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

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Seismology Ground-Based Observation Working Group

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EXECUTIVE SUMMARY.

The ESO Large Programme 185.D-0056 (HARPS@3.6m) continued with the second run. The log of the observations performed in December 2010 and January 2011, a tip on the preparation of the Observing Blocks, and the situation of the publications are given. The following actions/items are emphasized:

1. All the 15 nights were characterized by excellent weather. The targets related to the CoRoT runs LRa04 and LRa05 were observed. The observations in both runs were secured by Monica Rainer. The survey of the CoRoT field was performed exactly how expected;
2. Long timeseries are available for LPV analysis on the δ Sct star HD 41641, on the suspected γ Dor variable HD 43338, and on the Be star HD 43285. Other stars have been observed less frequently, but always as requested by the respective PIs;
3. Spectroscopic observations were also performed at OHP (HD 41641, HD 43285, and HD 43338) and at Mercator telescope (HD 42597);
4. The spectra have been fully reduced and distributed to the respective PIs.

1. Introduction

The ground-based spectroscopic monitoring of the CoRoT targets continued in December 2010 and January 2011. Three sites were involved: European Southern Observatory (La Silla, Chile; HARPS@3.6m), Observatoire de Haute Provence (France; SOPHIE@1.9m), and Mercator telescope (Canary Islands; HERMES@MERCATOR).

As in the previous cases, the goals of this ninth (the fifth 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 23 to July 3, 2011 and from July 15 to 20, 2011. Luciano Mantegazza (INAF-OA Brera) and Markus

Hareter (Vienna University) will be the observers. Spectroscopic observations are also scheduled with SOPHIE@OHP from May 27 to June 8 and from June 20 to July 1 (P.I. P. Mathias).

2. Status of publications

Table 1 lists the stars observed in our Large Programmes, the status of the analyses of the spectroscopic timeseries, and the new attributions as well. 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).

The current policy about co-authorship 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 and long effort made to support CoRoT photometry with high-resolution spectroscopy.**

3. The ESO observations

The observer was Monica Rainer (INAF-Brera Observatory) for both runs, i.e., from December 22, 2010 to January 1, 2011 and from January 7 to 12, 2011. She stayed in Chile between the two runs, after a troublesome agreement with ESO. During her stay, a strong earthquake (grade 7 of the Richter scale) occurred in Chile on January 3.

The ESO observations performed in December 2010 were related to the LRa04 and LRa05 fields. The usual 160-d long run was split into two runs of 80 d. The solar-like variable HD 42618 (6.84; G4) was the only target observed in both runs.

The other four stars observed in the seismo field of LRa04 were: HD 43338 (7.63, F0; suspected γ Dor), GSC00144-03031

