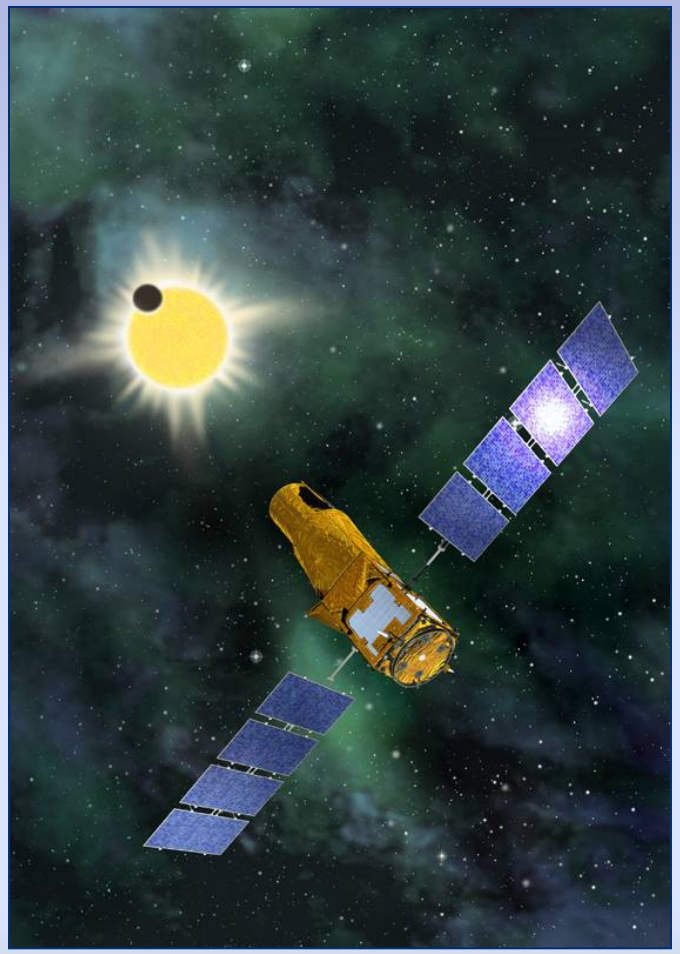
CoRoT ground-based asteroseismological programme

Ennio Poretti, Monica Rainer and the SGBWG

Ground-based spectroscopy



A large ground-based high-resolution spectroscopic campaign is being performed since the launch of the CoRoT satellite (27th December 2006).

High-resolution spectroscopy allows us to **complete** the pulsational scenario disclosed by the photometric CoRoT observations of asteroseismic targets.

Ground-based spectroscopy

P.I. Ennio Poretti	
FEROS@2.2m	ESO-LaSilla
HARPS@3.6m	ESO-LaSilla
P.I. Philippe Mathias	
SOPHIE@1.9m	OHP
P.I. Pedro Amado	
FOCES@2.2m	Calar Alto
P.I. Katrien Uytterhoeven	
FIES@NOT	ORM
P.I. Conny Aerts	
HERMES@MERCATOR	ORM
CORALIE@1.2m	ESO-LaSilla
P.I. Karen Pollard	
HERCULES@1m	Mt. John Obs.

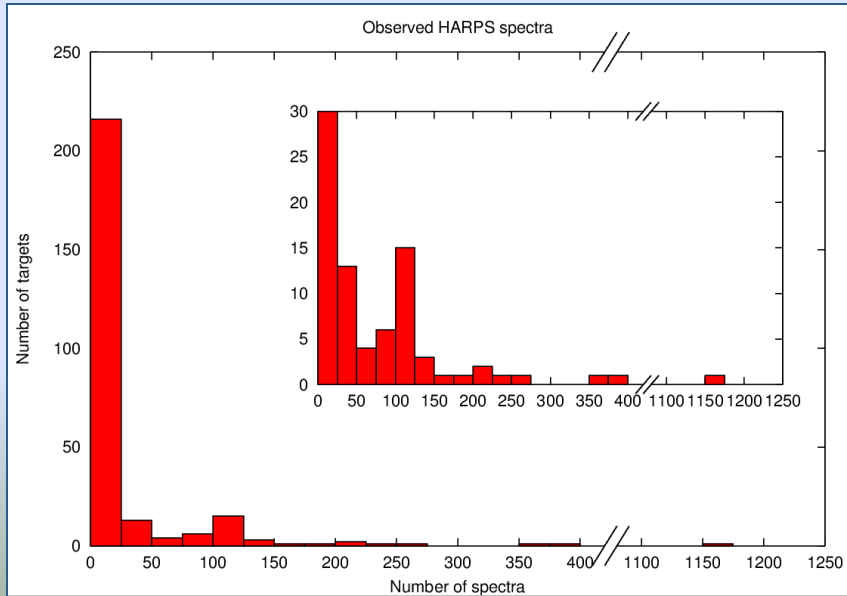
Targets belong to three main groups

- Targets of the seismology field to be intensively monitored to study line-profile variation

