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Multi-object spectroscopy of stars in the CoRoT fields

II. The stellar population of the CoRoT fields IRa01, LRa01, LRa02, and LRa06[⋆],[⋆⋆]

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ABSTRACT

Context. With now more than 20 exoplanets discovered by CoRoT, it has often been considered strange that so many of them are orbiting F-stars, and so few of them K- or M-stars. Up to now, studies of the relation between the frequency of extrasolar planets and the spectral types, or masses of their host stars has been the realm of radial velocity surveys. Although transit search programs are mostly sensitive to short-period planets, they are ideal for verifying these results. This is because transit search programs have different selection biases than radial velocity surveys. To determine the frequency of planets as a function of stellar mass, we also have to characterize the sample of stars that was observed.

Aims. We study the stellar content of the CoRoT-fields IRa01, LRa01 (=LRa06), and LRa02 by determining the spectral types of 11 466 stars. Nine planet-host stars have already been identified in these fields. Determing the spectral types of thousands of stars of which CoRoT obtained high-precision light-curves also makes a wide variety of other research projects possible.

Methods. We used spectra obtained with the multi-object spectrograph AAOmega and derived the spectral types by using template spectra with well-known parameters.

Results. We find that 34.8 ± 0.7% of the stars observed by CoRoT in these fields are F-dwarfs, 15.1 ± 0.5% G-dwarfs, and 5.0 ± 0.3% K-dwarfs. We conclude that the apparent lack of exoplanets of K- and M-stars is explained by the relatively small number of these stars in the observed sample. We also show that the apparently large number of planets orbiting F-stars is similarly explained by the large number of such stars in these fields. Given the number of F-stars, we would have expected to find even more F-stars with planets. Our study also shows that the difference between the sample of stars that CoRoT observes and a sample of randomly selected stars is relatively small, and that the yield of CoRoT specifically is the detection one hot Jupiter amongst 2100 ± 700 stars.

Conclusions. We conclude that transit search programs can be used to study the relation between the frequency of planets and the mass of the host stars, and that the results obtained so far generally agree with those of radial velocity programs.

Key words. catalogs – stars: late-type – planetary systems – stars: solar-type

1. Introduction

Analyzing the statistical properties of extrasolar planets provides important clues on planet formation. Particularly important are the relations between the properties of host stars and their planets. Up to now, most of these studies have been carried out using radial velocity surveys. Radial velocity surveys have the clear advantage that they allow one to detect planets with orbital periods ranging from less than a day to many years, but they have the disadvantage that they are biased against rapidly rotating and active stars. This is a problem if one aims to determine the relation between the mass of the host stars and the frequency of planets, because most of the main-sequence stars with masses larger than the Sun rotate fast (e.g. Reiners & Schmitt 2003). One possible solution is to observe giant stars. However, giant stars do not have close-in planets and it is therefore difficult to compare the results obtained for giant stars with those for main-sequence stars. Nevertheless, by combining data of main-sequence and giant stars, Johnson et al. (2010) concluded that the frequency of planets increases proportionally to the mass of the host stars (see also Johnson et al. 2007; Udry & Santos 2007).

It would consequently be important to test these results with an independent method. Although transit search programs detect mostly short-period planets, they offer this possibility. The CoRoT-survey (COnvection, ROtation, and planetary Transits) is particularly suitable for this purpose. The discovery of a planet transiting an F6V star with a $v \sin i$ of 40 ± 5 km s^{-1} (Gandolfi et al. 2010), and a planet orbiting a highly active star (Alonso et al. 2008) shows that this survey is not biased against rapidly rotating and active stars. Furthermore, the detection of a planet with an orbital period of 95 days (Deeg et al. 2010), and a planet with radius of $1.58 \pm 0.10\,R_{\rm Earth}$ (Léger et al. 2009; Bruntt 2010) shows that CoRoT is able to detect planets in relatively long orbit as well as planets of small radii. The statistical analysis of the CoRoT survey thus will give us a complementary view to

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[⋆] Based on observations obtained with the Anglo-Australian Telescope in program 07B/040 and 08B/003.

