not only widened the scope of photometric precision, it also yielded a considerable amount of new astrophysical discoveries combined with novel insights in handling of photometric data and a broader understanding of instrumental performance at an unprecedented high level of cost-effectiveness.

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The Contribution of Detailed Analyses of F, G and K Stars to the Knowledge of the Stellar Populations of the Galactic Disk

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Introduction

Five subsystems of stars have been clearly identified in the Galaxy: the Halo, the Thick Disk, the Thin Disk, the Spiral Arms and the Galactic Bulge. The stars which populate the Halo are very old and are known also as Population II (Pop. II). Those of the Thick Disk are old stars, almost as old as the Halo stars, and are known as intermediate Pop. I stars. The stars of the Thin Disk, which are true Pop. I stars, may have any age between 0 and 10 Gy (10×10^9 years), or even more. The Thin Disk population may be split in "young" Thin Disk, and in "old" Thin Disk Pop I stars (Nissen and Schuster 1991). The youngest Pop. I stars are found in the Spiral Arms. In the Galactic Bulge exists the full span of populations and of stellar ages. The Halo and the Bulge are called the spheroidal stellar components of the Galaxy; their spatial distribution is strongly centrally concentrated, in contrast with the Disk and Spiral Arm populations.

The knowledge of the age, the kinematics, and the chemical composition of a star is essential for determining the subsystem to which the star belongs. Unfortunately, the age of a star is not an easy parameter to determine, too many assumptions on the internal structure and the state of evolution of the star must be made, before being able to attribute an age to a star. We are still arguing about the age of the oldest stars of the Halo, born soon after the Universe. The age of the oldest stars lies inside a bracket of at least 5 Gy (from 13 to 18 Gy). If we want to attribute a turn-off age to a star, the star must, first, be in its "turn-off" stage of evolution, and, second, must fit a reliable isochrone, constructed with the help of a grid of evolutionary models computed with a good input physics, and having very similar chemical composition (X, Y, Z), as that of the star to be dated.

The study of the chemical composition of stars belonging to different subsystems is of great importance, because the variation of metallicity as a function of space and time is a central problem for the knowledge of the chemical evolution of our Galaxy and of other galaxies.

Very interesting is the help we can derive from long-lived low-mass stars, evolving slowly, for the study of the chemical evolution of the Galaxy. Indeed, it is among late F, G and K stars, having effective temperatures between 6000 K and 4000 K, that evolution has not depleted the initial stellar populations of the Galaxy, and that the full span of stellar ages is still present. The extended convective zones of low-mass stars prevent the formation of peculiar abundances at their surface, with, however, the exception of lithium for some F stars and hotter G stars. Therefore, the abundances of the elements found in analysing in detail an atmosphere of a low-mass star give direct information about the chemical composition of the interstellar cloud out of which the star was formed.

In general, late F, G and K stars are used to study stellar populations, the abundance gradients across the Galactic Disk, the constraints on primordial nucleosynthesis imposed by the chemical composition of extremely metal deficient objects, the connection between kinematic and dynamic evolution of our Galaxy and of other galaxies. F, G and K stars have also another advantage: their spectra are easier to analyse than the spectra of hotter stars with broadened spectral lines and which require analyses based on Non-LTE (Local Thermodynamic Equilibrium) model atmosphere computations, and of cooler stars in which molecular bands become a serious problem.

We use as a metal abundance indicator, the well-known parameter:

$$[Fe/H] = \log (Fe/H)^{*} - \log (Fe/H)$$

which represents the logarithmic difference between the relative abundance of iron with respect to hydrogen in the atmosphere of a star, and the relative abundance of iron with respect to hydrogen in a standard star. Following Gilmore and Reid (1983), Gilmore and Wyse (1985), Rich (1990), we define in Table 1 four abundance intervals Δ [Fe/H] constructed with stars belonging to different subsystems.

However, if these four population criteria are defined kinematically, and non-chemically, each of them has a spread in metallicity, and there is some overlapping in their metallicity distribution (Laird et al. 1989). The best way to differentiate a Halo from a Thick Disk star having the same [Fe/H] value, say, 1.2 dex, is the analysis of their galactic orbits. Indeed, both chemical composi-

Table 1: *Abundance intervals of F, G and K stars belonging to four different galactic subsystems:*

Halo (Pop II):	$-4.5 < [Fe/H] < -1.0$
Thick Disk (intermediate Pop. I):	$-1.0 < [Fe/H] < -0.4$
Thin Disk (Pop I):	$-0.4 < [Fe/H] < +0.25$
Bulge:	$-1.5 < [Fe/H] < +0.7$

tion and galactic orbits have to be taken into account to disentangle stellar populations (Nissen and Schuster 1991). The astrometric and kinematic properties of a given star play an important role in the recognition to which population this star belongs.