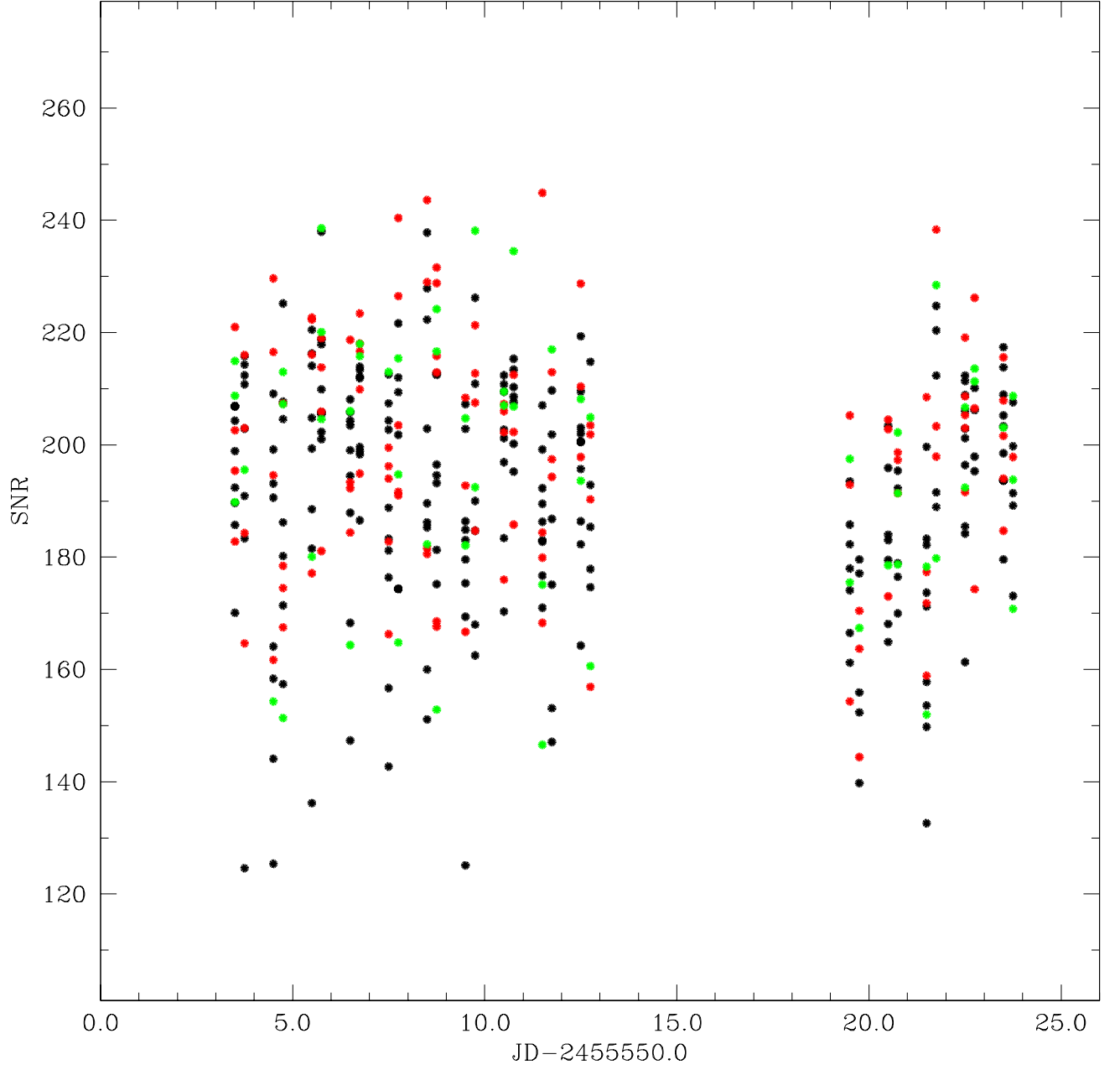


Fig. 1. SNR values of the HARPS spectra. Black filled circles: HD 41641; red filled circles: HD 43285; green filled circles: HD 43338.

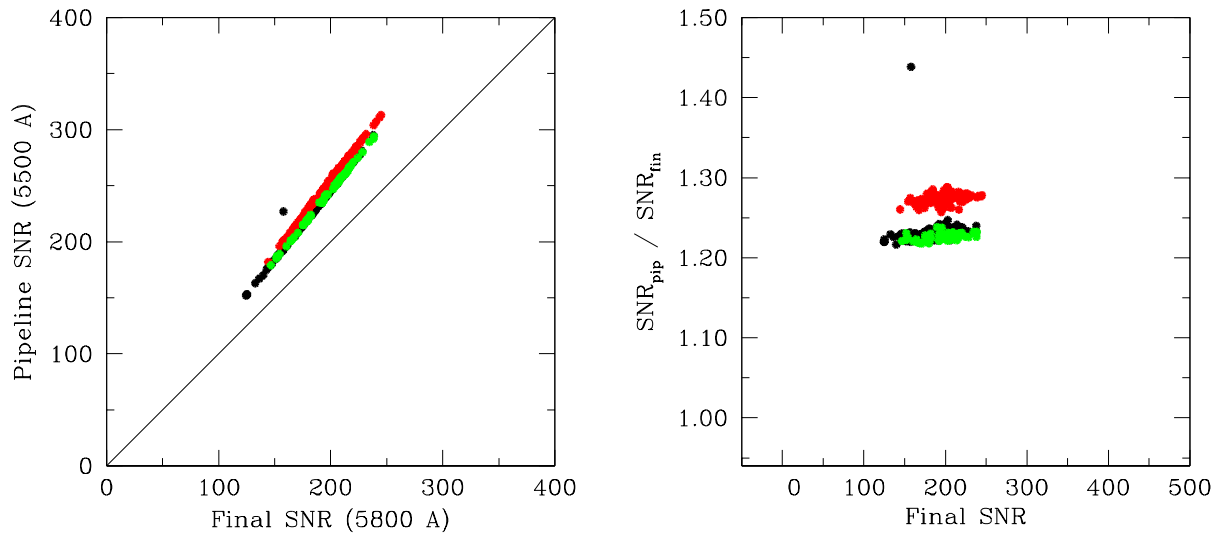


Fig. 2. Differences between on-line and calculated SNR values. *Left:* the values sorted by the HARPS lines (at 5500 Å) vs. the values calculated on the reduced spectra (at 5800 Å). *Right:* the ratio between the two SNR values vs. the SNR. Black filled circles: HD 41641; red filled circles: HD 43285; green filled circles: HD 43338.

