Preparation of the COROT space mission: fundamental stellar parameters determinations from photometric and spectroscopic analyses for COROT potential target candidates

E. Lastennet  
_Depto de Astronomia, UFRJ, Ladeira Pedro Antônio 43, 20080-090 Rio de Janeiro RJ, Brazil_

F. Lignières  
_Laboratoire d’Astrophysique, CNRS UMR 5572, OMP, 57, av. d’Azereix, 65008 Tarbes Cedex, France_

R. Buser  
_Astronomisches Institut der Universität Basel, Venusstr. 7, CH-4102 Binningen, Switzerland_

Th. Lejeune  
_Observatório Astronómico de Coimbra, Santa Clara, P-3040 Coimbra, Portugal_

Th. Lüftinger  
_Institut für Astronomie, Universität Wien, Türkenschanzstr. 17, A-1180 Wien, Austria_

F. Cuisinier  
_Depto de Astronomia, UFRJ, Ladeira Pedro Antônio 43, 20080-090 Rio de Janeiro RJ, Brazil_

C. van ’t Veer-Menneret  
_Observatoire de Paris, 61 avenue de l’Observatoire, F-75014 Paris, France_

**ABSTRACT**

We present a sample of 9 nearby F-type stars with detailed spectroscopic analyses to investigate the Basel Stellar Library (BaSeL) in two photometric systems simultaneously, UBV Johnson and uvby Strömgren. The sample corresponds to potential targets of the central seismology programme of the COROT (COnvection & ROtation) space experiment, which have been recently observed at Observatoire de Haute-Provence (OHP, France). The atmospheric parameters $T_{\text{eff}}$, [Fe/H], and log g obtained from the BaSeL models are compared with spectroscopic determinations as well as with results of other photometric calibrations (the “Templogg” method and the catalogue of Marsakov & Shevelev, 1995). Moreover, new rotational velocity determinations are also derived from the spectroscopic analysis and compared with previous results compiled in the SIMBAD database. For a careful interpretation of the BaSeL solutions, we computed confidence regions around the best $\chi^2$-estimates and projected them on $T_{\text{eff}}$-[Fe/H], $T_{\text{eff}}$-log g, and log g-[Fe/H] diagrams. In order to simultaneously and accurately determine the stellar parameters $T_{\text{eff}}$, [Fe/H] and log g, we suggest to use the combination of the synthetic BaSeL indices $B-V$, $U-B$ and $b-y$ (rather than the full photometric information available for these stars: $B-V$, $U-B$, $b-y$, $m_1$ and $c_1$) and we present full results in 3 different diagrams, along with the results of other methods (photometric and
All the methods presented give consistent solutions, and the agreement between Templogg and BaSeL for the hottest stars of the sample could be especially useful in view of the well known difficulty of spectroscopic determinations for fast rotating stars. Finally, we present current and future developments of the BaSeL models for a systematic application to all the COROT targets.

1. Introduction

In order to prepare the target selection for the asteroseismology space missions MONS and COROT, a photometric and spectroscopic survey is planned of bright main target candidates as well as fainter targets to be observed. The data obtained from different sites will be used for an automatic classification to derive effective temperature (\(T_{\text{eff}}\)), gravity (\(\log g\)), and metallicity ([Fe/H]) of stars.

During the COROT-MONS Workshop, existing tools which must be applied for these tasks, and which should be adapted and further developed to give the maximal support to the space missions through groundbased support were presented. In this contribution, we only focus on the COROT (COnvection and ROTation) mission and the results we obtained from different methods: a detailed spectroscopic study, and 3 methods based on various photometric calibrations. One of this method (the BaSeL library) can be easily automatized for future applications for the COROT targets stars, so we put particular emphasis on this method in the context of the present workshop.

In this contribution, we first present the sample (Section 2) and the different methods (Sect. 3) used to assess the validity of the BaSeL library for the present purpose. In Sect. 4 we discuss the results derived from the BaSeL models, with comparison with the other methods presented in Sect. 3. Finally in Sect. 5 we present future development of the BaSeL models for the COROT target stars, and Sect. 6 draws the general conclusions.

