Report on the third run of the ESO Large Programme

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EXECUTIVE SUMMARY. The ground–based spectroscopic observations complementing the COROT ones have continued in December 2007 and January 2008. The log of the observations, a few preliminary results and a look to the future are given. The following actions/items are emphasized:

1. The FEROS spectroscopic runs on the CoRoT targets of LRa1 have been characterized by very good weather, as in the past runs; also in this occasion the observers made an excellent work. The spectra have been fully reduced. Long timeseries are available for LPV analysis on HD 49434 (γ Dor star) and HD 49330 (Be star);
2. the short nights allowed to perform a limited but satisfactory filling program;
3. it is time to submit a new ESO Proposal. The FEROS instrument is available for Normal Programmes, but not for Large Programmes;
4. the publication rate must speed up after the availability of the space photometric series.

1. Introduction

The ground–based spectroscopic monitoring of the CoRoT targets continued from November 2007 to January 2008. Four sites have been involved: European Southern Observatory (La Silla, Chile; FEROS@2.2m), Observatoire Haute Provence (France; SOPHIE@1.9m), Calar Alto (Spain; FOCES@2.2m), Mt John (New Zealand; HERCULES@1.0m). As in the previous cases, the goals of this third internal report are to circulate useful information about the ESO observations within the team and to keep the record of the observations. We remind you that Anne-Laure Huat (Meudon Observatory) and Pedro Amado & Dario Diaz (IAA Granada) have been the observers for the December (from 18th to 28th) and January (from 9th to 14th) runs with FEROS, respectively.

The main target has been the bright γ Dor variable HD 49434. No other target has been observed at OHP, Calar Alto and Mt. John. On the other hand, the higher performances ensured by the FEROS instrument allowed us to add another target for the ESO observations. Two candidates were available, i.e., the Be stars HD 49330 (V=8.95) and HD 50209 (V=8.36). Since both are faint, a selection was necessary and the Be team preferred HD 49330. We remind that HD 50209 has been observed one year ago at ESO. The photospheric lines of this Be star are polluted by emission lines formed in the circumstellar environment; moreover, the line profile variations are weak.

We also stress that the *Call for Proposals for the ESO Period 82* clearly states that the 2.2m telescope is not offered anymore for Large Programmes. A limited amount of nights is available for Normal Programmes. We quickly have to find new strategies (Large Programme with HARPS ? Normal proposals with FEROS ? ...) to continue our project since proposals have to be submitted before April 1st, 2008.

The next ESO runs are scheduled in the periods 12–22 July and August 2–7, 2008. Owing to scheduling constraints, the allocations of our slots has been problematic. Interested observers are kindly requested to inform E. Poretti. OHP observations are scheduled in the complementary periods 1–11 July and 21–31 July.

2. The spectroscopic data of stars observed in December 2006 and January 2007

The spectra collected at ESO, OHP, and CAHA have been fully reduced (by M. Rainer, P. Mathias and P. Amado, respectively), put in the archive at Merate Observatory and made available upon request to all the CoIs. For each star observed with FEROS we provide both the calibrated and normalized merged spectra.

Table 1 updates the list of the observed targets and the (chair)persons at work on the specific stars.

3. The ESO runs in December 2007 and January 2008

The observations performed at La Silla fully benefitted from very good weather. Observations have been secured by Anne-Laure Huat (from December 18th to 28th) and Pedro Amado & Dario Diaz (from January 9th to 14th). Table 2 summarizes the logs of both runs. The setup was the same as listed in the Appendix of the First Report. We remind that the instrument must be set in the Object+Sky mode, the ADC (Atmospheric

Table 1. Targets observed in the framework of ground–based complemetary observations. The responsible(s) of the analysis of the spectroscopic data are also listed.

Star	Type	Investigators
HD 49434	γ Dor	Mathias and Uytterhoeven
HD 50209	Be	Floquet and Hubert
HD 49330	Be	Hubert
HD 50747	Am, SB2	Dolez
HD 50844	δ Sct	Mantegazza, Rainer and Zima
HD 50846	Be, EB	Fremat and Desmet
HD 51106	Am, SB2	Dolez
HD 292790	F8	Poretti
HD 180642	β Cep	Briquet and Uytterhoeven
HD 181231	Be	Neiner
HD 181555	δ Sct	Mantegazza, Rainer and Zima

Dispersion Corrector) must be enabled, the binning is 1x1 in the fast readout and low gain modes. Overheads for focusing are confirmed to be around 10 min plus pointing. HD 34816 has been used to better define the blaze function.

3.1. Observing cycle

The targets for the ESO observations have been the γ Dor star HD 49434 and the faint Be star HD 49330. The analysis of the previous observations (January 2007) has suggested that also a rapid δ Sct–like variability is excited in HD 49434. Exposure times have been set to 240 sec for the bright HD 49434 and to 1800 sec for the faint HD 49330.

Therefore, we established the following sequence:

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HD 49434 - HD 49434 - HD 49330 - ...
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We estimated that the above sequence lasted 45-min, thus ensuring 10–11 cycles per night. Both observers have been very clever in following the cycle and adapting it to the particular circumstances. In particular, only HD 49434 was observed at the beginning and end of nights, when the airmass was too large to ensure a good S/N for HD 49330. Moreover, due to the poor conditions, only HD 49434 was observed on the night of 26-27 December.