[⋆⋆] Table 2 is only available at the CDS via anonymous ftp to `cdsarc.u-strasbg.fr` (130.79.128.5) or via
`http://cdsarc.u-strasbg.fr/viz-bin/qcat?J/A+A/543/A125`

the results obtained in radial velocity surveys, because it is less biased against rapidly rotating and active stars. As an additional advantage, CoRoT observes fields in different regions of the sky, allowing us to find out whether the population of planets depends on the region in the sky that is being observed.

At first glance there seems to be a huge difference between results obtained in transit and radial velocity surveys. Out of the first 20 planet-hosting stars discovered by CoRoT, 35% are F-stars, 55% G-stars, and 20% are K-stars, with not a single one being an M-star. If we consider the number of stars harboring planets with a semi-major axis ≤0.1 AU discovered by radial velocity surveys, 7% of them are F-stars, 39% G-stars, 39% K-stars, and 13% M-stars. It has therefore often been considered strange that CoRoT finds so many planets orbiting F-stars, and so few orbiting K- and M-stars. However, before we can conclude that there is a difference between the two types of surveys, we have to know how many F, G, K and M-stars the samples contains.

To compare the results obtained in radial velocity surveys with those obtained by CoRoT, we have to know how many F, G, and K-type stars CoRoT has observed. This is the aim of this work. By spectroscopically characterizing the sample of stars that CoRoT has observed, we answer the question whether relatively few planets are found around K- and M-stars because of the lack of such objects in the sample, or whether it reflects a real lack of close-in planets around these types of stars. In the same way, we also answer the question why CoRoT finds so many planets of F-stars.

2. Concept of the survey

This work is part of a series of articles devoted to the spectroscopic study of the stellar population in the CoRoT exoplanet fields. Using intermediate-resolution spectroscopy acquired with the FLAMES/GIRAFFE multi-fibre facility at ESO-VLT, Gazzano et al. (2010) determined $v \sin i$, $V_{\rm rad}$, $T_{\rm eff}$, $\log(g)$, [M/H], and [α/Fe] for 1227 stars in the CoRoT-fields LRa01, LRc01, and SRc01. While 1227 stars sounds like a high number, it means that only ∼4% of the stars that CoRoT observed in these fields were analyzed. Additionally, the survey contained stars in fields located in two opposite directions in the sky (the so-called galactic "center" and "anti-center"-eyes of CoRoT), which makes the sample of stars for each "eye" relatively small. There is consequently a need for a more comprehensive study in which a larger sample of stars is analyzed.

There are more potential target stars in the CoRoT exoplanet fields than there are stars observed by the satellite. Based on a massive $UBVr'i'$ photometric survey performed during the mission preparatory phase (Deleuil et al. 2009), the CoRoT-targets were selected by giving higher priority to photometrically identified dwarf stars. It is thus also important to find out how much the CoRoT-sample differs from a sample of randomly chosen stars. To quantify the effect of the selection process, we analyzed 7131 stars observed by CoRoT and 4335 stars that were not observed by CoRoT but have the same brightness and are in the same regions as the CoRoT target stars.

The results of our spectroscopic survey are published in two articles. In Paper I (Sebastian et al. 2012), we gave a list of stars with spectral types O, B, and A in IRa01, LRa01, and LRa02. Here we analyze stars with spectral types F, G, K, and M. The LRa01-field was recently re-observed by CoRoT, the field is called LRa06 in the new observations.