Hereafter, we would like to present and discuss some results we have obtained on the atmospheric parameters and, in particular, on the chemical composition, of F, G, and K stars belonging to the Thin and Thick Galactic Disk, located in the near solar neighbourhood, ($\pi < 25$ pc).

High Resolution, High S/N Spectroscopic Observations of Disk Stars in the Solar Neighbourhood and Corresponding Results

The solar neighbourhood is composed of a mixture of stars at different stages of evolution. A few of them are Pop. II stars, coming from the interpenetrating spheroidal component, but the majority are F, G, and K stars belonging to the Thin Disk population.

For astronomers interested in both high-resolution spectroscopic analyses and the chemical evolution of the Galaxy, the study of disk stars of different ages in the solar neighbourhood is interesting, because, owing to the proximity, and therefore the brightness of the objects, they can be observed with relatively small telescopes at high resolution and high S/N ratios.

Our observations of stars belonging to the Thick and Thin Disks are obtained by means of high resolution (between 40,000 and 80,000), high S/N (between 200 and 800), solid state spectroscopy (Reticon and CCD), mostly at the 1.4-m CAT of ESO, but also at the 3.6-m of CFHT, and at the 1.52-m of OHP. Our final aim is to establish for this sample of Disk stars a homogeneous set of results of chemical composition, effective temperature and state of evolution.

Prior to the discussion here is a short reminder of the methods we have used to derive such data rigorously.

The spectra of the programme stars are interpreted by a detailed differential curve of growth analysis. The theoretical equivalent widths of the spectral lines and the theoretical curve of growth of the analysed stellar spectra are computed using a grid of LTE model atmospheres, of various effective temperatures, gravities and metallicities, suitable for F, G and K dwarfs and subgiants, kindly provided by B. Gustafsson in 1981. The Sun (sky light or Moon) is adopted as comparison star. Departures from LTE in the atmospheres of the programme stars are not very disturbing, because, in solar-like stars, as those we are discussing, the atmospheric structure is similar to that of the Sun. Therefore, in a differential analysis with respect to the Sun, the Non-LTE departures in the analysed star and in the comparison star largely cancel out.

It is important to remark that reliable stellar abundance determinations are possible only if we have previously determined, with great care, the fundamental physical parameters of the star to be analysed: its effective temperature, surface gravity, microturbulence, rotational velocity, etc. For the knowledge of the chemical composition of a star, it is as important to improve the determination of T_{eff} and log g, as the model atmosphere computation.

The effective temperatures, T_{eff}, of a programme star is derived on purely spectroscopic grounds from the depth of its H_α wings (set at 4 Å from the H_α core) relative to the continuum, and/or from the observed ratio of the stellar spectrum to the sunlight spectrum near H_α as compared to computed ratios.

The gravity, log g, is determined from the ionization equilibrium.

The "microturbulence", ξ_t (km s^{-1}) is derived from an absolute curve of growth of the Sun with equivalent widths coming from the same observational material as that of the stars.

The chromospheric activity is qualitatively estimated from the central intensity of two lines of the Ca II triplet at 8550 Å.

The metal abundance is determined by matching equivalent widths in the observed spectrum of a programme star to those of a model computed with the most appropriate T_{eff}, log g, and ξ_t previously found for this star.

To ensure the differential character of the analysis, it is essential that the models used for all the programme stars, including the comparison star, in our case the Sun, come from one and the same grid of model atmospheres.

Having given the recipe of how to perform a reliable detailed spectroscopic analysis, we now present some of our research programmes and the subsequent results. These results are given in Table 2. They concern the gravity, the iron abundance, the bolometric magnitude, the effective temperature of the observed stars. We thought it useful to also add distance, kinematics, colour and spectral type results extracted from the literature. The last column of Table 2 indicates the observatory at which our observations have been made. In Table 2 the values attributed to the parallaxes of 16 Cyg A and B, and to those of HD 1835, HD 20630, and HD 76151 are not extracted from the Catalogue of Gliese (1969), but have been kindly sent to the author by C. Dahn in 1991.

F, G and K Well Separated Visual Binaries, or Visual Multiple Stars with Good Parallaxes

Nearby visual double or multiple stars do not only inform us about the kinematics and the chemical composition of the Solar neighbourhood, as do single stars, but also give information about stellar masses near the Sun. If one of the components or both are slightly evolved, their age can also be estimated with the help of a grid of theoretical isochrones. After having determined the effective temperature and bolometric magnitude of each component we can draw a (log T_{eff}, M_{bol}) diagram representing a portion of the observational isochrone constructed with two, three, or more components of the visual system. The observational isochrone can then be compared with a grid of theoretical isochrones computed with the same metal abundance, Z, as the one previously found in analysing in detail the stars of the system, but with different He abundances, Y. In such a way, if we know the metal content of the observational isochrone (from the chemical analysis of its stars), the He content can be estimated from the theoretical isochrone which best fits the observational isochrone (Perrin et al. 1977). This procedure permits to estimate the He content of G and K stars too cold to show He lines in their spectra. If a computation of the orbit of a multiple system exists, the masses of the components are known. These masses can be compared with those determined by internal structure computations. This is a way to check if the physical input of the internal structure computations is correct.