2. The sample: 9 F-type stars

We use a sample of 9 nearby (\(\leq 45\) pc) F-type stars for which a detailed spectroscopic analysis has been performed. These stars are potential candidates of the COROT space experiment main programme (see for instance Catala et al. 1995, Michel et al. 1998, and Baglin et al. 1998 for details), and has been observed at the 193cm telescope at Observatoire de Haute-Provence (OHP, France) as part of the target selection process. High signal to noise ratio (S/N \(\simeq 150\)) spectra have been obtained using Elodie echelle spectrograph and analysed by comparison with theoretical spectra (Lignières et al. 1999). This set of new spectroscopic data together with both Johnson and Strömgren photometry from the literature provides a unique test of the predicted results of the BaSeL library. In addition, other calibration methods, namely the Templogg programme (based on Napiwotzki et al. 1993, and Künzli et al. 1997) and the Marsakov & Shevelev (1995) catalogue, provide further comparisons.
The photometric data in the Johnson (B−V and U−B) and Strömgren (b−y, m$_1$=(v−b)−(b−y), c$_1$=(u−v)−(v−b)) systems of our working sample of F-type stars are presented in Table 1, along with cross-identifications, and Hipparcos parallaxes (π). The issue of reddening is discussed in detail in Lastennet et al. (2001a).

Table 1: Cross-identifications (HD and HIP numbers), Hipparcos parallaxes (ESA catalogue, 1997; see also Perryman et al., 1997), and photometric data used in the BaSeL and Templogg determinations for the 9 target stars (accuracy of photometric data is given in Lastennet et al., 2001a).

| ID† | HD   | HIP   | π (mas) | B−V  | U−B  | b−y  | m$_1$ | c$_1$ |
|-----|------|-------|---------|------|------|------|-------|-------|
| 1   | 43587| 29860 | 51.76±0.78 | 0.61 | 0.10 | 0.384| 0.187 | 0.349 |
| 2   | 43318| 29716 | 28.02±0.76 | 0.49 | 0.00 | 0.322| 0.154 | 0.446 |
| 3   | 45067| 30545 | 30.22±0.92 | 0.56 | 0.07 | 0.361| 0.168 | 0.396 |
| 4   | 49933| 32851 | 33.45±0.84 | 0.39 | −0.09| 0.270| 0.127 | 0.460 |
| 5   | 49434| 32617 | 24.95±0.75 | 0.295| 0.05 | 0.178| 0.178 | 0.717 |
| 6   | 46304| 31167 | 23.13±0.76 | 0.25 | 0.06 | 0.158| 0.175 | 0.816 |
| 7   | 162917 | 87558 | 31.87±0.77 | 0.42 | −0.03| 0.280| 0.166 | 0.458 |
| 8   | 171834| 91237 | 31.53±0.75 | 0.37 | −0.04| 0.254| 0.145 | 0.560 |
| 9   | 164259| 88175 | 43.11±0.75 | 0.38 | −0.01| 0.253| 0.153 | 0.560 |

† Arbitrary running number.

3. Description of the methods

In this section, we briefly present the methods we used to derive T$_{eff}$, log g and [Fe/H]: the BaSeL library, two photometric calibrations and a detailed spectroscopic analysis.

