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# Report on the fourth run of the ESO LP 185.D-0056 (HARPS@3.6m)

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## EXECUTIVE SUMMARY.

The ESO Large Programme 185.D-0056 (HARPS@3.6m) continued with the fourth run. The log of the observations performed in December 2011 and January 2012, a tip on the preparation of the Observing Blocks, [the data backup](#), and the situation of the publications are given. The following actions/items are emphasized:

1. The monitoring of the CoRoT targets related to the SRa04, SRa05, and LRa06 runs was successful, although for the first time we had some bad weather during December observations;
2. Long timeseries are available for LPV analysis on the early B-stars HD 45418 and HD 45546, on the B9-star HD 45975, and on the subgiant HD 45398. Other CoRoT stars have been observed less frequently, but always as requested by the respective PIs;
3. The spectra have been fully reduced and distributed to the respective PIs;
4. No other spectroscopic campaign was performed with another instrument.

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## 1. Introduction

The ground-based spectroscopic monitoring of the CoRoT targets continued involving the European Southern Observatory (La Silla, Chile; HARPS@3.6m) only. The proposal submitted to use SOPHIE@1.9m at OHP was not accepted. Additional spectra on some targets will be taken at the HERMES@MERCATOR instrument (Canary Islands) at end of 2012.

As in the previous cases, the goals of this eleventh (the seventh of the HARPS series) internal report are to circulate useful information about the ESO observations within the team and to keep the record of the observations. The next HARPS runs are scheduled from June 24 to July 5, 2012 and from July 23 to 28, 2011. Ennio Poretti (INAF-OA Brera) and Juan Carlos Suarez (IAA Granada) will be the observers.

## 2. The ESO observations

Thierry Morel (Université de Liege) was the observer for the first 10-nights run (December 17-27, 2011), Monica Rainer and Francesco Borsa (INAF-OA Brera) for the second 5-nights run (January 7-12, 2012).

The HARPS observations were related to the SRa04 (September 30-November 28, 2011), SRa05 (November 29, 2011-January 9, 2012), and LRa06 (January 10-March 29, 2012) runs. The CoRoT targets were:

- SRa04: HD 45975, HD 45418, HD 45398, HD 45546, and HD 45517. All these stars are located in the open cluster NGC 2264;
- SRa05: HD 48784, HD 49429, HD 48977, HD 48752, and HD 49566;
- LRa06: HD 49933, HD 50230, HD 49385, HD 49585, and HD 49608.

The stars of primary interest for studying line profile variations were HD 45975 (late B-type star with chemical peculiarities), HD 49585 (Be star), HD 45418 and HD 45546 (early B-type stars). Moreover, the Be star HD 43913 (monitored by CoRoT in the LRa03) was also observed. The K0 subgiant HD 45398 was intensively monitored to study the radial velocity variations associated to solar-like oscillations. All the other targets were observed at least once to provide a very high SNR HARPS spectrum.

The observing sequence was

HD 45975 - HD 45418 - HD 45546 - HD 45398 - slot - ...

The Be stars HD 49585 and HD 43913 were put in the slot once or twice per night, the other stars at least once in the whole observing run. Moreover, 3 spectra of V588 Mon and V589 Mon were taken. These pre-main sequence  $\delta$  Sct stars were not observed by CoRoT in the Exofield, but they were observed with MOST. A few spectra of HD 50870 were also taken to verify the binarity of this  $\delta$  Sct star. Table 1 reports the logs of both runs. As usual, the exposure times were

modified by the observer accordingly to the weather conditions (clouds, poor seeing, ...).

The SNRs listed in Table 1 are those estimated by the HARPS pipeline at 5500 Å. The smallest SNR values are those of the spectra at the greatest airmasses.

The setup of the HARPS instrument is summarized in the Appendix of the first report of the LP182.D-0356 (Poretti et al., March 2009). **We just remind that we are currently using HARPS both in the HAM (high-resolution,  $R=115,000$ ) and in the EGGs mode (high-efficiency,  $R=80,000$ ). Calibrations must be run in both modes during daytime. Do not take care of a message error during the EGGs calibrations. It is due to the fact that one optical fiber is damaged.**

As a tip for future observers, the value in the “Target Radial Velocity” keyword has to be set with particular care. It must be set to “99999” for hot stars, so that the pipeline will not calculate the radial velocity value (it crashes due to the too few lines). It must be set to “-99999” for cool stars. Note that decimal figures are not admitted anymore.

### 2.1. Saving the log of the night and the RV measurements

At the end of night it is **mandatory** to save two log-files, i.e., the log of all spectra (spectra\_harps) and the list of the radial velocities measured by the pipeline (rv\_harps).