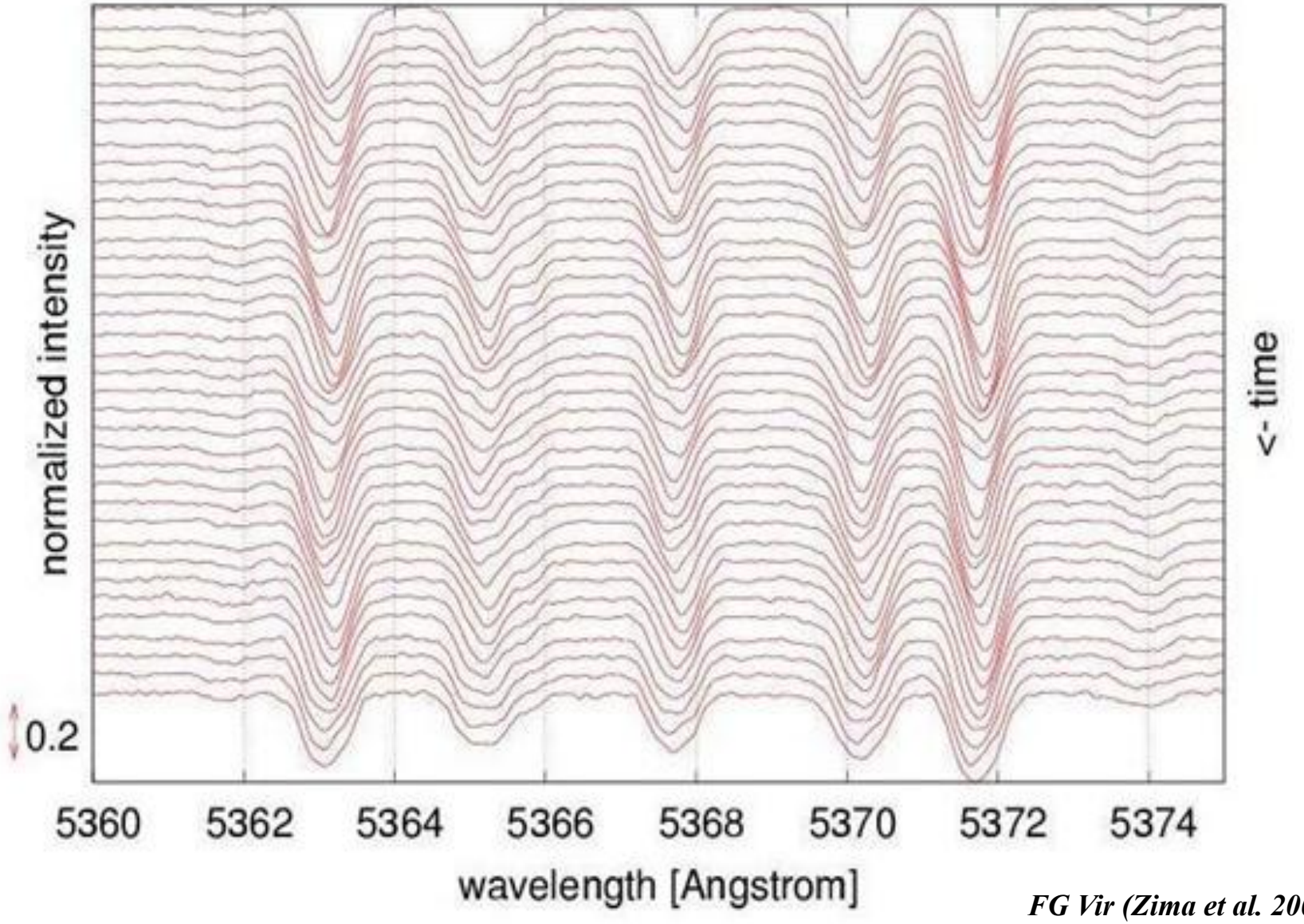
- Targets of the seismology field to be observed a few times to obtain spectra with SNR>200 (abundance analysis, binarity)

- Stars not belonging to the CoRoT field which could give useful information on the the class of the CoRoT variables

  (observed when CoRoT target were not visible)