We have already applied this procedure to near visual binaries or multiple systems (Cayrel et al. 1988, Cayrel de Strobel et al. 1989, Chmielewski et al. 1991, Chmielewski et al. 1992, Friel et

Table 2: *Basic parameters for some nearby Thin and Thick Disk stars*

HD	V	B-V	Sp	π_{trig}	U	V	W	log g	[Fe/H]	M_{bol}	T_{eff}	Obs
The triple system: 36 Ophiuci												
155886 A	5.05	0.86j	K0V	0.188 ± 0.008	+8	−19	+1	4.60 ± 0.20	−0.29 ± 0.06	6.23 ± 0.12	5125 ± 30	ESO
155885 B	5.08	0.86j	K1V	0.188 ± 0.008	+9	−19	+1	4.6 ± 0.20	−0.31 ± 0.05	6.25 ± 0.13	5100 ± 50	ESO
156026 C	6.34	1.16	K5V	0.183 ± 0.007	+8	−19	+1	4.70 ± 0.30	−0.36 ± 0.12	7.12 ± 0.12	4550 ± 75	ESO
The triple system: HD 53705. HD 53706. HD 53680												
53705 A	5.56	0.64	G2V	0.057 ± 0.006	−46	−59	−14	4.30 ± 0.20	−0.25 ± 0.05	4.60 ± 0.10	5870 ± 40	ESO
53706 B	6.79	0.80	K0V	0.057 ± 0.006	−47	−63	−15	4.50 ± 0.20	−0.28 ± 0.06	5.83 ± 0.10	5290 ± 60	ESO
53680 C	8.64	1.18	K5V	0.057 ± 0.006	−48	−61	−14	–	–	6.75 ± 0.15	–	–
The UMa stream – visual binary: γ Lep												
38393 A	3.60	0.47	F6V	0.127 ± 0.005	+26	+17	−3	4.3 ± 0.25	−0.14 ± 0.04	4.05 ± 0.12	6200 ± 40	CFHT
38392 B	6.15	0.94	K2V	0.127 ± 0.005	+26	+18	−4	4.5 ± 0.25	+0.02 ± 0.10	6.41 ± 0.12	4950 ± 70	CFHT
UMa stream dwarfs												
115043	6.85	0.60	G1V	0.049 ± 0.015	+24	+13	0	4.5 ± 0.25	−0.03 ± 0.06	5.22 ± 0.60	5830 ± 60	CFHT
72905	5.64	0.62	G0V	0.073 ± 0.006	+19	+13	−3	4.5 ± 0.25	−0.01 ± 0.06	4.90 ± 0.25	5850 ± 50	CFHT
41593	7.23	0.81	K0V	0.066 ± 0.010	+22	+12	−5	4.5 ± 0.25	+0.08 ± 0.08	6.18 ± 0.50	5350 ± 60	CFHT
The visual binary: 16 Cyg												
186408 A	5.96	0.64	G1.5V	0.047 ± 0.002	+26	−17	+8	4.28 ± 0.20	+0.06 ± 0.04	4.27 ± 0.06	5785 ± 40	OHP
186427 B	6.23	0.66	G2.5V	0.047 ± 0.002	+26	−19	+6	4.40 ± 0.20	+0.04 ± 0.04	4.53 ± 0.06	5770 ± 40	OHP
The visual binary: 39 Eridani												
26846 A	4.87	1.17	K3III	0.013 ± 0.010	+43	−31	−20	2.70 ± 0.30	+0.21 ± 0.06	+0.09 ± 1.20	4600 ± 40	CFHT
26846 B	8.57		G2V	0.013 ± 0.010	+43	−31	−20	4.10 ± 0.20	+0.19 ± 0.03	4.07 ± 1.20	5830 ± 50	CFHT