Table 1. Targets observed in the framework of the ESO ground-based complementary observations. The responsables of the analysis of the spectroscopic data are also listed.

Star	CoRoT run – ESO LP	Investigators Spectroscopic data	Papers
<i>Published results*</i>			
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	
<i>Papers in preparation</i>			
HD 181555	LRc01 - LP 178.D-0361	L. Mantegazza	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 50870	LRa02 - LP 182.D-0356, LP 185.D-0056	L. Mantegazza	Mantegazza et al.
HD 51193	LRa02 - LP 182.D-0356	J. Gutierrez-Soto	
HD 174966	SRc01 - LP 182.D-0356	L. Mantegazza	Garcia-Hernandez et al.
<i>Analyses in progress</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 51452	LRa02 - LP 182.D-0356	M. Floquet	
HD 174532	SRc02 - LP 182.D-0356	L. Mantegazza	Fox et al.
HD 170580	LRc05 - LP 182.D-0356, LP 185.D-0056	A. Thoul	
HD 44195	LRa03 - LP 182.D-0356	E. Poretti	
HD 43317	LRa03, LRa02 - LP 182.D-0356	P. Papics	
HD 51844, HD 49310	LRa02, SRa01 - LP 182.D-0356	M. Hareter	
Red giants	All LPs, not still observed by CoRoT	T. Morel	
HD 170699	LRc05, LRc06 - LP 185.D-0056	L. Mantegazza	
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	C. Neiner	
HD 41641	LRa05 - LP 185.D-0056	L. Mantegazza	
HD 43285	LRa04 - LP 185.D-0056	C. Neiner	
HD 43338	LRa04 - LP 185.D-0056	Ph. Mathias	
GSC00144-03031	LRa04 - LP 185.D-0056	E. Poretti	
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 42597	LRa05 - LP 185.D-0056	P. Degroote	
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		

* Reduced spectra available in the ESO archive.

(10.2, F0; HADS), HD 43285 (6.05, Be), and HD 42787 $\equiv$ V1389 Ori (6.48, M2III; semiregular variable).

The other four stars observed in the seismo field of LRA05 were: HD 41641 (7.86, A5, a δ Sct star discovered in the preparatory work), HD 42597 (7.05, B1V), HD 42089 (6.65, G0V), and HD 42299 (7.64, A3).

All these stars were observed with HARPS. We also monitored other stars belonging to previous CoRoT Runs: the solar-like star HD 43587 (5.70, G0V, LRA03), the red-giants HD 50890 (6.06, G6 III, IRA01) and HD 49566 (7.71, G5, SRA01), and the δ Sct star HD 50870 (8.88, F0, LRA02, a good target for the end-of-night).

HD 41641 and HD 43285 were monitored intensively and the observations of the other CoRoT targets were secured by the “slot” in the observing sequence

HD 41641 - HD 43285 - HD 41641 - slot - ...
...

Exposure times have been set to 1200 sec for HD 41641 and to 300 sec for HD 43285. However, these exposure times were modified by the observer accordingly to the weather conditions (clouds, poor seeing, ...). Table 2 reports the logs of both runs.

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 the instrument must be set in the EGGs mode (i.e., lower resolution mode), corresponding to $R=80,000$, as measured on the spectra we obtained. **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.**

3.1. Length of the nights

The nights were about 8^h50^m long. At the declination value of the CoRoT fields ($+6^\circ$), the HARPS observations could be performed from -4^h05^m to $+4^h05^m$. At these extreme hour angles the airmass is 2.8, i.e., the critical telescope pointing limit. The CoRoT fields LRA04 and LRA05 could be observed for 8^h00^m , but targets of other runs (HD 50870 and HD 50890) could be observed a bit longer. HD 34816 was observed at the beginning of the night to better define the blaze function (exposure time 100 sec, SNR around 300).