The spectroscopic complement of the COROT observations

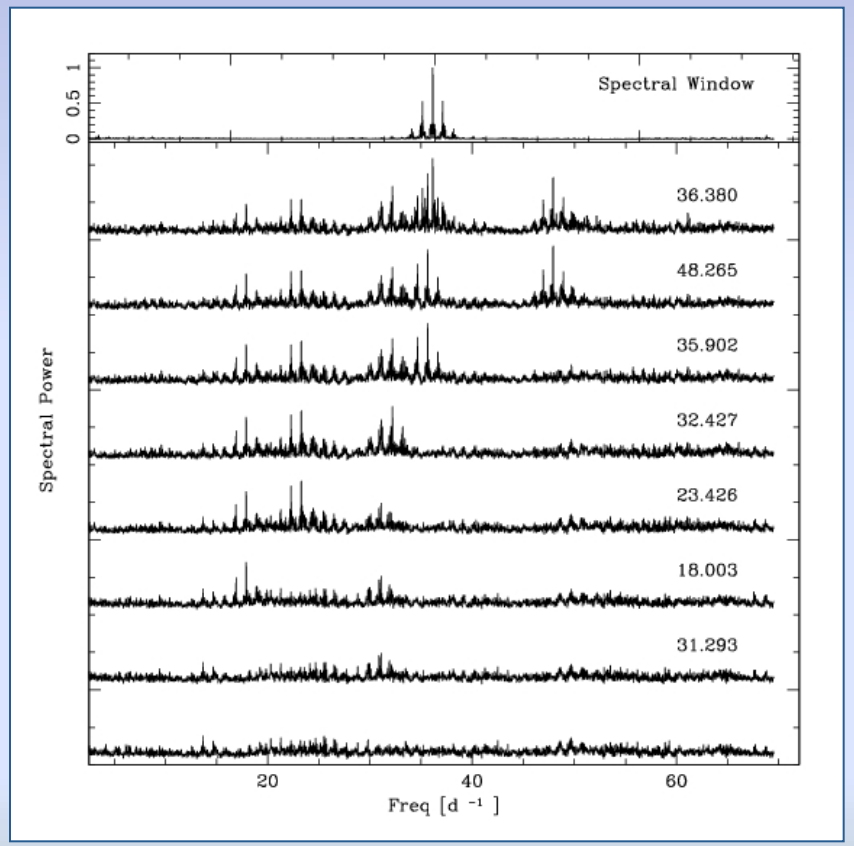


FG Vir (Zima et al. 2006)

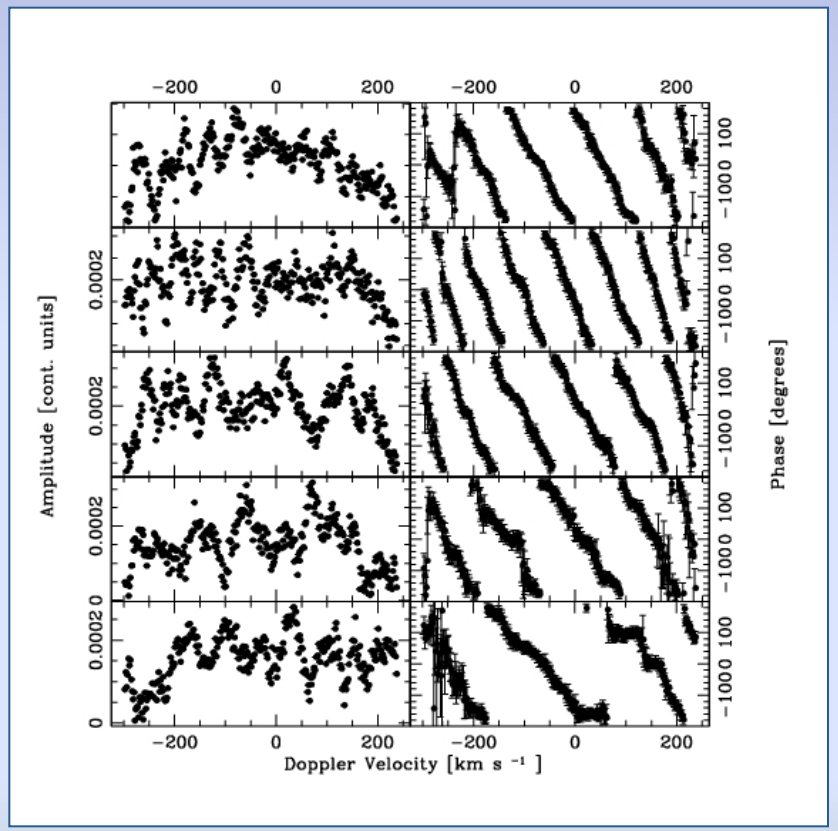
How spectroscopy can help ?