The α Centauri system												
128620 A	−0.01	0.68	G2V	0.743 ± 0.007	−20	+13	+21	4.31 ± 0.20	+0.22 ± 0.02	4.27 ± 0.02	5800 ± 25	ESO
128621 B	+1.33	0.895	K1V	0.743 ± 0.007	−20	+13	+21	4.58 ± 0.20	+0.26 ± 0.04	5.54 ± 0.03	5325 ± 50	ESO
Very nearby G and K dwarfs												
156384 A	6.10	1.04	K3V	0.140 ± 0.006	+13	+30	−29	4.50 ± 0.20	−0.59 ± 0.07	6.59 ± 0.12	4930 ± 50	ESO
100623	5.27	0.83	K0V	0.103 ± 0.008	−39	+32	+17	4.60 ± 0.20	−0.38 ± 0.06	6.00 ± 0.20	5232 ± 45	ESO
156274 A	5.53	0.80	G8V	0.133 ± 0.007	+38	+31	−20	4.50 ± 0.20	−0.35 ± 0.06	4.91 ± 0.12	5295 ± 45	ESO
4628	5.76	0.88	K2V	0.137 ± 0.004	+ 9	−33	− 3	4.60 ± 0.20	−0.29 ± 0.07	6.20 ± 0.08	4940 ± 50	ESO
115617	4.74	0.71	G6V	0.113 ± 0.007	−14	−35	−24	4.5 ± 0.20	−0.02 ± 0.07	4.93 ± 0.10	5585 ± 40	ESO
20630	4.85	0.68	G5V	0.109 ± 0.002	−14	+ 8	+ 2	4.50 ± 0.20	+0.04 ± 0.06	5.10 ± 0.07	5630 ± 40	CFHT
76151	6.00	0.67	G3V	0.056 ± 0.002	−22	− 6	+ 1	4.5 ± 0.20	+0.06 ± 0.03	4.65 ± 0.08	5710 ± 40	ESO
76151	6.00	0.67	G3V	0.056 ± 0.002	−22	− 6	+ 1	4.5 ± 0.20	+0.07 ± 0.05	4.65 ± 0.08	5710 ± 40	CFHT
17925	6.04	0.85	K2V	0.127 ± 0.006	− 6	− 4	− 4	4.6 ± 0.20	+0.10 ± 0.05	6.36 ± 0.13	5090 ± 35	ESO
125072	6.66	1.03	K3V	0.106 ± 0.007	−24	0	−22	4.5 ± 0.20	+0.26 ± 0.08	6.55 ± 0.20	4965 ± 50	ESO
Grb 1830	6.45	0.75	G9VI	0.103 ± 0.006	+280	−141	− 8	4.5 ± 0.10	−1.30 ± 0.06	6.34 ± 0.20	5170 ± 60	Mc Donald
Some proposed Solar analogues												
Sun	−26.74		G2V	–	+ 9	+12	+ 7	4.44	0.00	4.75	5770	–
44594	6.60	0.66	G3V	0.041 ± 0.014	+38	+51	+ 2	4.50 ± 0.20	+0.17 ± 0.05	4.59 ± 1.0	5770 ± 40	ESO
44594	6.60	0.66	G3V	0.041 ± 0.014	+38	+51	+ 2	4.50 ± 0.20	+0.13 ± 0.06	4.59 ± 1.0	5770 ± 40	CFHT
186427 B 16 Cyg B	6.23	0.66	G2.5V	0.047 ± 0.001	+26	−19	+ 6	4.40 ± 0.20	+0.04 ± 0.04	4.53 ± 0.06	5770 ± 40	OHP
28099 Hyades cluster	8.12	0.66	G2V	0.023 ± 0.004	−32	− 7	+ 5	4.50 ± 0.20	+0.14 ± 0.04	4.80 ± 0.08	5770 ± 40	CFHT
1835	6.39	0.66	G2V	0.044 ± 0.006	−27	− 3	+ 9	4.50 ± 0.20	+0.17 ± 0.04	+4.77 ± 0.07	5770 ± 40	CFHT