3.1. The BaSeL library

The Basel Stellar Library (BaSeL models) is constituted of the merging of various synthetic stellar spectra libraries, with the purpose of giving the most comprehensive coverage of stellar parameters. This is a library of theoretical spectra corrected to provide synthetic colours consistent with empirical colour-temperature calibrations at all wavelengths from the near-UV to the far-IR (see Lejeune et al. 1998 and references therein for a complete description). It has been corrected for systematic deviations detected in respect to UBVRIHKLM photometry at solar metallicity, and can then be considered as the state-of-the-art knowledge of the broad band content of stellar spectra. These model spectra cover a large range of fundamental parameters (2000 ≤ T$_{eff}$ ≤ 50,000 K, −5 ≤ [Fe/H] ≤ 1 and −1.02 ≤ log g ≤ 5.5) and their photometric calibrations are regularly updated and extended to an even larger set of parameters (see e.g.
The BaSeL library spectra have been calibrated directly for standard dwarf and giant sequences at solar abundances and using UBVIJHKLM broad-band photometry, and are hence expected to provide excellent results in these photometric bands (see for instance Lastennet et al., 2001b for a recent applications to AGB stars in near-infrared JHKLM photometry). Since they are based on synthetic spectra, they can in principle be used in many other photometric systems taken either individually or simultaneously, and this is another major advantage - used in this work - of these models.

Thus, because the BaSeL library has only been calibrated in the UBVIJHKLM colours, the best parameters derivations come from this system. Whilst parameters derivations in equivalent bandwidth systems such as Washington seem to be as good with the BaSeL libraries than with empirical methods (Lejeune 1997), parameter derivations from the BaSeL library in narrow band systems such as Strömgren photometry should be of poorer quality. However, even in this non optimal case, good results were obtained for individual stars of detached eclipsing binaries (Lastennet et al. 1999).

In order to derive simultaneously the effective temperature \( T_{\text{eff}} \), the metallicity \([\text{Fe/H}]\), and the surface gravity \( \log g \) of each star, we minimize a \( \chi^2 \) -functional (see Lastennet et al. 2001a for all details).

### 3.1.1. The "Templogg" method

We have also run the "Templogg" program which is designed to determine effective temperature and \( \log g \) from either Strömgren or Geneva photometry. For Strömgren photometry it uses a Fortran program written by E. Fresno which relies upon the grids of Moon & Dworetsky (1985) in the \( T_{\text{eff}} - \log g \) parameter space relevant to this paper, with the improvements by Napiwotzki et al. (1993). For Geneva photometry it uses a Fortran program written by M. Kunzli (see North et al. 1994). The program chooses among eight different regions in the HR diagram for selecting the best calibration within the Strömgren system and three different regions for the Geneva system. The results from this method are gathered in Table 3.

### 3.1.2. The catalogue of Marsakov & Shevelev (1995)

Marsakov & Shevelev (1995) (hereafter [MS95]) have computed effective temperatures and surface gravities using Moon’s (1985) method, which is also based on the interpolation of the grids presented in Moon & Dworetsky (1985). According to Moon (1985), the standard deviations of the derived parameters are \( T_{\text{eff}} = \pm 100 \text{ K} \) and \( \log g = \pm 0.06 \). The metallicities of Marsakov & Shevelev (1995) are obtained with the equation of Carlberg et al. (1985) which relates \([\text{Fe/H}]\) with the colour excess \( \delta m_1 \) and the Strömgren \( \beta \) index. All the [MS95] results relevant for our sample are given in Tab. 3.
3.2. Spectroscopic analysis

The fundamental stellar parameters have been derived from a detailed analysis of spectra with high signal to noise ratio (S/N ≃ 150) obtained at OHP with the *Elodie* echelle spectrograph (spectra ranging from 3906 Å to 6811 Å at a resolution of $\lambda/\Delta\lambda = 42000$). After reduction, the observed spectra were compared with theoretical ones constructed from a combination of Kurucz atmospheric models (ATLAS9 - Mixing Length Theory of convection with $l/H_P = 0.5$ and without overshooting), the VALD-2 atomic database (Kupka et al. 1999), and the SYNTHE radiative transfer codes (Piskunov 1992) and BALMER9 (Kurucz 1993). In addition, the Least-Squares Deconvolution method (Donati et al. 1997) provided accurate determination of the projected rotational velocities listed in Tab. 2. While we confirm the low $v \sin i$ values of HD 43587, HD 43318, HD 45067, HD 49933 and the high $v \sin i$ of HD 46304 provided by the SIMBAD database, we find slightly largest values (by ~25 to 40%) for HD 162917, HD 171834 and HD 171834. We also derive a new rotational velocity determination for HD 49434: $v \sin i = 79$ km s$^{-1}$.