HD 170699, v sin i = 250 km/s, close to break-up velocity, seen equator-on

Power spectra of HARPS data

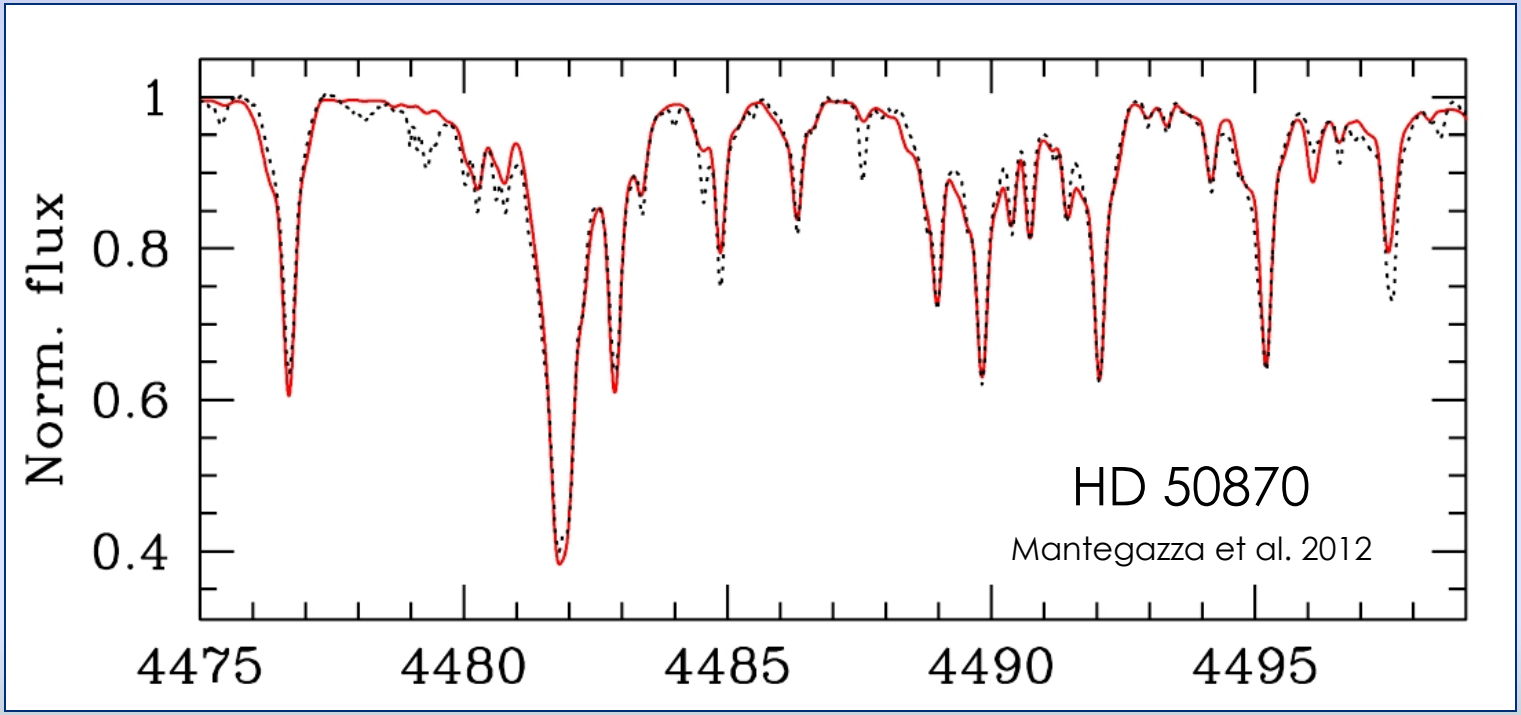


The phase diagrams suggest prograde with different *m*