To do it, digit

```
cd /diska/home/harusr
```

in the pipeline computer (whaldrs2). It is advisable to create a subdirectory with your name:

```
mkdir yourname
```

```
cd yourname
```

then digit the two commands:

```
list_spectra_harps /data/reduced/yyyy-mm-dd > yyyy-mm-dd_log.vdb
list_rv_harps      /data/reduced/yyyy-mm-dd      >
yyyy.mm.dd.rv.vdb
```

After that, you can ftp or copy the two text files everywhere you like.

### 2.2. Saving the data

**Following the new ESO procedures about the backup and storage of the data, it is also mandatory to save the raw and reduced spectra.** To do so, open a window in the whaldrs2 computer, by clicking with the left button of the mouse outside any window in the screen of the HARPS pipeline: a small window will then appear. Click with the left button of the mouse on **harusr** on whaldrs2 and the window of the desired computer will appear. The raw and reduced spectra are in

```
/data/raw/yyyy-mm-dd
```

```
/data/reduced/yyyy-mm-dd
```

**Copy them on your directory (see above) and then ftp on your own computer. You can also ask to the daytime telescope operator to plug your hard disk directly to the computer and automatically download the raw and reduced spectra after the end of every night. In this case, you should take care of the following advices:**

- your hard disk should be formatted as ext2;
- be careful to check that alla the data have been transferred before leaving La Silla. Because of new policy the data are kept on the LaSilla computer only for a short time before being cancelled.

### 2.3. Length of the nights

The nights were about  $8^h30^m$  long. At the declination value of the CoRoT fields ( $-4^\circ$ ), the HARPS observations could be performed from  $-4^h15^m$  to  $+4^h15^m$ . At these extreme hour angles the airmass is 2.8, i.e., the critical telescope pointing limit. HD 34816 was observed at the beginning of the night (both in HAM and EGGs modes) to better define the blaze function (exposure times 200 and 100 sec, respectively, giving a SNR around 300).

The

night of 19-20 December started at UT  $00^h40^m \equiv$  ST  $01^h45^m$  and ended at UT  $08^h50^m \equiv$  ST  $09^h57^m$ . The night of January 8-9 started at UT  $00^h32^m \equiv$  ST  $02^h57^m$  and ended at UT  $09^h03^m \equiv$  ST  $11^h29^m$ .

### 2.4. Weather statistics and technical problems

For the first time we had some bad weather in the December run. One night was fully lost (23-24 December), two half nights were partially lost (24-25 and 26-27 December). We also had some technical problems (HAM guide) on the nights of 17-18 and 21-22 December). In the second run we lost  $1^h10^m$  for bad weather on the night of 9-10 January and still guiding problems on the nights of 10-11 ( $10^m$ ) and 11-12 ( $20^m$ ) January. **Therefore, we could use the 74% of the awarded time.**

## 3. Backup and filling programs

Sunsets and sunrises bracketed almost perfectly the CoRoT observations in the December nights. Therefore, a very limited filling program was used. A few spectra (EGGS mode) of  $\delta$  Sct stars RX Cae, V435 Car, AA Col, EQ Eri, HV Eri, XZ Men, AK Men, V1247 Ori, V1359 Ori, YY Pic, UZ Ret, and TX Ret (P.I. E. Poretti) were taken at the beginning of the nights of the 10-d run. In the 5-d run some series of spectra (HAM mode) of the bright ( $V=4.66$ ) subgiant HD 110014 were taken at the end of four nights (16, 19, 18, 21, and 24 spectra, respectively).

The backup programme (intensive monitoring of SX Phe and AI Vel) was not used. We remind that both backup and filling programs have to be submitted by the PI 10 days before the observations and then approved by the ESO staff.

## 4. Status of publications

Table 2 list the papers based on spectroscopic observations of the CoRoT targets. New papers with respect to the previous report are highlighted in red. After publication of the results in a refereed journal, the reduced spectra have been made available to the community through the ESO archive (ESO rule for Large Programmes). Table 3 lists the stars observed in our Large Programmes, the status of the analyses of the spectroscopic timeseries, and the new attributions as well.

The current policy about co-autorship is to include the PIs of the Large Programmes (i.e., P. Amado, P. Mathias, E. Poretti), the observers of the specific star and, if the ESO data are used, M. Rainer, who reduced the ESO spectra for the whole team. The contribution of other instruments (HERCULES, FIES, HERMES, NARVAL, FRESCO,...) should be evaluated case by case. I suggest that in the second round of papers at least one of the scientists in the ground-based activities will be included in the first positions, to reward the great

**Table 1.** Log of the observing runs (December 2011 and January 2012) at ESO with the HARPS@3.6m instrument. The number of spectra and the SNR range (values obtained from the pipeline at the telescope) are indicated for every star on each night. Spectra with low SNR have not been counted.