Details about these determinations are given in the two next subsections and the results are summarized in Tables 2 and 3.

Table 2: Cross-identifications (HD and HIP numbers), and rotational velocities $v \sin i$ derived from the application of the LSD method of Donati et al., 1997 on the OHP spectra (Lastennet et al. 2001a) and from the SIMBAD database.

| ID† | HD   | HIP  | $v \sin i$ (km s$^{-1}$) | Lastennet et al. (2001a) | SIMBAD database |
|-----|------|------|--------------------------|--------------------------|-----------------|
| 1   | 43587| 29860| 2                        | 3 (<6)                   |                 |
| 2   | 43318| 29716| 5                        | 3 (<6)                   |                 |
| 3   | 45067| 30545| 6                        | 5 (<10)                  |                 |
| 4   | 49933| 32851| 10                       | 5 (<10)                  |                 |
| 5   | 49434| 32617| 79                       |                          |                 |
| 6   | 46304| 31167| 200                      | 200                      |                 |
| 7   | 162917| 87558| 25                       | 20                       |                 |
| 8   | 171834| 91237| 64                       | 50                       |                 |
| 9   | 164259| 88175| 76                       | 54                       |                 |

† Arbitrary running number.

3.2.1. Determination of $T_{\text{eff}}$ from the H$\alpha$ line

The effective temperature can be determined by taking advantage of the sensitivity of H$\alpha$ line wings. Detailed studies (e.g. van ’t Veer-Menneret & Mégessier 1996), have shown that the H$\alpha$ line is independent

---

1This choice of parameters different than those used by Kurucz is fully justified in van ’t Veer-Menneret & Mégessier (1996)
of the surface gravity (for non-supergiant stars) for effective temperatures ranging from 5000 K to ∼8500 K, and depends only slightly on the metallicity. $T_{\text{eff}}$ is therefore obtained for each star of the sample by fitting the observed H$\alpha$ line with synthetic spectra computed from a grid of solar metallicity atmospheric models separated by 250K.

3.2.2. Determination of the surface gravity and metallicity

Within the temperature range that we found, we noticed that Fe I absorption lines depend only on temperature and metallicity, being practically independent of the surface gravity, while Fe II lines are sensitive to the temperature, metallicity and gravity. Consequently, the temperature being known from the H$\alpha$ line, the metallicity along with the microturbulence velocity are determined first by fitting a set of weak and strong Fe I lines. Then, the gravity is obtained by fitting Fe II lines. The spectral region near 6130 Å proved to be suitable for this analysis. However, the line broadening induced by rotation tends to mix neighbouring lines and prevent the analysis of individual Fe lines for high values of $v \sin i$: HD 49434, HD 46304, HD 171834 and HD 164259 (all these stars have $v \sin i \geq 60$ km s$^{-1}$).

3.3. Other determinations in the literature

To be as complete as possible, we looked for other determinations available in the literature and the SIMBAD database. One of the most comprehensive sources for our purpose is the fifth Edition of the catalogue of Cayrel de Strobel et al. (1997), which includes [Fe/H] determinations and atmospheric parameters ($T_{\text{eff}}, \log g$) obtained from high-resolution spectroscopic observations and detailed analyses, most of them carried out with the help of model atmospheres. However, the stars of our sample are not included in this catalogue. Since the catalogue comprises the literature (700 bibliographical references) up to December 1995, we only looked for more recent references. To the best of our knowledge, the catalogue of metallicities of Zakhozhaj & Shaparenko (1996) (hereafter [ZS96]) is the only one which contains useful information for our purpose. These metallicities are obtained from photometric UBV data and are available for two stars of our sample: HD 43587 and HD 164259 (see Table 3).

4. Results

Fig. 1, 2 and 3 show the $T_{\text{eff}}$-[Fe/H]-log g results by using the following synthetic colour combination: B$-$V, U$-$B, and b$-$y. The results are also summarized in Table 3. Other photometric combinations are presented and discussed in detailed elsewhere (Lastennet et al. 2001a).