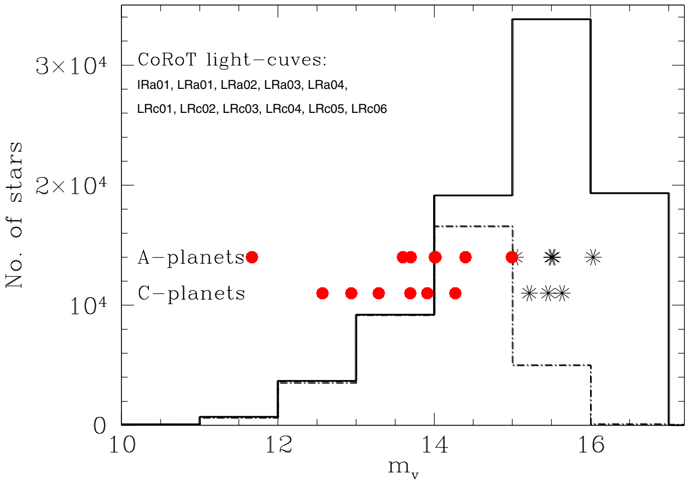

Fig. 1. Histogram of the visual magnitudes of the stars observed by CoRoT in eleven exoplanet fields. The full line represents all stars, the dashed line only those that were observed in the CHR-mode. The thick (red) points indicate the brightness of the planet-host stars found in the "galactic center" (C-planets) and "anti-center eyes" (A-planets) of CoRoT. The asterisks shows the brightness of the planet-hosting stars observed in the MONO-mode.

3. Spectroscopic observations and data reduction

Observations, data-reduction, and spectral type determination are described in detail in Paper I. For convenience, a short summary is provided below.

We used the AAOmega multi-object spectrograph mounted on the Anglo-Australian telescope during two observing campaigns, i.e., from 13 to 20 January 2008 and from 28 December 2008 to 4 January 2009. AAOmega is ideal for our purpose, because it has a field of view of about two degrees, which matches the CoRoT-fields IRa01, LRa01, and LRa02 well, which have a size of 1.8° × 3.6°. In the blue arm we employed the *580V*-grating, which covers the wavelength range 3740–5810 Å, and in the red arm the *385R*-grating, which covers the 5650–8770 Å range. The spectral resolution of both gratings is $\lambda/\Delta\lambda \sim 1300$. Using the AAOmega data-reduction pipeline *2dfdr* (Saunders et al. 2004; Smith et al. 2004), we subtracted the bias from the frames, flat-fielded them, and extracted and wavelength-calibrated the spectra. The sky-background was then subtracted from the spectra using the data obtained with fibres that were placed on sky-background. In the last step we flux-calibrated the spectra. In total we obtained spectra for 11 466 stars.

Figure 1 shows the histogram of the visual magnitudes of the stars observed by CoRoT in eleven exoplanet fields. CoRoT is equipped with a bi-prism that disperses the light into a short spectrum. For relatively bright stars, the flux is measured in three colors (CHR-mode), for faint stars only the total flux is determined (MONO-mode). The dashed line in Fig. 1 gives the number of stars per magnitude interval monitored in the CHR-mode, and the full line the number of stars observed with the CHR and the MONO-mode together. Down to $V \sim 15$ mag essentially all stars are observed in the CHR-mode. To focus on stars that were observed in this mode, we limited our survey to $V \leq 15$ mag. We focused on stars observed in the CHR-mode, because the quality of this data-set is higher. For example, from the first 20 planet host stars discovered by CoRoT, seven were discovered with the MONO-mode, and 13 with the CHR-mode. The points in Fig. 1 represent the brightness of the planet host stars observed in the

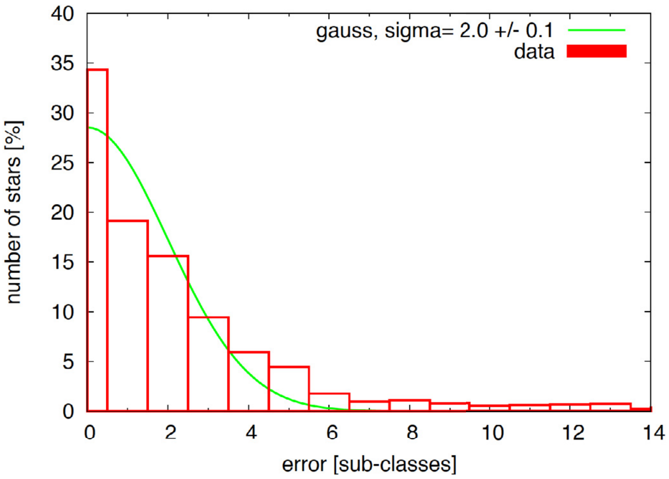

Fig. 2. Histogram of the spectral type differences. The error on the spectral class determination is on average 2.0 ± 0.1 sub-classes.