al. 1992). The results are given in Table 2. Although these results concern only 6 multiple visual systems (among them the UMa stream binary, γLep, and three stars of the UMa stream), the abundance range found for the six systems is as large as that of the Thin Disk population given in Table 1. Among the three oldest visual systems of the sample, HD 53705, 53706, and 53680, 16 Cyg A and B, α Cen A and B, the first in the list is metal deficient by a factor of 2, the second is metal normal, and the third is metal rich by a factor of 2.

We have also found that there is no abundance correlation between the "turn-off age" of the visual systems and their metallicity, in the sense that old stars can be metal rich, as is the case of αCenA and αCenB. Concerning kinematic results of the stars in Table 2, we see that the space velocity vectors U, V, W, of the stars of the 36 Oph system are very different from those of the HD 53705 system, in spite of their identical metallicities.

High Resolution, High S/N Survey of F, G and K Stars within 10 Parsecs of the Sun

The "Catalogue of Nearby Stars" of Gliese (1969) contains 69 non-degenerate stars with effective temperatures higher than 4000 K, and which are nearer than 10 parsecs from the Sun. Four of these stars are A stars, five are F stars and the remaining 60 are G and K dwarfs and slightly evolved subgiants. A few years ago, we decided to obtain for these stars a homogeneous set of well determined physical parameters: chemical composition, effective temperature, spectroscopic gravity, microturbulence, and if possible, age and mass. We hope that these results on the physical parameters of the nearest F, G, and K stars will be ready at the same time as their revised parallaxes resulting from the Hipparcos observations. Then, we shall have at our disposal reliable results which will allow to better understand the state of evolution and the chemical composition of our nearest stellar neighbours. We are currently taking at ESO and OHP observatories high resolution, high S/N spectrograms of those stars in the sample of 69 for which only poor spectroscopic data, or no data at all, are available (Perrin et al. 1988).

If we consider the [Fe/H] values, relative to the 16 stars nearer than 10 parsecs from the Sun, contained in Table 2, we find that the range of their metallicities is surprisingly large, from −0.59 dex to +0.26 dex, in this randomly selected, small sample of stars. This probably means that the nearest solar neighbourhood is populated with stars belonging to the Thick and the Thin Galactic Disk populations. By the way, there exists also one Halo star, Groombridge 1830, nearer than 10 parsecs from the Sun and hotter than 4000 K. We thought that it would be interesting for the reader to give in Table 2 for this star the same parameters as those given for the Disk stars. The stellar atmosphere parameters for Grb 1830 were taken from Smith et al. (1992).

The values of the space velocity components U (in the direction to the galactic centre) V (in the direction of galactic rotation), W (in the direction of the north galactic pole) are given in columns 6, 7, 8, of Table 2. The U, V, W of the 16

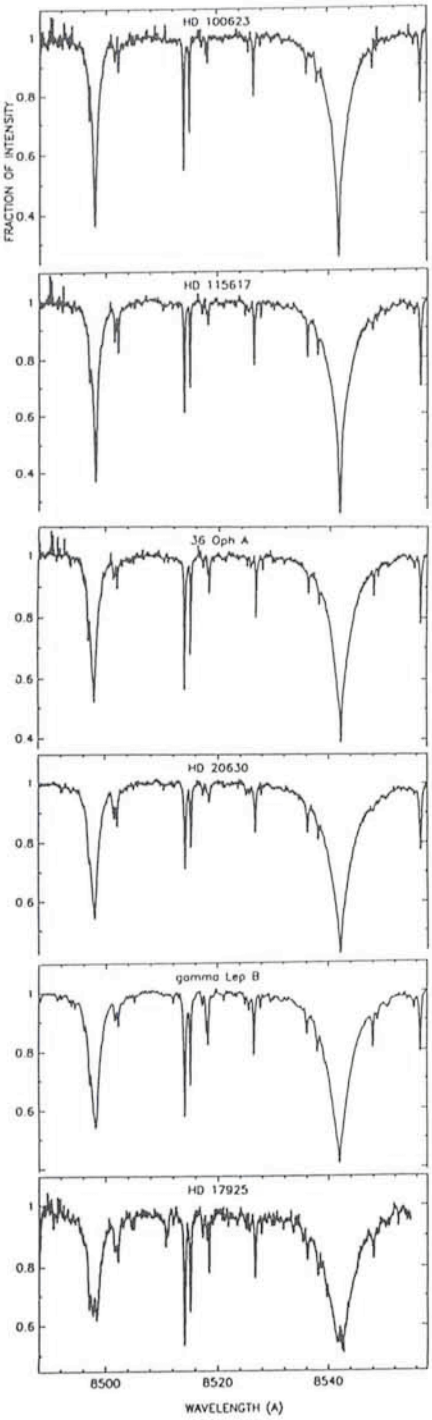

Figure 1: *Observed profiles of two of the Ca II infrared triplet lines (λ 8498.06 Å and λ 8542.14 Å) of six early K dwarfs, listed in Table 2, having about the same effective temperature. The central depths of these lines are excellent chromospheric activity indicators: the more shallow the lines are in the spectrum of a star, the more active is the chromosphere of this star. Please note the difference between the profiles of HD 100623 and HD 17925.*