A general comparison with the other methods shows that the BaSeL solutions are very satisfactory for the 3 fundamental parameters: effective temperatures are in excellent agreement, and [Fe/H] and gravities show good agreement. The improvement using the B$-$V, U$-$B, b$-$y combination is clear when compared with the original results using the B$-$V, U$-$B, b$-$y, $m_1$, $c_1$ combination presented in Figs. 1 and 2 of Lastennet et al. (2001a) because there is no longer any systematic trend towards lower temperatures and because the
Table 3: Comparison of fundamental stellar parameters determinations. The Templogg method uses Strömgren and Geneva photometric data, Marsakov & Shevlev 1995 ([MS95]) used Strömgren data, and the BaSeL method uses Johnson and Strömgren data (B–V, U–B and b–y in this table). Results from our spectroscopic analysis (Spectro.), and Zakhozhaj & Shaparenko 1996 [ZS96] are also given. The uncertainties are not reported but can be directly seen on the figures.

| ID† | HD | Method | Templogg | [MS95] | BaSeL | Spectro.‡ |
|-----|----|--------|----------|--------|--------|------------|
|     |    |        |          |        |        |            |
|     | 1  | 2      | 3        | 4      | 5      | 6          |
| HD  | 43587 | 43318 | 45067 | 49933 | 49434 | 46304 | 162917 | 171834 | 164259 |
| T eff |       |        |        |        |        |            |
|      | 6009 | 6420 | 5982 | 6535 | 7321 | 7379 | 6587 | 6714 | 6789 |
| [MS95] | 5952 | 6280 | 6066 | 6625 | 6629 | 6739 | 6730 |
| BaSeL | 5720 | 6320 | 5940 | 6600 | 7240 | 7240 | 6660 | 6700 | 6820 |
| Spectro.‡ | 6000 | 6250 | 6000 | 6500 | 7250 | 7250 | 6500 | 6750 | 6750 |
| log g |       |        |        |        |        |            |
|      | 4.32 | 4.20 | 4.16 | 4.25 | 4.16 | 3.93 | 4.32 | 4.02 | 4.11 |
| [MS95] | 4.11 | 4.05 | 4.02 | 4.46 | 4.49 | 4.10 | 4.10 |
| BaSeL | 4.3 | 4.5 | 3.8 | 4.3 | 4.0 | 3.4 | 4.5 | 3.9 | 4.2 |
| Spectro.‡ | 4.5 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 |
| [Fe/H] |       |        |        |        |        |            |
|      | −0.13 | −0.18 | −0.15 | −0.48 | −0.03 | −0.09 | +0.03 | −0.20 | −0.11 |
| [MS95] | −0.15 | −0.18 | −0.17 | −0.35 | +0.08 | −0.15 | −0.05 |
| BaSeL | −0.2 | +0.0 | −0.1 | −0.6 | −0.1 | −0.8 | +0.0 | −0.5 | +0.0 |
| Spectro.‡ | −0.1 | −0.3 | −0.1 | −0.5 | −0.2 | −0.2 | −0.03 |
| [ZS96] | +0.03 |        |        |        |        |            |

† Running number as in Tab. 1 and 2.
‡ Estimated error: $\Delta T_\text{eff} \approx \pm 250$ K, $\Delta \log g \approx \pm 0.5$, $\Delta [\text{Fe/H}] \approx \pm 0.2$.

determinations of log g and [Fe/H] are also much better, without systematic deviations. There is only one exception (HD 46304): its $T_\text{eff}$ is in perfect agreement with its spectroscopic value, but the predicted log g and [Fe/H] are still low. While the BaSeL contours are consistent with the Templogg gravity only at the 2-$\sigma$ level, the metallicity predicted from the BaSeL models is poor in comparison to the result of the Templogg calibration ($\Delta [\text{Fe/H}] \approx 0.7$). What could explain this persistent difference? It is worth noticing that this star has a large $v \sin i$ (200 km s$^{-1}$, the largest in our working sample), and it is well known that high rotational velocities modify the colours. Since the expected colour effect due to rotation is typically a few hundredths of a magnitude$^2$ in B–V and increases with $v \sin i$, this is probably part of the reason why the predictions of the BaSeL models disagree with the Templogg method for this star. However