CHR-mode, and the asterisks the planet host stars observed in the MONO-mode.

In total, CoRoT observed 3097 stars in IRa01, 7470 stars in LRa01 (LRa06), and 4125 stars in LRa02 with the CHR-mode. This means that we determined the spectral types of more than 50% of the stars observed by CoRoT in the CHR-mode in these fields. We also obtained sufficient spectra of stars that were not observed by CoRoT, which allows us to find out by how much the stellar population of the CoRoT-targets differs from the general population of stars in these fields. The spectral types were derived by iteratively fitting the observed spectra with templates taken from a library of spectra.

4. The accuracy of the spectral type determination

For 33% of the stars observed with AAOmega, we obtained more than one spectrum. This strategy not only increases the accuracy of the spectral type determination but it also allowed us to assess the internal precision of our method by comparing the spectral types derived for the same star using different spectra. Figure 2 shows the histogram of the difference of the spectral classifications obtained for two or more spectra of the same star. The error is on average 2.0 ± 0.1 sub-classes. If we perform the same analysis for the different spectral-classes, we find an error of 1.90 ± 0.08 sub-classes for B-stars, 1.28 ± 0.07 sub-classes for A-stars, 2.2 ± 0.1 sub-classes for F-stars, 2.9 ± 0.2 sub-classes for G-stars, and 1.7 ± 0.1 sub-classes for K- and M-stars. As shown in Fig. 2, there are a few stars for which the difference is larger than five sub-classes. These outliers are caused by intrinsic variability of the stars, binaries, or by instrumental effects, like spectra with very low signal-to-noise ratio. Although we include spectra of very low signal-to-noise ratio in Fig. 2, we did not use such spectra for the classification. The true error therefore is certainly smaller than two sub-classes.

However, because in our method we essentially compare the observed spectra with templates, the quality of the templates and the accuracy with which their spectral types were determined is important. When selecting the library of spectra, there are three aspects to be taken into account: (1) the library of spectra should cover all spectral types and luminosity classes that are of interest in this work; (2) the spectral types given for the templates should be accurate; (3) the library must contain templates with a resolution that is at least as high as that of AAOmega. The three most promising libraries are Valdes et al. (2004, Val), Jacoby et al. (1984, JHC), and Le Borgne (2003, STELIB).

Our method does not derive the spectral types of the stars directly but identifies which spectrum from a library matches the observed spectrum best. The spectral type of the CoRoT-target is then given by the spectral type of that template. If we take for example CoRoT102899501 (=IRa01_E2_649), we find that HD 22468 (Val), HD 29050 (JHC), and HD 132141 (STELIB) match the observed spectrum best. The spectral types derived are thus G9V (Val), G9V (JHC), and K1V (STELIB), respectively. However, instead of using the spectral types of these stars given in these three articles, we can also look up their spectral types in Skiff (2010). Skiff (2010) compiled a long list of spectral-types of many stars from the literature. For HD 22468 Skiff (2010) lists three spectral types: K2Ve, G8Ve and K2:Vn k, and for HD 132141 K0V and K1V. HD 29050 is not listed in in this work but SIMBAD gives K1V. The values published in the literature for these stars generally agree with the values given in the three articles.

The best test of our method and the quality of the templates would be if we were to know the exact spectral type for some stars that we observed with AAOmega. Based on high-resolution spectra, Gondoin et al. (2012) determined for CoRoT102899501 $T_{\rm eff}$ = 5180 ± 80 and 4.35 ± 0.10. Using the the conversion from $T_{\rm eff}$ and log g into spectral type given in Gray (2009) this corresponds to a K1V star. The values derived from the AAOmega-spectra thus differ by $\leq$2 sub-classes from the true value. This is consistent with the internal error shown in Fig. 2.