The night of 22-23 December started at UT $00^h12^m \equiv$ ST 02^h01^m and ended at UT $09^h09^m \equiv$ ST 10^h33^m . The night of January 11-12 started at UT $00^h10^m \equiv$ ST 02^h52^m and ended at UT $09^h16^m \equiv$ ST 11^h59^m .

3.2. Weather statistics and technical problems

We had no interruption of the observations due to bad weather. Minor technical problems occurred: the observer lost 2^h30^m for guiding and pointing problems, mostly at the beginning of three nights in the second run. **Therefore, we could use the 98% of the awarded time.**

3.3. Signal-to-noise ratio evaluation

The SNRs listed in Table 2 are the median values of the SNRs in the region 5802–5825 Å. They have been computed during our reduction taking into account photon noise, readout noise and flat field correction. The smallest SNR values are those of the spectra at the greatest airmasses. They can be clearly identified in Fig. 1, where the SNR values of the spectra of HD 41641, HD 43285, and HD 43338 are plotted.

At the telescope, the HARPS pipeline provides an estimate of the SNR at three different wavelengths (4500, 5500 and 6500 Å). We still confirm that for our stars (B-A-F spectral types) the SNR values given by the HARPS pipeline at 5500 Å are a little too optimistic when compared with the values we measured at 5800 Å (Fig. 2, left panel). The ratio between the two SNR values is around 1.23 for A-F stars and around 1.28 for B stars (Fig. 2, right panel).

4. 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. In the 10-d run a few spectra of the γ Dor stars HD 41814 and HD 75202 (P.I. P. De Cat) were taken at the beginning of the night. In the 5-d run some series of spectra of the bright HADS variable AI Vel were taken at the end of four nights (25, 26, 25, and 28 spectra, respectively; P.I. E. Poretti).

The backup programme (complementary monitoring of SPB and γ Dor stars; P.I. P. De Cat) 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.

Table 2. Log of the observing runs (December 2010 and January 2011) at ESO with the HARPS@3.6m instrument. The number of spectra and the SNR range (values obtained from the reduced spectra) are indicated for every star on each night. Spectra with low SNR have not been counted.

Night	HD 41641 V=7.9 1200 sec	HD 43285 V=6.0 300 sec	HD 43338 V=7.6 900 sec	Other CoRoT targets	Seeing
Exp. Time (Default)					
December 22-23	16 [125-215]	8 [164-221]	4 [190-209]	HD 42299, HD42597, HD 50890	<1''0
December 23-24	15 [125-210]	8 [141-230]	4 [151-213]	HD 42299, HD42597, HD 50890, HD 42618	1''7–2''0
December 24-25	16 [136-238]	8 [177-222]	4 [180-238]	HD 42299, HD42597, GSC00144-03031, HD 50870	<1''0
December 25-26	17 [147-214]	9 [184-223]	4 [164-218]	HD 42299, HD42597, HD 43587, HD 50890	≤1''0
December 26-27	16 [143-222]	10 [166-240]	4 [165-215]	HD 42299, HD42597, HD 42618, HD 50870	0''5–1''8
December 27-28	16 [151-238]	10 [168-244]	4 [153-224]	HD 42299, HD42597, HD 50870	0''8–1''7
December 28-29	15 [125-226]	7 [167-221]	4 [182-238]	HD 42299, HD42597, HD 50870	2''0
December 29-30	15 [170-215]	7 [176-212]	4 [207-234]	HD 42299, HD42597, GSC00144-03031	<1''0
December 30-31	15 [147-210]	7 [168-245]	3 [147-217]	HD 42299, HD42597, HD 43587, HD 50890, HD50870	>1''5
Dec. 31 - Jan 1	15 [164-220]	7 [157-229]	4 [161-208]	HD 42299, HD42597, GSC00144-03031, HD 50870	1''0
January 7-8	12 [140-193]	6 [144-205]	3 [167-197]	HD 42299, HD42597, HD 50870	1''5–2''6
January 8-9	12 [168-203]	6 [173-204]	4 [178-202]	HD 42299, HD42597	0''7–1''9
January 9-10	14 [133-225]	7 [159-238]	4 [152-228]	HD 42299, HD42597, HD 43587	1''4–2''5
January 10-11	14 [161-212]	8 [174-226]	4 [192-214]	HD 42299, HD42597, HD 42618	≤1''0 <1''0
January 11-12	14 [173-217]	6 [185-216]	4 [171-209]	HD 42299, HD42597,	
Total ESO	222	114	58		
Total OHP	57	43	45		
Total MERCATOR				200 spectra of HD 42597	