$^2$These values are highly dependent of spectral type, age, and chemical composition, see for instance Maeder (1971) and Zorec (1992).
this explanation is not satisfying because rotation is not taken into account in the Templogg method.

In conclusion, except in the case discussed before, reliable and simultaneous estimates of the 3 atmospheric parameters can be derived for F-type stars from only the three synthetic BaSeL colours, B−V, U−B and b−y. This is a very useful criterion for further applications.

A comment on the impressively good accuracy of the BaSeL determinations for the Johnson-Strömgren B−V, U−B, b−y combination (see Figs. 1, 2 and 3) is in order. The Strömgren b−y index provides a reliable measure of the continuum and, therefore, a good temperature index, as discussed in detail in Lastennet et al. (2001a). This is particularly interesting, given the known difficulties of matching empirical and theoretical B−V-T\textsubscript{eff} scales to within better than about 0.03 mag (see, e.g., Sekiguchi & Fukugita, 2000). It is also well known that if one does not ask UBV data to provide the temperature in the first place (e.g., by using an independent source, such as spectroscopy, spectral classification, or else suitable other photometry, such as Strömgren b−y), the sensitivities of both U−B and B−V can be used to full advantage for determining log g and [Fe/H]. Moreover, although these sensitivities change with temperature, they are near or even at their maxima in the F-dwarf star domain (e.g., Buser & Kurucz 1992). This means that the derived values of [Fe/H] and log g presented in Figs. 1, 2 and 3 are as reliable as they can possibly be, given the uncertainties in the colours.

5. Future development of the BaSel models: application for COROT target stars

Usually, the BaSeL models provide colours in selected photometric systems, given a set of effective temperature, surface gravity and metallicity (T\textsubscript{eff}, log g, [Fe/H]). The new ”BaSel interactive server”, the web version of the BaSeL models hosted by the Coimbra Observatory since the end of 2000 (http://tangerine.astro.mat.uc.pt/BaSel/) already provides such information. We propose to develop in the near future a basic interactive tool based on the inverse method: an automatic tool based on the method of Lastennet et al. (1999) to complete the facilities of the ”BaSel interactive server”. This method would be applied to the ∼ 1000 remaining potential targets of the COROT exploratory programme to provide their fundamental stellar parameters as discussed by Lastennet, Lejeune & Cuisinier (2001).

6. Conclusion

Several methods of determination of the fundamental stellar parameters T\textsubscript{eff}, log g and [Fe/H] are compared for nine single F stars COROT potential targets. Particular attention has been paid to the simultaneous predictions of the BaSeL models in two photometric systems, Johnson and Strömgren.