Night	HD 45975 V=7.5	HD 45418 V=6.5	HD 45546 V=5.0	HD 45398 V=6.9	Be stars	Other CoRoT targets	Seeing
Exp. Time (Default)	900 sec	400 sec	100 sec	400 sec HAM			
December 17-18	6 [240-311]	6 [261-321]	6 [240-300]	6 [160-207]	HD43913: 1 HD49585: 1	V589 Mon, HD50870, HD50230, HD 45517, HD48784, HD49429, HD48977	0".5 – 1".0
December 18-19	8 [240-314]	8 [273-363]	9 [252-363]	8 [144-202]	HD43913: 1 HD49585: 1	V588 Mon	0".5 – 0".8
December 19-20	8 [271-342]	10 [273-334]	11 [276-322]	8 [151-187]	HD43913: 2 HD49585: 1	HD49566	0".5 – 0".6
December 20-21	8 [249-302]	10 [261-322]	11 [258-321]	9 [141-200]	HD43913: 2 HD45985: 1	HD48752	0".6 – 0".8
December 21-22	7 [205-280]	9 [226-310]	11 [168-304]	8 [127-167]	HD43913: 1 HD45985: 1	HD49385	0".8 – 1".2
December 22-23	7 [157-306]	9 [206-340]	10 [144-351]	9 [57-204]	HD43913: 2 HD45985: 2		0".6 – 1".5
December 23-24	Clouds						
December 24-25	2 [249-286]	4 [263-413]	5 [125-278]	4 [106-163]	HD43913: 0 HD45985: 0	HD50870	0".7 – 1".3
December 25-26	6 [230-303]	8 [226-296]	10 [164-295]	8 [121-209]	HD43913: 1 HD45985: 1	V588 Mon, V589 Mon	0".8 – 1".0
December 26-27	2 [230-297]	7 [287-317]	7 [237-366]	5 [128-196]	HD43913: 1 HD45985: 1	HD49608	0".7 – 0".9
January 7-8	4 [240-270]	14 [220-290]	14 [200-310]	12 [125-160]	HD 43913: 2 HD45985: 2	V589 Mon	< 1".0
January 8-9	5 [190-255]	12 [180-250]	12 [140-265]	8 [125-180]	HD 43913: 2 HD45985: 1		0".7 – 0".9
January 9-10	7 [210-270]	8 [225-290]	8 [215-270]	7 [115-187]	HD 43913: 1 HD45985: 1	HD 50230	0".7 – 0".9
January 10-11	5 [260-280]	11 [250-280]	11 [230-260]	11 [150-180]	HD 43913: 2 HD45985: 2	V588 Mon, RR17	0".7 – 0".9
January 11-12	–	20 [245-275]	16 [230-275]	1 [114]	HD 43913: 2 HD45985: 2	HD 50870, RR17	0".6 – 1".6
<b>Total ESO</b>	<b>75</b>	<b>136</b>	<b>141</b>	<b>104</b>			

and long effort made to support CoRoT photometry with high-resolution spectroscopy.

**Table 2.** Papers based on the ground-based complementary observations. New entries are in red.

Star	CoRoT run – ESO LP	Papers
HD 49434	LRa01 - LP 178.D-0361	Uytterhoeven et al. 2008, A&A, 489, 1213
HD 50747, HD 51106	IR01 - LP 178.D-0361	Dolez et al. 2009, A&A, 506, 159
HD 50844	IR01 - LP 178.D-0361	Poretti et al. 2009, A&A, 506, 85
HD 50846	IR01 - LP 178.D-0361	Desmet et al. 2010, MNRAS, 401, 418
HD 181231	LRc01 - LP 178.D-0361	Neiner et al. 2009, A&A, 506, 143
HD 180642	LRc01 - LP 178.D-0361	Briquet et al. 2009, A&A, 506, 269
HD 50209	LRa01 - LP 178.D-0361	Diago et al. 2009, A&A, 506, 125
HD 49330	LRa01 - LP 178.D-0361	Floquet et al. 2009, A&A, 506, 103
HD 46149	SRa02 - LP 182.D-0356	Degroote et al. 2010, A&A, 519, A38
HD 49434 - Paper II	LRa01 - LP 178.D-0361	Chapellier et al. 2010, A&A, 2011, 525, A23
HD 51756	LRa02 - LP 182.D-0356	Papics et al., 2011, A&A, 528, A123
CoRoT 101155310	LRc01 - LP 182.D-0356	Poretti et al. 2011, A&A, 528, A147
HD 50870	LRa02 - LP 182.D-0356, LP 185.D-0056	Mantegazza et al. 2012, A&A, 542, A24
HD 43317	LRa03, LRa02 - LP 182.D-0356	Papics et al. 2012, A&A, in press
HD 50230	LRa01 - LP 182.D-0356	Degroote et al. 2012, A&A, in press

**Table 3.** Targets observed in the framework of the ESO ground-based complementary observations. New entries are in red. The responsables of the analysis of the spectroscopic data are also listed.