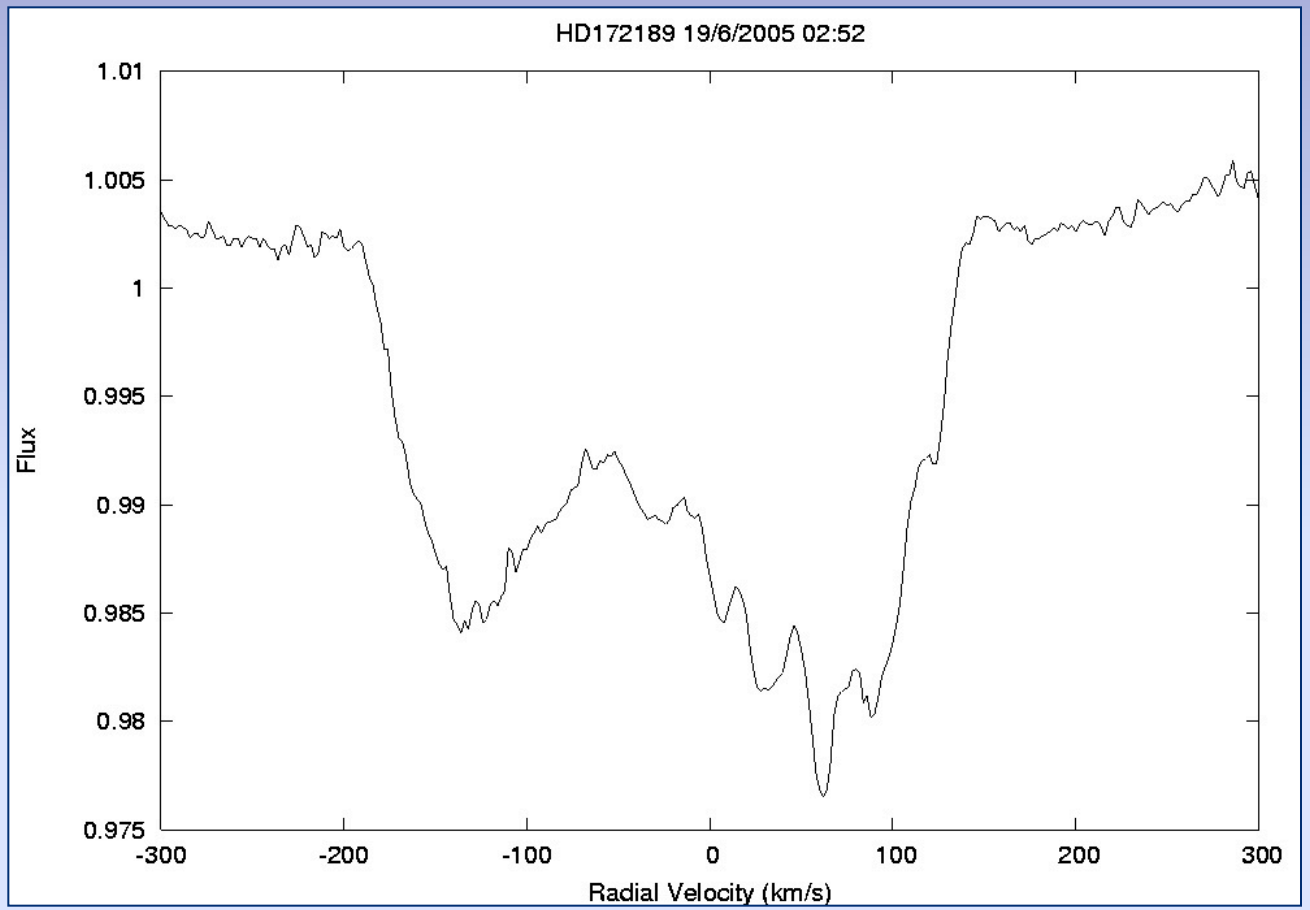


Physical parameters and binarity

The high-resolution spectra are very useful in determining the physical parameters of the targets, in particular concerning binary systems.