\footnote{The b−y index is less vulnerable than B−V to the secondary effects of surface gravity and metallicity, even at the low spectral resolution given by the model spectra.}
Fig. 1.— Simultaneous (log g, [Fe/H]) results for the 9 potential targets of the COROT central seismology programme. The solutions from the BaSeL models (1-, 2- and 3-σ confidence level contours) are obtained in order to fit simultaneously the 3 following observed photometric values: (B – V), (U – B) and (b – y). For each star, the contour solutions are displayed in a T_eff = constant plane, corresponding to the best T_eff spectroscopic estimates. The χ^2-value is an estimation of the quality of the fit (a χ^2-value close to 0 is a good fit). Only one bad fit is obtained: χ^2 ≃ 25 for HD 43587 (upper left panel), but even in this case the solutions are not unrealistic (and at least in agreement with the other methods). The results projected in the log g-[Fe/H] plane from the spectroscopic analysis (diamond with error bars) as well as from the "Templogg" programme (square), and Marsakov & Shevelev (1995) (triangle) are also shown for comparison.
Fig. 2.— Simultaneous ($T_{\text{eff}}$, [Fe/H]) results for the 9 potential targets of the COROT central seismology programme. The solutions from the BaSeL models (1-, 2- and 3-$\sigma$ confidence level contours) fitting simultaneously the 3 following observed photometric values : (B−V), (U−B), (b−y). For each star, the contour solutions are displayed in a $\log g$ = constant plane, corresponding to the best simultaneous ($T_{\text{eff}}$, [Fe/H], log g) solutions derived from the BaSeL models (the grid explored is: $5000 \leq T_{\text{eff}} \leq 8000$ K in 20K steps, $-1 \leq$ [Fe/H] $\leq 0.5$ in 0.1 steps, and $3 \leq \log g \leq 5$ in 0.1 steps). An estimation of the quality of the best fit ($\chi^2$-value) is also quoted in each panel. The results projected in the $T_{\text{eff}}$-[Fe/H] planes from the spectroscopic analysis (diamond with error bars, or solid plus two dotted lines for the hottest stars of the sample) as well as from the “Templogg” programme (square), and Marsakov & Shevelev (1995) (triangle) are also shown for comparison.
Fig. 3.— As Fig. 2, but this time in a \( (T_{\text{eff}}, \log g) \) diagram. For each star, the contour solutions are displayed in a \([\text{Fe/H}] = \text{constant}\) plane, corresponding to the best simultaneous \( (T_{\text{eff}}, [\text{Fe/H}], \log g) \) solutions derived from the BaSeL models. Note that for the hottest stars of the sample (HD 46304, HD 49434, HD 164259, and HD 171834), the determination of \( \log g \) is hampered by the line broadening induced by stellar rotation (see Sect. 3.4.2). For these stars, the \( T_{\text{eff}} \) determination is displayed by a \textit{solid line} plus two \textit{dotted lines} because there is no \( \log g \) determination inferred from the spectroscopic analysis.
We presented the best combination to determine stellar parameters within the BaSeL library, using a combination of two Johnson colours, $U-B$ and $B-V$, and a Strömgren colour, $b-y$. This BaSeL combination is the best because on the one hand the $b-y$ synthetic index gives reliable and accurate estimates of the effective temperature and, on the other hand, $B-V$ and $U-B$ give good estimates of $[\text{Fe/H}]$ and the surface gravity.

We also note that the agreement between Templogg and BaSeL for the hottest stars of the sample could be especially useful in view of the well known difficulty of spectroscopic determinations for fast rotating stars.

As far as the astrophysical applications are concerned, the BaSeL synthetic colours are of particular interest in evolutionary synthesis and colour-magnitude diagram studies of stellar populations, such as open clusters and young associations, where (i) F-type stars are highly common and, of course, (ii) a vast abundance of data are available in $B-V$, $U-B$ and $b-y$ colours. Concerning the determination of the atmospheric parameters of the COROT potential targets, a result of the present analysis is that all the methods presented give consistent solutions. In the context of the further $\sim$1000 potential targets of the COROT exploratory programme, it will be of first interest to compare the results of the BaSeL models with those of other automated spectral analysis methods (e.g. Katz et al. 1998, and Bailer-Jones 2000).

**Acknowledgments**

We thank J.C. Bouret, C. Catala and D. Katz for their participation in the spectral characterization of the stars. This research has made use of the SIMBAD database operated at CDS, Strasbourg (France).