Star	CoRoT run – ESO LP	Investigators Spectroscopic data	Papers
<i>Papers in preparation</i>			
HD 169392AB	LRc03 - LP 185.D-0056	H. Bruntt	Mathur et al.
HD 51452	LRa02 - LP 182.D-0356	M. Floquet	Neiner et al.
HD 181555	LRc01 - LP 178.D-0361		Michel et al.
HD 171586	LRc02 - LP 178.D-0361	T. Luftinger	Luftinger et al.
HD 172189 - Paper III	LRc02 - LP 178.D-0361	S. Martín	Martín et al.
HD 51193	LRa02 - LP 182.D-0356	J. Gutierrez-Soto	
HD 174966	SRc01 - LP 182.D-0356		Garcia-Hernandez et al.
<i>Analyses in progress - Line profile variations</i>			
HD 49434 - Paper III	LRa01 - LP 178.D-0361	K. Uytterhoeven	Uytterhoeven et al.
HD 171834	LRc02 - LP 178.D-0361, LP 182.D-0356	K. Uytterhoeven	
HD 174532	SRc02 - LP 182.D-0356		Fox et al.
HD 170580	LRc05 - LP 182.D-0356, LP185.D-0056	A. Thoul	
HD 44195	LRa03 - LP 182.D-0356	E. Poretti	Poretti et al.
HD 170699	LRc05, LRc06 - LP 185.D-0056		
HD 170973	LRc05, LRc06 - LP 185.D-0056	Th. Luftinger	
HD 170783	LRc05, LRc06 - LP 185.D-0056	M. Briquet	
HD 171219	LRc05 - LP 185.D-0056	Janot-Pacheco et al.	
HD 41641	LRa05 - LP 185.D-0056		
HD 43285	LRa04 - LP 185.D-0056	E. Alecian	
HD 43338	LRa04 - LP 185.D-0056	Ph. Mathias	
HD 42597	LRa05 - LP 185.D-0056	P. Degroote	
HD 170031, HD 170231	LRc07, LRc08 - LP 185.D-0056	T. Morel, E. Poretti (RV)	
HD170053	LRc07, LRc08 - LP 185.D-0056	T. Morel, E. Poretti (RV)	
HD 170200	LRc07, LRc08 - LP 185.D-0056	P. Degroote	
HD 45975	SRa04 - LP 185.D-0056	T. Morel	Alecian et al.
HD 45418	SRa04 - LP 185.D-0056	M. Briquet	
HD 45546	SRa04 - LP 185.D-0056	J. Telting	
HD 45398	SRa04 - LP 185.D-0056	E. Poretti (RV)	
HD 43913	LRa03 - LP 185.D-0056	C. Neiner	Neiner et al.
HD 49585	LRa06 - LP 185.D-0056	C. Neiner	Neiner et al.
<i>Analyses in progress - Binarity and/or physical parameters</i>			
HD 51844, HD 49310	LRa02, SRa01 - LP 182.D-0356	M. Hareter	
Red giants	All LPs, not still observed by CoRoT	T. Morel	
GSC00144-03031	LRa04 - LP 185.D-0056	E. Poretti	Poretti et al.
HD 50890	IRa01 - LP 185.D-0056	Th. Morel	Barban et al.
HD 49566	SRa01 - LP 185.D-0056	Th. Morel	Hekker et al.
HD 43587	LRa03 - LP 185.D-0056	P. Boumier	Boumier et al.
HD 42299	LRa04 - LP 185.D-0056		
HD 42787	LRa04 - LP 185.D-0056	H. Bruntt	
HD 42089	LRa05 - LP 185.D-0056	H. Bruntt	
HD 42618	LRa04, LRa05 - LP 185.D-0056		Barban et al.
HD 170174	LRc07, LRc08 - LP 185.D-0056	T. Morel	
HD 172046	LRc02 - LP 185.D-0056	P. De Cat	
HD 169556	LRc03 - LP 185.D-0056	H. Bruntt	Verner et al.
V588 Mon, V589 Mon	SRa04 - LP 185.D-0056	K. Zwintz	Zwintz et al.
HD 45517	SRa04 - LP 185.D-0056		
HD 48752	SRa05 - LP 185.D-0056	P. De Cat	
HD 48977	SRa05 - LP 185.D-0056	A. Thoul	