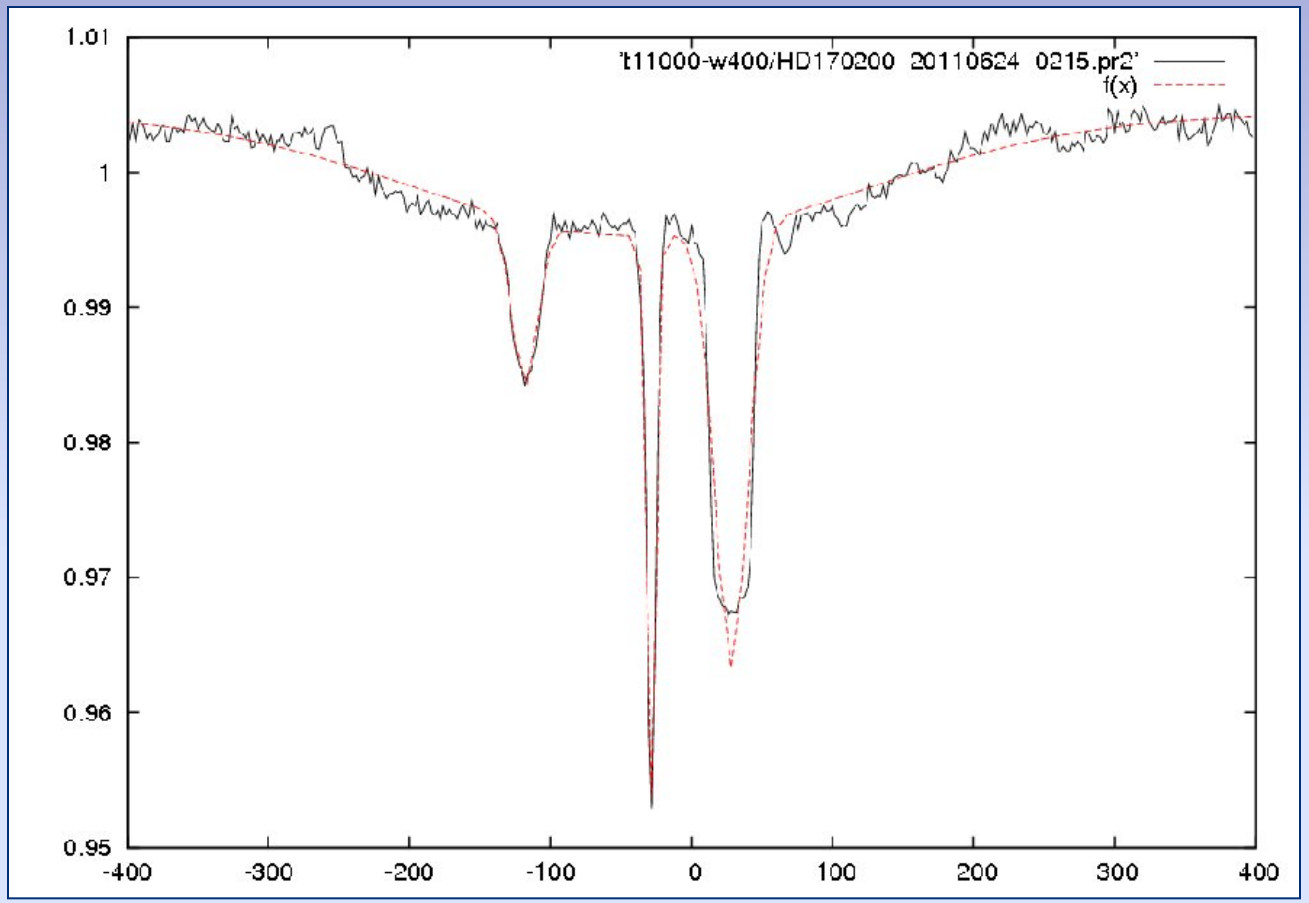
Binary systems



The spectra help to better characterise binary systems with a pulsating component.

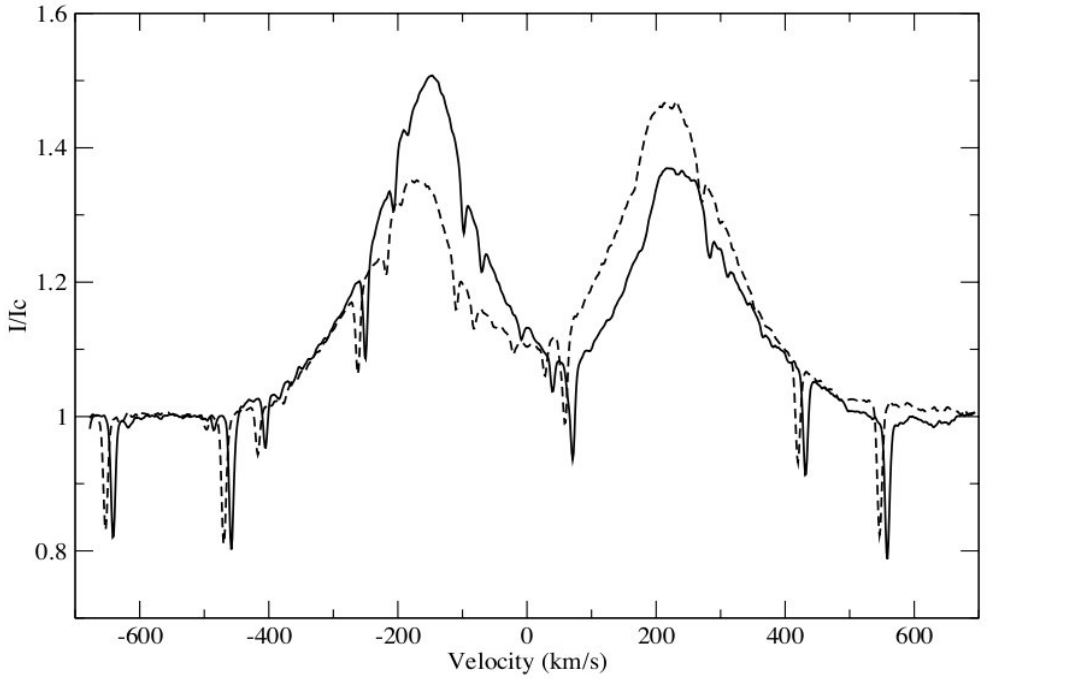
Creevey et al., 2009, A&A 507 901

Multiple systems



Some systems are particularly complex and the spectra are fundamental in computing the orbital parameters.