We can carry out similar tests using the planet-host stars, because their stellar parameters have been determined with very high accuracy using high signal-to-noise spectra obtained with UVES and HARPS. Our AAOmega-survey contains the planet-host stars CoRoT-1 (Barge et al. 2008), CoRoT-5 (Rauer et al. 2009), and CoRoT-7 (Léger et al. 2009; Bruntt et al. 2010). Using the three libraries we find for G0V-star CoRoT-1 the spectral types F6V (Val), F4III (JHC), and G0V (STELIB), respectively. For the F9V-star CoRoT-5 the three different templates give F9IV (Val), F7V (JHC), and F7V (STELIB), and for the G9V-star CoRoT-7 G8V (Val), G9V (JHC), K1V (STELIB).

If we consider that the resolution of the AAOmega-spectra is too low to distinguish luminosity-class IV from V stars, we obtain the correct luminosity class in all cases, except for the library published by Jacoby et al. (1984) in the case of CoRoT-1. The differences between the true spectral types and the spectral types derived from the AAOmega spectra are consistent with the internal error. Since the library of spectra published by Valdes et al. (2004) covers all spectral types and luminosity classes, and since the stars in this library have recently been precisely recalibrated by Wu et al. (2011), we used these templates.

5. Results

The primary result of the our survey is the determination of the spectral types of 11 466 stars in CoRoT-fields IRa01, LRa01 (LRa06), and LRa02. In Table 3 we give the spectral types of F, G, K, and M-stars in these fields, and in Paper I (Sebastian et al. 2012) the spectral types of all O, B, and A-stars. For completeness we list in Cols. 7 and 8 in Table 3 the $T_{\rm eff}$ and log g-values for the stars that were also observed by Gazzano et al. (2010). Knowing the spectral types of thousands of stars for which CoRoT obtained high-precision light-curves in three colors opens up possibilities for a wide variety of research projects. For example, we now determined the spectral types of many stars discussed in Kabath et al. (2007, 2008, 2009).

Table 1. Frequency of stars in IRa01, LRa01, LRa02.

Status	Luminosity class	O [%]	B [%]	A [%]	F [%]	G [%]	K [%]	M [%]
Stars observed	IV+V	<0.01	3.9 ± 0.2	15.9 ± 0.5	34.8 ± 0.7	15.1 ± 0.5	5.0 ± 0.3	<0.01
with CoRoT	I, II, III	<0.01	1.5 ± 0.1	3.0 ± 0.2	4.8 ± 0.3	9.6 ± 0.4	6.0 ± 0.3	0.3 ± 0.06
Stars not observed	IV+V	0.02 ± 0.02	4.7 ± 0.3	18.9 ± 0.7	27.7 ± 0.8	13.9 ± 0.6	4.6 ± 0.3	<0.02
with CoRoT	I, II, III	0.02 ± 0.02	1.5 ± 0.2	2.8 ± 0.3	4.8 ± 0.3	11.1 ± 0.5	9.1 ± 0.5	0.8 ± 0.1
All	IV+V	0.01 ± 0.01	4.2 ± 0.2	17.0 ± 0.4	32.1 ± 0.5	14.6 ± 0.4	4.9 ± 0.2	<0.01
stars	I, II, III	0.01 ± 0.01	1.5 ± 0.1	3.0 ± 0.2	4.7 ± 0.2	10.2 ± 0.3	7.2 ± 0.3	0.6 ± 0.1

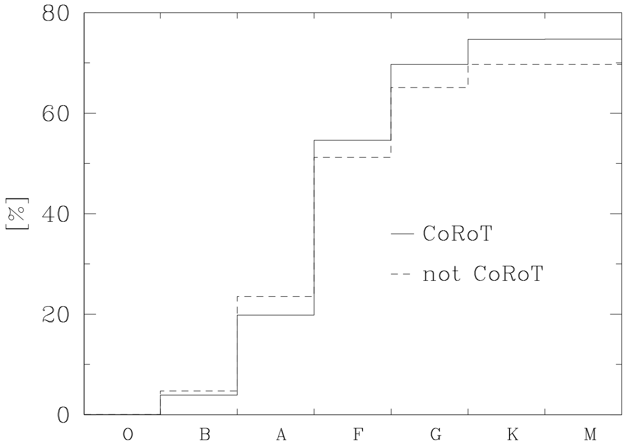

Fig. 3. Cumulative distribution function of dwarf stars that were observed and not observed with CoRoT.