**REFERENCES**

Baglin A., et al., 1998, IAU Symposium 185, *New Eyes to See Inside the Sun and Stars*, eds. F.-L. Deubner, J. Christensen-Dalsgaard, and D. Kurtz, p.301

Bailer-Jones C.A.L., 2000, A&A, 357, 197

Buser R., Kurucz R.L., 1992, A&A, 264, 557

Carlberg R.G., Dawson P.C., Hsu T., Vandenberg D.A., 1985, ApJ, 294, 674

Catala C., Mangeney A., Gautier D., Auvergne M., Baglin A., Goupil M.J., Michel E., Zahn J.P., Magnan A., Vuillemin A., Boumier, P., Gabriel A., Lemaire P., Turck-Chieze S., Dzitko H., Mosser B., Bonneau F., 1995, Astronomical Society of the Pacific Conf. Series, Vol. 76, p.426

Cayrel de Strobel G., Soubiran C., Friel E.D., Ralite N., Francois P., 1997, A&AS, 124, 299

Donati J.-F., Semel M., Carter B.D., Rees D.E., Cameron A.C., 1997, MNRAS, 291, 658
ESA, 1997, *The Hipparcos and Tycho Catalogues* (ESA-SP 1200)

Katz D., Soubiran C., Cayrel R., Adda M., Cautain R., 1998, A&A, 338, 151

Künzli M., North P., Kurucz R.L., Nicolet B., 1997, A&AS, 122, 51

Kupka F., Piskunov N., Ryabchikova T.A., Stempels H.C., Weiss W.W., 1999, A&AS, 138, 119

Kurucz R.L., 1993, CD-ROM 13, 14

Lastennet E., Lejeune T., Cuisinier F., 2001, to appear in the ASP Conference Series, *Observed HR diagrams and stellar evolution: the interplay between observational constraints and theory*, Coimbra, Portugal

Lastennet E., Lejeune T., Westera P., Buser R., 1999, A&A, 341, 857

Lastennet E., Lignières F., Buser R., Lejeune T., Lüftinger Th., Cuisinier F., van ’t Veer-Menneret C., 2001a, A&A, 365, 535

Lastennet E., Lorenz-Martins S., Cuisinier F., Lejeune T., 2001b, to appear in the ASP Conf. Series, *Observed HR diagrams and stellar evolution: the interplay between observational constraints and theory*, Coimbra, Portugal

Lejeune T., 1997, Ph.D. Thesis, Observatoire Astronomique de Strasbourg, France

Lejeune T., Cuisinier F., Buser R., 1998, A&AS, 130, 65

Lignières F., Catala C., Katz D., Lastennet E., Lüftinger Th., van ’t Veer-Menneret C., *Joint European and National Astronomical Meeting (JENAM 99)*, 7-11 Sept. 1999, Toulouse (France)

Maeder A., 1971, A&A, 10, 354

Marsakov V.A., Shevelev Y.G., 1995, Bull. Inform. CDS 47,13 [MS95]

Michel E., Baglin A., et al., 1998, *Structure and Dynamics of the Interior of the Sun and Sun-like Stars*, SOHO 6/GONG 98 Workshop Abstract, June 1-4, 1998, Boston, Massachusetts

Moon T.T., 1985, Com. Univ. London Obs. 78, 1

Moon T.T., Dworetsky M.M., 1985, MNRAS, 217, 305

Napiwotzki R, Schönberner D., Wenske V., 1993, A&A, 268, 653

North P., Künzli M., Nicolet B., 1994, 22nd GA of the IAU, the Hague

Perryman M.A.C., et al. 1997, A&A, 323, L49,

Piskunov N.E., 1992, in *Stellar magnetism*, Y.V. Glagolevskij, I.I. Romanyuk (eds.), Nauka, St. Petersburg, p.92
Sekiguchi M., Fukugita M., 2000, AJ, 120, 1072 (astro-ph/9904299)

van ’t Veer-Menneret C., Mégessier, 1996, A&A, 309, 879

Westera P., Lejeune T., Buser R., 1999, ASP Conf. Series, Hubeny I., Heap S.R. and Cornett R.H (eds.), Vol. 192, p.203, (astro-ph/9906064)

Zakhozhaj V.A., Shaparenko E.F., 1996, Kinematika Fiz., Nebesn. Tel., 12, part no 2, 20-29, [ZS96]

Zorec J., 1992, Hipparcos, Goutelas 1992, Benest D., Froeschlé C. eds., p.407