Be stars



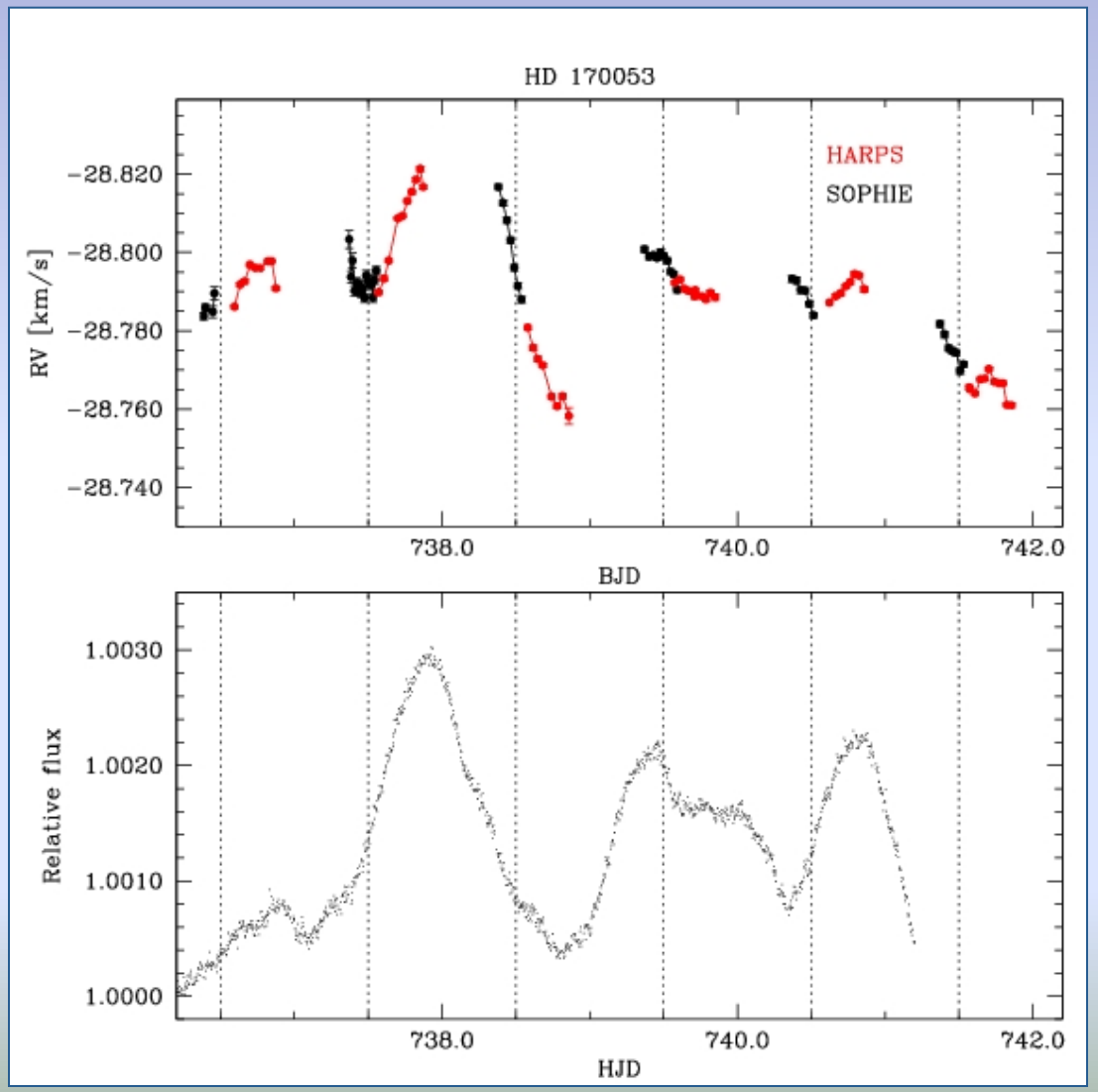
HD 49330 Floquet et al., 2009, A&A 506, 103

In the case of the Be stars, the spectra give information on the structure of the circumstellar disk, allowing to disentangle stellar and circumstellar contributions to the pulsations.