The first application of our results was to calculate the planet-yield of CoRoT. In total 21 280 light curves of IRa01, and LRa01 have been analyzed (Carpano et al. 2009; Carone et al. 2011), and 91 candidates were found, of which at least six are hosting planets. Five of these are hosting hot Jupiters ($0.45\,M_{\rm Jup} \leq M_{\rm p} \leq 2.5\,M_{\rm Jup}$; $P < 10$ d). Since all of the known hot Jupiters in these fields orbit F- and G-dwarfs, and since 49.9 ± 0.8% of the stars in the sample are stars of this type, the yield of CoRoT is one hot Jupiter amongst 2100 ± 700 stars. If we take the geometric probability for a transit into account, the true frequency of hot Jupiters is 0.4 ± 0.2%. This result agrees well with the results obtained in radial velocity surveys. For example, Cumming et al. (2008) and Naef et al. (2005) reported frequencies of 0.4 ± 0.3% ($P < 11.5$ d), and 0.7 ± 0.5% ($P < 5$ d), respectively. The fact that the number of hot Jupiters detected with CoRoT agrees with the number of hot Jupiters discovered in radial velocity surveys implies that CoRoT detects all transiting planets of this type in these fields.

As mentioned above, when selecting the CoRoT targets, preference was given to stars that were more likely to be late-type dwarfs. With the spectral types derived, we can now asses the effect of the selection process.

Figure 3 shows the cumulative distribution function for dwarf stars observed, and not observed by CoRoT[1]. A Kolmogorov-Smirnov test shows that the samples are indeed different. The main difference is that the CoRoT-sample contains more F- and G-dwarfs than the sample of stars that was not observed by CoRoT. This is obviously the effect of the selection process of the targets. The difference of the stellar populations of the two samples is small however. This can also be seen in Table 1, were we list the frequency of stars for each spectral type for the two samples. For example, the fraction of dwarfs (sub-giants and dwarfs) is 75.3 ± 1.0% for the CoRoT sample, compared to 69.9 ± 1.3% for the sample of stars that was not observed by CoRoT. The fraction of O and B stars in the two samples is 5.4 ± 0.3%, and 6.2 ± 0.5%, respectively. The stellar population of the CoRoT-sample thus is not that different from the general population of stars in these fields.

The distribution of spectral types in a sample of stars depends on the region in the sky that is being observed and on the limiting magnitude of the survey. If we were, for example, to carry out a deep survey at a high galactic latitude, we would find only very few intrinsically bright stars, because such stars would have to be at a large distance to be that faint but the number of stars decreases with the distances from the plane of the milky way (see for example Phleps et al. 2005). If we observe at low galactic latitude, extinction complicates somewhat more the picture but the fraction of intrinsically luminous stars will still decrease for fainter stars. For example, Robin et al. (2003) showed that giants dominate for $V < 11$, and main-sequence stars for $V > 14$. Because the sample in this study contains stars from $V = 10$ to $V = 15$, we expect that it will contain a relatively high percentage of late-type main sequence stars. A high percentage of late-type main-sequence stars is an advantage for a planet search program.

Prior to the CoRoT-observation, the fields IRA01, LRa01, and LRa02 were observed photometrically in the U, B, V, r', i' bands. After combining these data with 2MASS-photometry, the photometric spectral types of the stars were determined. When selecting the CoRoT-targets, preference was given to stars that had a higher probability of being late-type dwarfs, and to stars with a low content of contaminating stars. All information was made public in the form of the EXODAT-catalog (Deleuil et al. 2009). The CoRoT-sample therefore is not a random sample of stars but a sample that was optimized for planet search. Using our results, we can now quantify what fraction of stars in these fields are suitable stars for a planet search (e.g. A- to M-dwarfs).

