT STARS IN SOLAR VICINITY

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ABSTRACT.The data of absolute spectrophotometry were used for determination of the characteristics for 700 standards' stars in spectral region from G0 to M4. The 170 stars were selected for calibration of new photometric indicies obtained by using a multicolour photometric catalogue in Geneva observatory and Gildenkern's systems. Effective tenperatures,gravities and metallicities have been determinated for 1000 stars of Geneva observatory and for 600 stars of Gildenkern's systems in the region of spectral types from G0 to K5.

Key words: Cool giant stars, evolution of stars

The determination of abundances in the atmospheres of cool stars is associated with the problems:
- of determining their characteristics, i.e. effective temperatures T_{eff}, on gravities on the surface (g), metallicities ([Fe/H]), microturbulent velocities ξ_t
- of calculation of model atmospheres adequate to the structure of atmospheres of real stars
- of determining physico-chemical radiation and collision parameters of atoms and molecules (Ridgway et al. 1980, Komarov et al. 1985b, Korotina et al. 1992).

In Tabl. 1-4 are given fundamental characteristics for giant stars of the field in the solar vicinity of Galaxy disk (stars of open clusters and moving groups were exluded). It should be noted that T_{eff} of a star for the same spectral type (at the same spectral index) with small metallicity increases with growth metallicity. This is caused by a large blanketing or blocking effect. This is together with the account of histograms of stellar distribution from spectral types may affect the behaviour of T_{eff} depending on a spectral type, and namely, an

Table 1. The dependence $T_{eff}$from [Fe/H].

Sp	[Fe/H]<-0.35	[Fe/H]=0	[Fe/H]>0.1
G0	5230	5440	
G1	5200	5400	-
G2	5180	5320	-
G3	5140	5280	-
G4	5110	5260	-
G5	5000	5220	-
G6	4860	5140	-
G7	4860	5060	-
G8	4870	5060	5160
G9	4820	5030	-
K0	4770	4950	-
K1	4670	4820	4950
K2	4420	4690	4760
K3	4260	4450	4660
K4	3970	4160	4410
K5	3800	4010	4170
M0	-	3880	-
M1	3720	3800	-
M2	3650	3720	-
M3	3550	3650	-
M4	3440	3500	-
M5	3390	3440	-
M6	3300	3350	-

insignificant variation in T_{eff} in the K6 III – M0 III spectral range results from considerable variation in intensities of molecular bands and other spectral features. Therefore, to attain a smooth run of the T_{eff} the from K6 III to M0 III spectral interval was excluded.Moreover, in the spectral range from K0 III to M0 III variations in mechanisms of energy transfer from inner layers outwards should be expected since in this spectral range there occurs a separation of stars according to the structure of outer envelopes. It is shown that luminosities of giant of stars field of *Galaxy disk* increase with growth metallisities.

When of fundamental characteristics T_{eff}, log g,[Fe/H] and M_{bol} of giant stars was became available, the values of luminosities (L), radii $\Re$ and masses ($\mathcal{M}$) were determined for 1370 cool giant–stars and their dependencies on [Fe/H] by the coident formulae:

$$M^{\star}_{bol} - M^{\odot}_{bol} = -2.5\log(L^{\star}/L^{\odot})$$

$$\log(L^{\star}/L^{\odot}) = 2\log(\Re^{\star}/\Re^{\odot}) + 4\log(T^{\star}_{eff}/T^{\odot}_{eff})$$

$$\log(g^{\star}/g^{\odot}) = \log(\mathcal{M}^{\star}/\mathcal{M}^{\odot}) - 2\log(\Re^{\star}/\Re^{\odot})$$

With that, for the Sun the following values were accepted:

$M^{\odot}_{bol} = 4.72$, $T^{\odot}_{eff} = 5784$K, log $g^{\odot} = 4.44$

Luminosities (Tabl.2) of giant stars in the Galactic disk of spectral types from G5 to K5 are markedly different and within 19 to 235 solar luminosities.

Table 2. The dependence log ($L^{\star}/L^{\odot}$) from from [Fe/H].

Sp	[Fe/H]<-0.35	[Fe/H]=0	[Fe/H]>0.1
G5	1.28	1.34	1.33
G8	1.40	1.46	1.50
K0	1.53	1.59	1.63
K1	1.65	1.71	1.75
K2	1.81	1.87	1.91
K3	1.98	2.04	2.08
K4	2.17	2.23	2.27
K5	2.27	2.33	2.37

The radii (Tabl.3) investigated stars range from 5 to 30 those of the Sun and are nearly independent on metallisities (that is log g nearly independent on metallisities too). Stars masses practically depend neither on the spectral type nor on chemical composition and amount to 0.7 – 1.3 solar masses (Tabl.4).We must underline it applies only to giant of star field in Galactic disk.

Cool giant stars of the Galactic disk with metallicity increase shift in the HR diagram towards higher temperatures and larges luminosities.

The most impressive result is that for cool giant *field* stars in the Galactic disk, their masses in the G5 – K5 range proved to be statistically less than the solar ones,and consequently,these have the age compared with that of a globular clusters. Independently, this result was supported Edvardson et al. (1993). In addition, spectroscopic investigations of *visual* binary systems, one component of which is a cool giant–stars, have shown that the mass of these stars is less or equal to that of the Sun (Scalo et al., 1978).

Table 3. The dependence log ($\Re^{\star}/\Re^{\odot}$) from from [Fe/H].

Sp	[Fe/H]<-0.35	[Fe/H]=0	[Fe/H]>0.1
G5	0.75	0.75	0.74
G8	0.84	0.83	0.84
K0	0.92	0.93	0.94
K1	0.96	1.00	0.98
K2	1.12	1.10	1.11
K3	1.24	1.23	1.21
K4	1.40	1.39	1.36
K5	1.49	1.47	1.46

Table 4. The dependence log ($\mathcal{M}^{\star}/\mathcal{M}^{\odot}$) from [Fe/H].

Sp	[Fe/H]<-0.35	[Fe/H]=0	[Fe/H]>0.1
G5	-0.03	-0.04	-0.09
G8	-0.06	-0.08	-0.08
K0	-0.08	-0.08	-0.08
K1	-0.06	-0.06	-0.10
K2	0.00	-0.04	-0.03
K3	-0.01	-0.02	-0.07
K4	-0.06	-0.08	-0.14
K5	-0.07	-0.10	-0.13

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