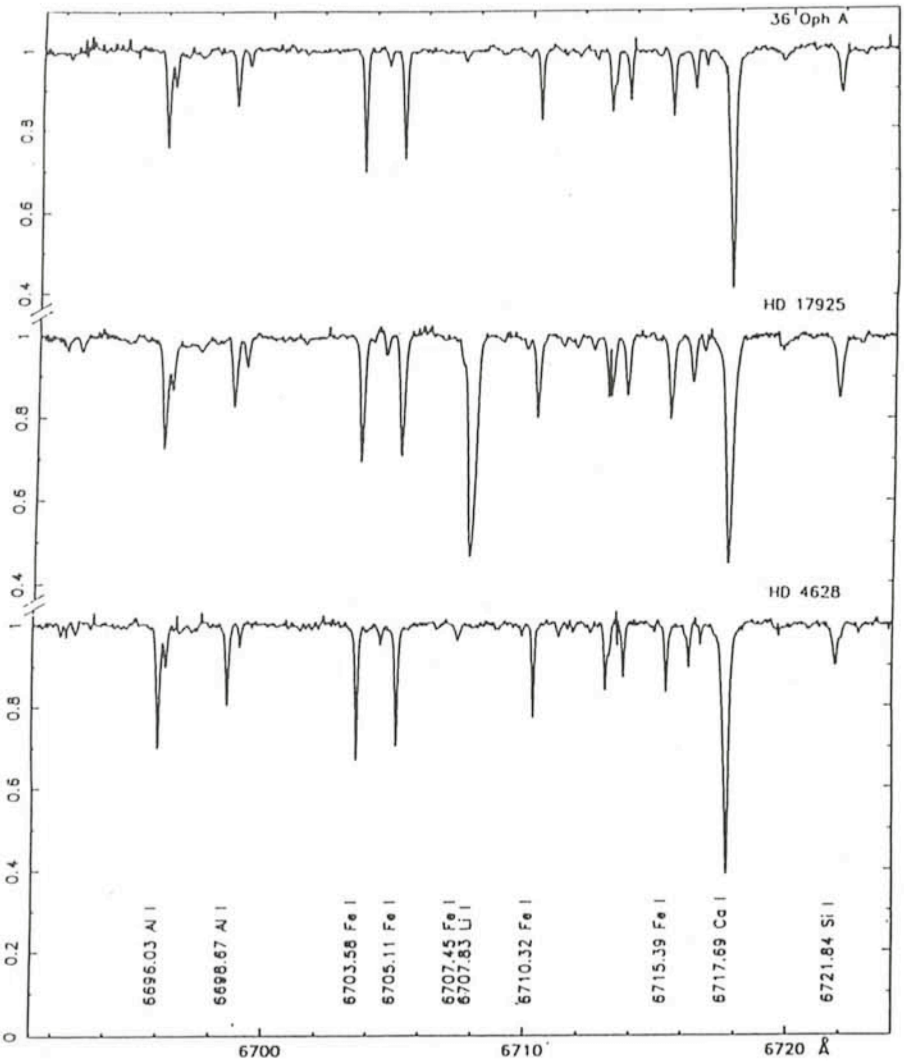

Figure 2: *ESO CAT-CES spectrum of HD 1792 K2V of the Li region as compared to the same region of two early K dwarfs: 36 Oph A K0V (upper spectrum) and HD 4628 K2V (lower spectrum). Please note the very strong Li line in HD 17925. No lithium is visible in 36 Oph A and in HD 4628. The feature just to the blue of the Li line is primarily due to Fe I (λ = 6707.4 Å).*