Figure 4 shows the distribution of CoRoT-targets in the Hertzsprung-Russell diagram (HRD). The area of each of the circles is proportional to the number of stars of that class. Figure 4 clearly shows that the most abundant type of stars in the CoRoT-sample are F-dwarfs. Figure 5 shows the distribution of the spectral types in more detail. For this figure we added up stars of luminosity class IV and V, which we called "dwarfs", and all stars with luminosity class I, II, and III, which we called "giants". It turns out that the most abundant type of stars are late F-dwarfs. M-stars are rare amongst the CoRoT-targets, and most of them are giants, not dwarfs.

Figure 6 shows the same kind of diagram for bright stars for comparison. We selected for Fig. 6 stars brighter than $V = 6.5$ mag so that the number of stars in Figs. 4 and 6 is about the same. The CoRoT-sample contains more A, F, and G-dwarfs

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[1] The cumulative number is smaller than 100%, because not all stars are dwarfs.

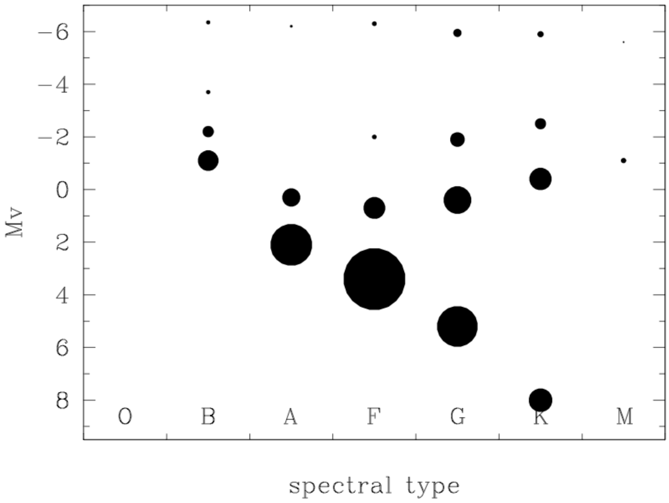

Fig. 4. HRD of the stars observed by CoRoT. The size of the circles is proportional to the number of stars of that category.

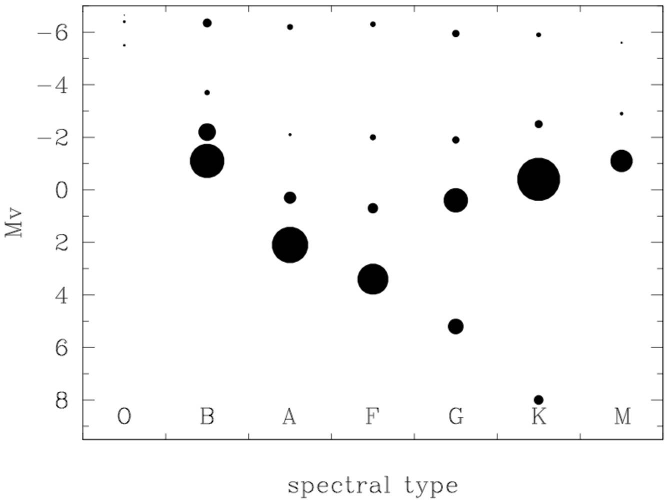

Fig. 6. Same as Fig. 4 but for stars brighter than 6.5 mag.

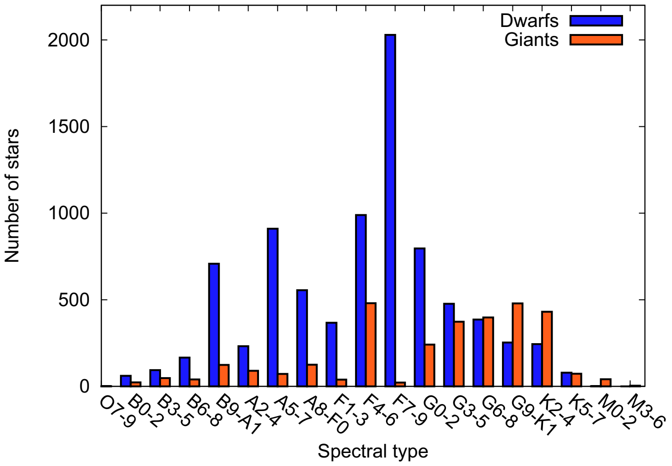

Fig. 5. Distribution of spectral types in our sample. The blue column is the sum of sub-giants and dwarfs (designated as dwarfs), and the red column the sum of super-giants, bright giants and giants (designated as giants). The most common species of stars are late F-dwarfs.