3.2. Length of the nights

The nights of both runs were about 8^h–8^h20^m long, very close to the maximum observing time allotted by the limitations on the telescope pointing, i.e., 8^h40^m. We remind that the observations can be performed from to -4^h20^m to $+4^h20^m$. At these extreme hour angles the airmass of the CoRoT fields is 2.8, i.e., the critical telescope limit. The night of 20-21 December started at UT 00^h39^m≡ST 01^h53^m and ended at UT 08^h57^m≡ST 10^h12^m. The night of 11-12 January started at UT 00^h30^m≡ST 03^h10^m and ended at UT 08^h35^m≡ST 11^h13^m.

3.3. Weather statistics

In total we had 122^h at our disposal to observe the COROT field. Almost one full night (9-10 January) has been lost due to high humidity. Humidity and strong wind also stopped observations in two nights (25-26 and 26-27 December). Moreover, thin clouds disturbed the 18-19 December night and high humidity, but below the limit, the 12-13 and 13-14 January nights.

We lost only 13^h for meteorological reasons; Anne-Laure also note that the Full Moon was very close to the CoRoT field on the Christmas night (24-25 December) and to the blaze star on the next one. Except in the cases of strong wind, during both runs the seeing was generally very good (Table 2).

3.4. Signal–to–noise ratio evaluation

The S/N values listed in Tab. 2 are the median values of the S/N values in the region 5805–5825 Å. They have been computed during the reduction taking into account photon noise, readout noise and flat field correction. These S/N values are 1.0–1.5 times greater than the values evaluated by the observers in the 5750-5760 Å and 4902-4910 Å ranges by using the MIDAS command `@@snr`.

4. Backup and filling programs

The short nights did not give us the possibility to observe other targets (*filling program*) on a fixed basis as we did at the beginning and at the end of the nights of the second run. However, a list of some stars was prepared and P. Amado and D. Diaz could observe the brightest at the end of their nights.

Be stars (P.I. A.M. Hubert) – All the proposed stars have been observed: μ Pic, HD 71510, DR Cha, E Car, f Car, J Vel, ω Car, ρ Car, and V518 Car.

B stars (P.I. M. Briquet) – These stars are fainter than the Be ones and hence only a few could be observed: HD 65074, HD 66053, HD 67531, HD 69824, and HD 73568.

A backup program (in case of continuous strong wind from North only) has also been prepared, but not used.

5. Data reduction, analysis and publication policy

We remind that the proprietary period for the FEROS data collected in January 2007 has expired. The data are now public.

Two papers based on the ground–based observations are in preparation: the first is on the γ Dor star HD 49434 (1st author Katrien Uytterhoeven), the second on the β Cep star HD 180642 (1st author Marilyne Briquet). Both papers will not discuss the CoRoT photometry from space.

At the moment, the following statements are valid for other stars:

HD 50844: a common paper discussing ground-based data (high–resolution spectroscopy and multicolour photometry) and space photometry is planned (responsible: E. Poretti).

HD 181555: a common paper discussing high–resolution spectroscopy and space photometry seems the best solution. This δ Sct star is a fast rotator and the merging of photometric and spectroscopic outputs is probably the only way to model it. The PI of the CoRoT data is Eric Michel.

Table 2. Log of the observing runs (December 2007–January 2008) at ESO with the FEROS@2.2m instrument. The number of spectra and the S/N range are indicated for every star on each night.

Night	HD 49434 V=5.7	HD 49330 V=8.9	Seeing	Notes
Exp. Time	240 sec	1800 sec		
December 18-19	22 [300-650]	9 [180-285]	$\sim 0''.9$	Thin clouds at beginning
December 19-20	22 [370-670]	10 [190-280]	$0''.6$–$1''.0$	First two spectra of HD 49434 low S/N
December 20-21	24 [300-470]	10 [180-275]	$\sim 0''.7$	Bad seeing at end
December 21-22	24 [370-460]	10 [220-290]	$< 1''.0$	Bad seeing at beginning
December 22-23	25 [380-507]	10 [240-295]	$<0''.5$–$1''.1$	
December 23-24	26 [390-435]	10 [200-270]	$<0''.5$–$1''.1$	
December 24-25	26 [375-480]	10 [220-310]	$<0''.5$–$1''.5$	Full Moon close to the field
December 25-26	12 [370-450]	7 [225-280]	$0''.8$–$1''.5$	3.5 h lost due to humidity Full Moon close to the blaze star
December 26-27	45 [100-510]	–	$1''.0$–$2''.0$	1.5 h lost due to humidity
December 27-28	26 [265-475]	10 [195-280]	$0''.7$–$1''.5$	
January 9-10	2 [330-340]	1 [144]		After beginning closed due to high humidity
January 10-11	21 [280-430]	10 [215-245]	$0''.6$–$1''.3$	
January 11-12	21 [270-365]	10 [155-200]	$0''.6$–$2''.0$	
January 12-13	22 [260-330]	10 [165-210]		High humidity, but below the limit
January 13-14	21 [275-380]	10 [170-220]		High humidity, but below the limit
Total	**339**	**127**		