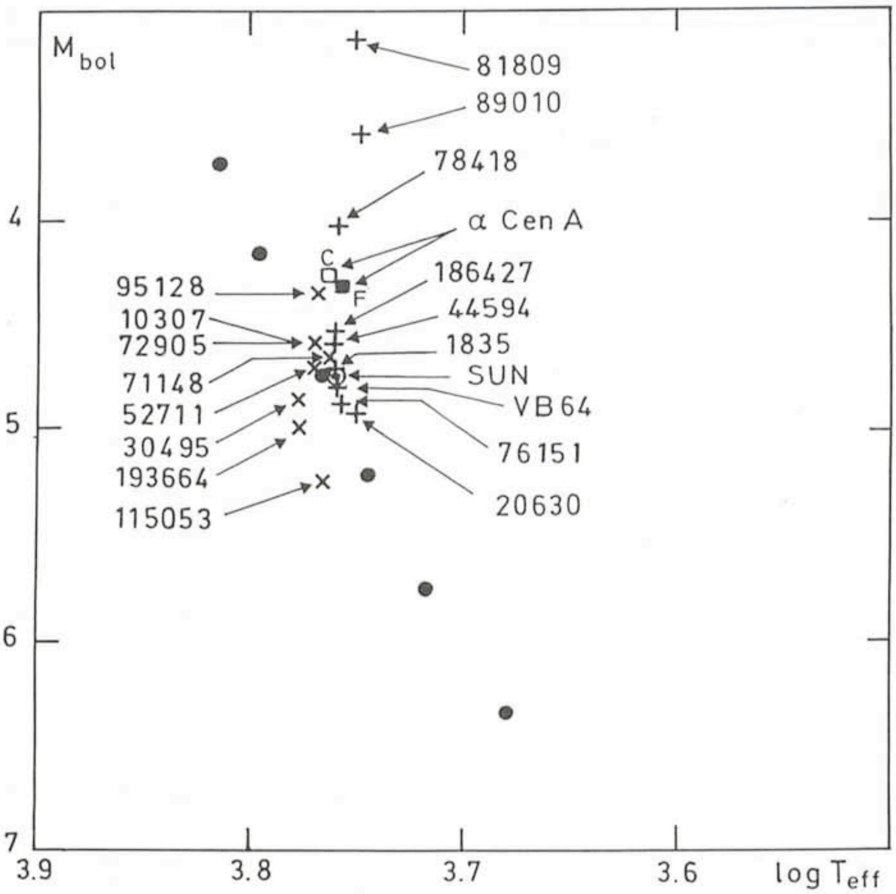

Figure 3: *Positions occupied in the (log T_{eff}, M_{bol}) diagram by solar analogues contained in Tables 3 and 4 of Cayrel de Strobel (1990). Plusses are stars from Table 3, and crosses stars from Table 4. Black circles are evolutionary models computed by Lebreton (Cayrel de Strobel et al. 1989) representing a theoretical ZAMS, (Z=0.02, Y=0.287, α=2.18).*

nearest Disk stars exemplify the kinematic variety found in the solar neighbourhood.

A parameter which shows that the nearest solar neighbourhood is built up by young and old Disk stars is the strength of their chromospheric activity. Such activity is tightly connected to the age of a star. The central depths of the CaII doublet lines at λ3933.6 and 3968.5 Å and those of the CaII triplet lines at λ 8498.0, 8542.1 and 8662.1 Å are excellent indicators of chromospheric activity: the more shallow these lines are in the spectrum of a star, the more active is its chromosphere and the younger is the star. We have used the first two of the infrared lines of the CaII triplet (we could not observe the three lines together in a same spectral interval using high spectral resolution) for ranking the age of the observed Disk stars. In Figure 1 are represented the infrared profiles of these lines for six of our programme stars. In this figure we see that the central depth of the Ca II lines is deep for the first two stars, and becomes more shallow for the last stars. This shows the great difference in age between the first star, which is several billion years old, and the last star, only a few million years old.

Are there Very Young Stars in the Solar Neighbourhood? Yes, an Example: HD 17925

Nearly 98% of the stars in the solar neighbourhood belong to the Thin Disk Population (Nissen and Schuster 1991). Most of the field stars we have analysed and presented in Table 1 belong to the "old" Thin Disk population, having ages between solar and twice solar, approximately, whereas the UMa and the Hyades cluster stars belong to the "young" Thin Disk population, with ages between 0.2 and 0.7 Gy.

During one of our recent observing runs at ESO, we found in the spectrum of a nearby (7.9 parsecs) K2V dwarf a very strong lithium line (Cayrel de Strobel and Cayrel 1989). The presence of such a strong Li line in this low-mass star ($M = 0.8\ M_{\odot}$, $T_{eff} = 5090$) indicates that HD 17925 must be very young. Figure 2 reproduces ESO CAT-CES spectra of the Li region of HD 17925 as compared to the same region of two early K dwarfs. No lithium is visible in 36 Oph A (K0V) and in HD 4628 (K2V). Even in the comparatively young Hyades dwarfs, Li is already totally depleted in dwarf members with effective temperatures around 5200 K. The small age of HD 17925 is consistent with its high chromospheric activity, as shown in Figure 1 by the shallow central depths of its Ca II triplet lines. Observations with still higher spectral resolution are planned to study the structures of the cores of these lines.

Where does such a young star come from? We have investigated what could be the place of origin of HD 17925 using Contopoulos and Strömgren (1965) projected orbits of stars. We think that the star comes from the Scorpio-Centaurus complex, where it was formed a few million years ago

Photometric Solar Analogues Versus High-Resolution Spectroscopic Solar Analogues

This research (Cayrel de Strobel et al. 1981, Cayrel de Strobel and Bentolila 1989, Friel et al. 1992) has primarily been concerned with the question of whether photometric solar analogues remain such when submitted to detailed spectroscopic analysis. In other words, whether the physical parameters, like chemical composition, effective temperature, gravity, chromospheric activity, etc. as derived from a detailed spectroscopic analysis of a photometric solar analogue, will be identical, or at least very similar to those of the Sun? For example, the photometric solar analogue, the Hyades dwarf VB 64, while having the same T_{eff} as the Sun (Cayrel et al. 1985), is certainly not a real solar twin, because the age (0.7 Gy versus 4.5 Gy) and chromospheric activity of the Sun and VB 64 are very different. Also the chemical composition is different $[Fe/H]^{64}_{\odot} = +0.15 \pm 0.03$ dex, and so is their state of evolution, the Sun being slightly more evolved than the much younger Hyades star.