than the bright-star sample. We find that the fraction of suitable targets for a planet-search program is 73.6 ± 1.0% for CoRoT, compared to 28.6 ± 0.6% for a bright-star sample. This shows to which degree the CoRoT-sample is optimized for planet-detection.

6. Discussion and conclusions

Of these nine planet-host stars discovered in the three CoRoT-fields studied in this work, four are F-type stars (CoRoT-4, Moutou et al. 2008; CoRoT-5, Rauer et al. 2009; CoRoT-14, Tingley et al. 2011; CoRoT-21 Pätzold et al. 2011), four are G-type stars (CoRoT-1, Barge et al. 2008; CoRoT-7, Léger et al. 2009; CoRoT-12, Gillon et al. 2010; CoRoT-13, Cabrera et al. 2010), and one is a K-star (CoRoT-24; Alonso et al. 2012). With only nine planet-host stars, the sample is too small to answer the question whether or not the number of planets increases with the mass of the host star.

However, we can still discuss whether the high percentage of planets orbiting F-stars and the small fraction orbiting K-stars can be explained with the observed sample of stars, or whether it can already be taken as evidence for an increase of the planet frequency with the mass of the host star.

Given that only 5.0 ± 0.3% of the stars in the sample are K- and M-dwarfs, the small number of planets found in K- and M-stars by CoRoT is due to the lack of K- and M-stars in the sample. The situation is more complicated for the F-stars. Since four of the planet-hosting stars are G-stars, and there are 2.3 times as many F- than G-stars, there should have been 9 to 14 planet-hosting F-stars, depending on whether we assume that the frequency of planets increases with the mass of the star, or not. In contrast to this, only four planet-hosting stars of this type were found. Of course, this is still low-number statistics, but we can conclude that there is no excess of close-in F-star planets. Quite contrary to this, we would have expected to find even more planets of F-stars.

If we add up the results obtained for all galactic anti-center fields, CoRoT has found four F-stars and eight G-stars that are hosting planets. If there were also twice as many F- as G-stars in these fields, we would have expected to find four times as many F-stars hosting planets than we have found. However, we have to carry out a similar study of all the other fields before we can draw any firm conclusion. In any case, our study shows that the statistical analysis of transit search programs can lead to very interesting results. Once the CoRoT survey is completed, it will be possible to answer the question whether or not there is a lack of close-in planets of F-stars.

Up to now, we have only analyzed stars located in the so-called "galactic anti-center region" of CoRoT. The next step would be to carry out a similar survey for the fields in the so called "galactic center eye" of CoRoT. Apart from improving the statistics, there is another good reason: because of the metallicity gradient in our galaxy and the correlation between planet frequency and metallicity, it is expected that stars orbiting closer to the galactic center should have a higher frequency of planets than stars orbiting at larger distances. If we take the gradient of -0.06 ± 0.01 kpc^{-1} from Friel et al. (2002) and the relation between metallicity and planet frequency from Santos et al. (2004), we expect a difference of a factor of two for the planet frequency of stars with galactocentric distances that differ by 2 kpc. Using a more sophisticated model, Reid (2008) estimated that the difference of the planet-frequency is a factor of 1.8 for stars with galactocentric distances between 7 and 9 kpc. Since CoRoT observes stars in this range CoRoT-data might show this effect, if all fields are analyzed. Interestingly, the galactocentric distance from 7 to 9 kpc corresponds also to the galactic habitable zone (Lineweaver 2004). By extending the survey to the "galactic center" fields we will thus not only improve the statics but we might even be able to find out whether the properties of the planets depend on the galactocentric distance.

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