Catalogue of ages, metallicities, orbital elements and other parameters for nearby F stars

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Abstract

Absolute magnitudes, metallicities, effective temperatures, surface gravities, distances, and tangential velocities are calculated for 5489 F stars with homogeneous data on uvby photometry and proper motion, and placed within 80 pc from the Sun. Components of space velocities, eccentricities of galactic orbits, perigalactic and apogalactic distances, and maximal remotnes from galactic plane are presented for 1787 stars. Isochrone ages are determined for 3405 slightly evolved stars proceeding from Revised Yale isochrones.

1 Introduction

The present sample is composed on the base of the Hauck and Mermilliod (1985) compilative homogenious catalogue wich contains all *uvby* photometrical measurements being known up to the end of 1983. The coordinates, spectral classification, visual magnitudes, proper motions and radial velocities have been added into our sample from Ochsenbein (1980) catalogue. The radial velocities from some other sourses have also been added.

The temperature indices $(b-y)$ were corrected for blanketing and luminosity effects, according to Crawford (1975) are following:

$$(b-y)_{cor} = (b-y) + 0.05\delta c_1 + [0.1 + 3.6(2.72 - \beta'_{st})]\delta m_1,$$

where preliminary value β'_{st} has been founded from the observed $(b-y)$ colour by means of the table of standard indices from the same reference paper. Final values of colour excess δm_1, δc_1, and index β_{st} are determined from $(b-y)_{cor}$ for each star. Absolute magnitude and metallicity are obtained by using the relations:

$$M_V = M_{V,ZAMS} - [9 + 20(2.72 - \beta_{st})]\delta c_1$$

(Crawford,1975), and

$$[Fe/H] = 0.16 - 0.66(2.72 - \beta_{st}) - [12.3 - 38(2.72 - \beta_{st})]\delta m_1$$

(Carlberg et al., 1985), where $M_{V,ZAMS}$ is the absolute magnitudes of ZAMS obtained by Crawford (1975) for the stars of solar–composition. Crawford has estimated that the standard deviation in M_V for a single disk F stars proceeding from *uvby* data is $\pm 0.25^m$.

The effective temperatures and surface gravities are calculated by using the Moon's (1985) methodic. In accordance with Moon the standard deviations of this parameters are: $T_{eff} = \pm 100K$, and $\lg g = \pm 0.06$. The distances to the stars are calculated on the basis of the absolute magnitude and visual magnitude from Ochenbein (1980) catalogue. Distance errors of the stars mainly due to absolute magnitude errors are estimated as 11Component of tangential velocities was calculated on the base of proper motions and photometric distancies. The components of the space velocities ralative to the Sun are calculated only for 178 stars with radial velocities. The galactic orbital elements are calculated for the same stars proceeding from the paper by Allen and Santillan (1991) containing bulge, disk, and massive spherical halo.

The ages was found for 3405 slightly evolved ($\delta M_V > 0.3^m$) stars proceeding from Revised Yale isochrones (Green et al., 1987). The stellar deviation from the theoretical $ZAMS$ (δM_V), determined as $[9 + 20(2.72 - \beta_{st})]\delta c_1$, was used in comparison with the theoretical isochrones. The helium content was assumed Y=0.25. The mean value of stellar age was determined in the vicinity of geometrical place of turn-off points at the H-R diagram, where three (sometimes—two) isochrones are crossing in earch point (so-called "hook-region"). The uncertainty in the age of these stars is about 15% (Shevelev,Marsakov,1993).

The criteria for the selection of the sample were the following:

$0.222 \leq (b-y)_{cor} \leq 0.412$	(that coresponds approximately to F2-G2 spectral interval);
$-0.06 \leq \delta c_1 \leq 0.20$	(that excludes pecular and far evolved stars);
$R \leq 80pc$	(that excluded reddened stars);
$[Fe/H] > -1.0$	(interval, where the metallicity calibration is correct).

The final sample is practically full in the vicinity within 80 pc of the Sun for stars with $(b-y)_{cor} \lesssim 0.32$, and completnes equals about 60% for the whole temperature interval. There is also some boundary selection on the red end near $0.39 \lesssim (b-y)_{cor} \leq 0.412$.

2 File discription

The present catalogue consists of 2 files:

- File 1. Description of the catalogue
  Record length: 80 bytes – Number of records: ???.
- File 2. Catalogue of ages, metallicities, orbital elements and other
  parameters for nearby F stars.
  Record length: 142 bytes – Number of records: 5498.

A brief description of the data fields is given below. For earch field is listed: mnemonic abbreviation of the data item; the position of the data in File 2 (first–last byte or column number); a short description of the data item.

HD	1 - 6	HD number of the star
D	7	duplicity
$(b-y)_{cor}$	8 - 13	temperature index, corrected for blanketing and luminosity effects

δm_1	14 - 20	index of metallicity
δc_1	21 - 27	index of luminosity
$[Fe/H]$	28 - 33	metallicity
T_{eff}	34 - 38	effective temperature
$\log g$	39 - 43	gravity
M_V	44 - 48	absolute magnitude
t	49 - 54	age in billion years
l	55 - 61	galactic longitude
b	62 - 68	galactic latitude
Sp	69 - 79	MK spectral classification
R	80 - 83	distance from the star to the Sun in parsecs
V_l	84 - 90	components of tangential velocity in km/s relative
V_b	91 - 97	to the Sun in l- and b-derections respectively
u	98 -104	components of velocity in km/s relative to the Sun,
v	105 - 111	measured in a galactic frame and positive towards
w	112 - 118	the galactic anti-centre, in the direction galactic rotation, and towards the north galactic pole respectively
R_p	119 - 124	perigalacticon in kpc
R_a	125 - 130	apogalacticon in kpc
Z_{max}	131 - 136	maximum remotness from galactic plane in kpc
e	137 - 142	eccentricity

3 References

[1] Allen C., Santillan A. 1991, Rev. Mexicana. Astron. Astrof. **22**, 255.
[2] Carlberg A.G., Dawson P.C., Hsu T., Vandenberg D.A. 1985, Astrophys. J. **294**, 674.
[3] Crawford D.L. 1975, Astron. J. **80**, 955.
[4] Green E., Demarque P., King C. 1987, The revised Yale isochrones. Yale Univ. obs., New Haven.
[5] Hauck B., Mermilliod M. 1985, Astron. Astrophys. Suppl. Ser. **60**, 61.
[6] Moon T.T. 1985, Com. Univ. London obs. **78**, 1.
[7] Ochsenbein F. 1980, Bull. Inf. CDS **19**, 74.
[8] Perry C.L., Johnston L., Crawford D.L. 1983, Astron. J. **87**.1751.
[9] Shevelev Yu.G., Marsakov V.A. 1993, Astron. Zhurn. **70**, 1218.