Photometric solar analogues have been proposed by different authors, and the lists can be found in Cayrel de Strobel (1990; Table 3 and 4). Figure 3 shows the position of the Sun and of some photometric solar analogues in a theoretical (log T_{eff}, M_{bol}) diagram. Detailed spectroscopic analyses of the stars in Figure 3 have shown that none of them is a real solar twin.

The two stars which most ressemble the Sun, are 16CygB in the northern hemisphere, and the photometric analogue, HD44594, discovered by Hardorp (1978), in the southern hemisphere. The Ca II infrared profiles of these two stars together with those of the Sun and the Hyades dwarf, VB 64, are reproduced in Figure 4. The central depths of the Ca II profiles of the first three stars are very similar, indicating that the three of them have very low chromospheric activity. The central depths of the Ca II profiles of VB 64 are smaller than those of the first stars indicating a substantial difference in chromospheric activity, hence in age, between VB 64 and the other three stars.

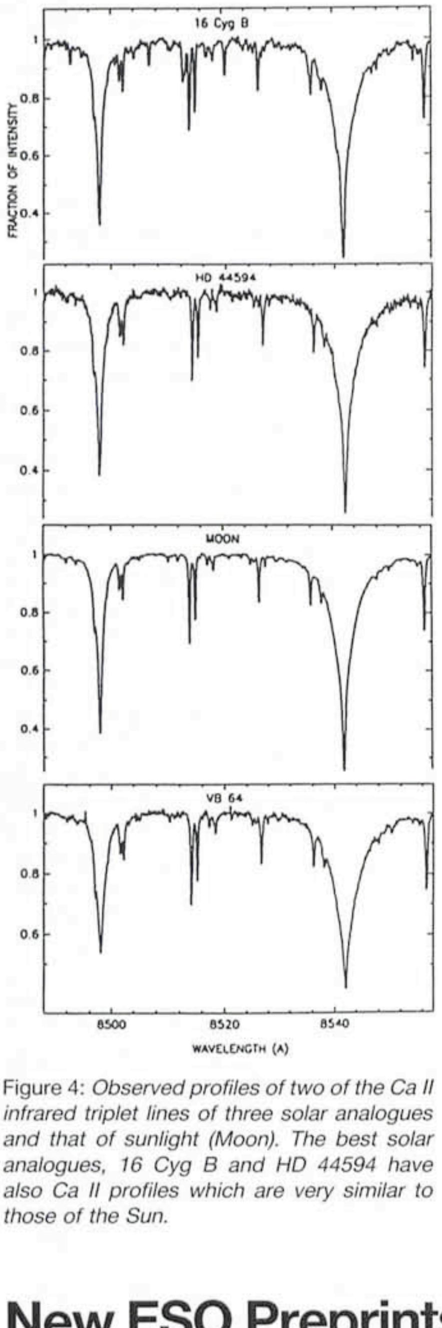

Figure 4: *Observed profiles of two of the Ca II infrared triplet lines of three solar analogues and that of sunlight (Moon). The best solar analogues, 16 Cyg B and HD 44594 have also Ca II profiles which are very similar to those of the Sun.*

SMR Disk Stars Versus SMR Bulge Stars

New spectroscopic CCD and Reticon observations have confirmed the existence of nearby G and K stars with metallicities higher than those of the Hyades, the so-called SMR (super metal rich) stars. A good example of them are the stars in the binary system α Cen A and B, our nearest neighbours (see in Table 2 the values of their [Fe/H]).

A few years ago, we determined with the help of the [Fe/H] Catalogue (Cayrel de Strobel 1992), the "turn-off age" of a sample of slightly evolved SMR subgiants. We found a great spread of age between the oldest and the youngest SMR stars. We constructed for these SMR subgiants an age versus [Fe/H] relation, and found that the slope of the relation was slightly negative for younger ages of SMR stars. This could be an indication that the SMR phenomenon was more active in the past than it is now, but has always existed in the Thin Disk Population. The discovery by Withford and Rich (1983) of a group of very metal rich stars in the Bulge of our Galaxy with metal abundances more than 3 times that of the Sun, may support the existence of a very metal rich population of stars in the Galactic Bulge (Rich 1990a, Rich 1990b).

Conclusion

In this article, after having briefly introduced the concept of galactic subsystems or stellar populations, we have discussed Disk stars, belonging to the solar neighbourhood. The physical parameters: chemical composition, effective temperature spectroscopic gravity, microturbulence, have been determined in a very homogeneous way and are based on excellent observational material, of which more than half comes from ESO observations. The results show that the solar neighbourhood is populated with a great variety of objects. We hope that by combining space observations with ground-based observations and improving our methods of reduction and interpretation, the physical status of some of the above-discussed stars will be known in a detail that is comparable to that available for the Sun.

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