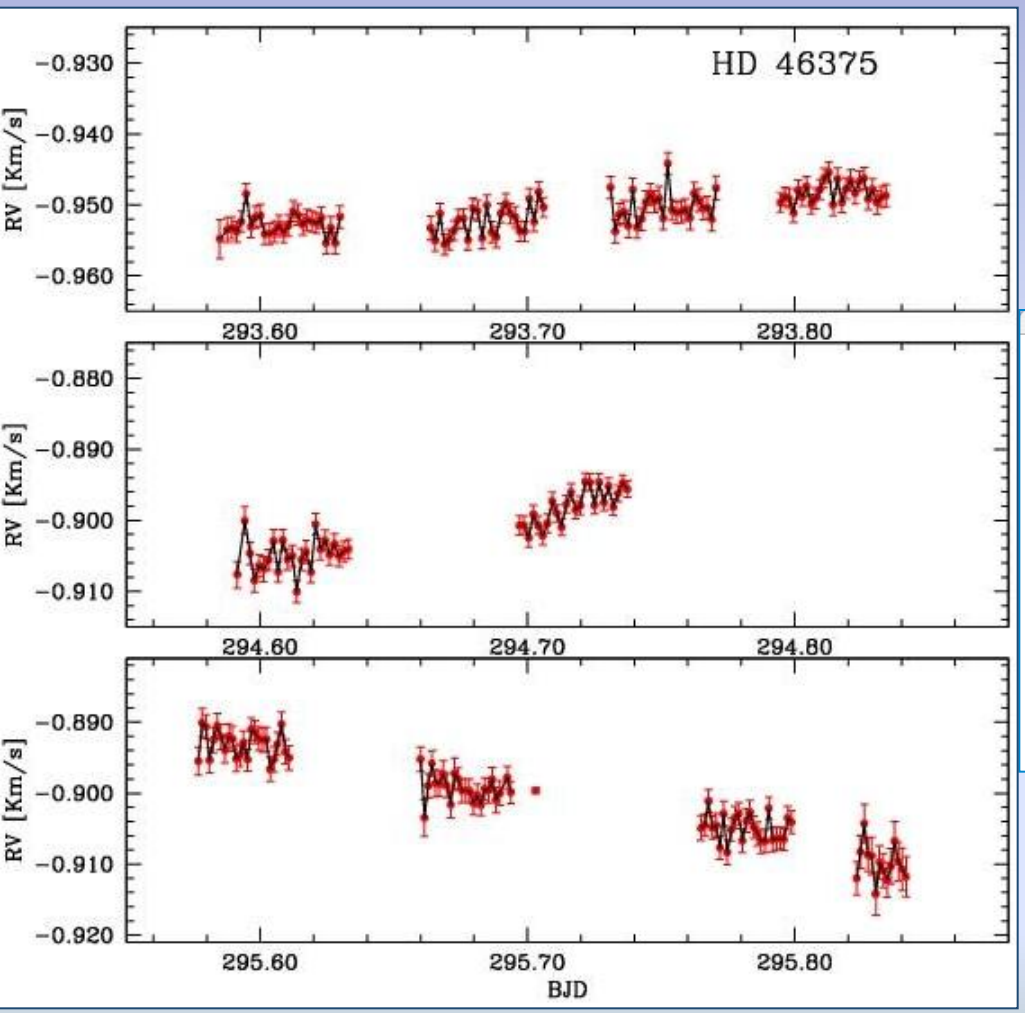
Simultaneous flux and RV curves

HD 170053.

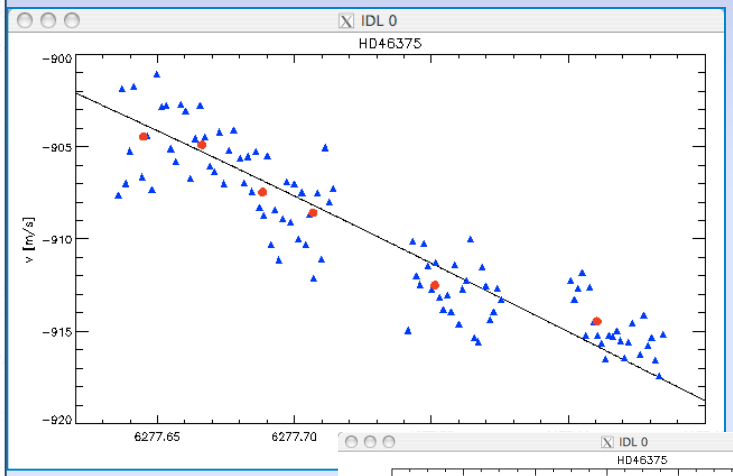
Red giant variable

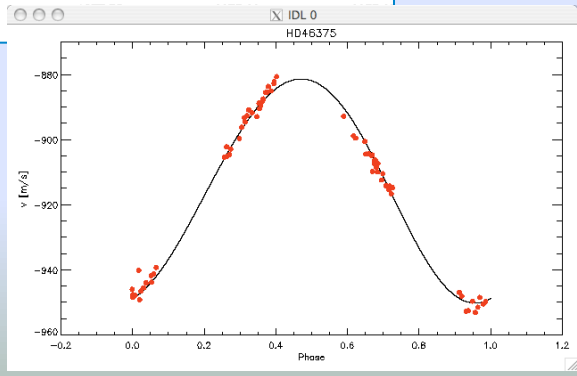


Planetary orbits and asteroseismology

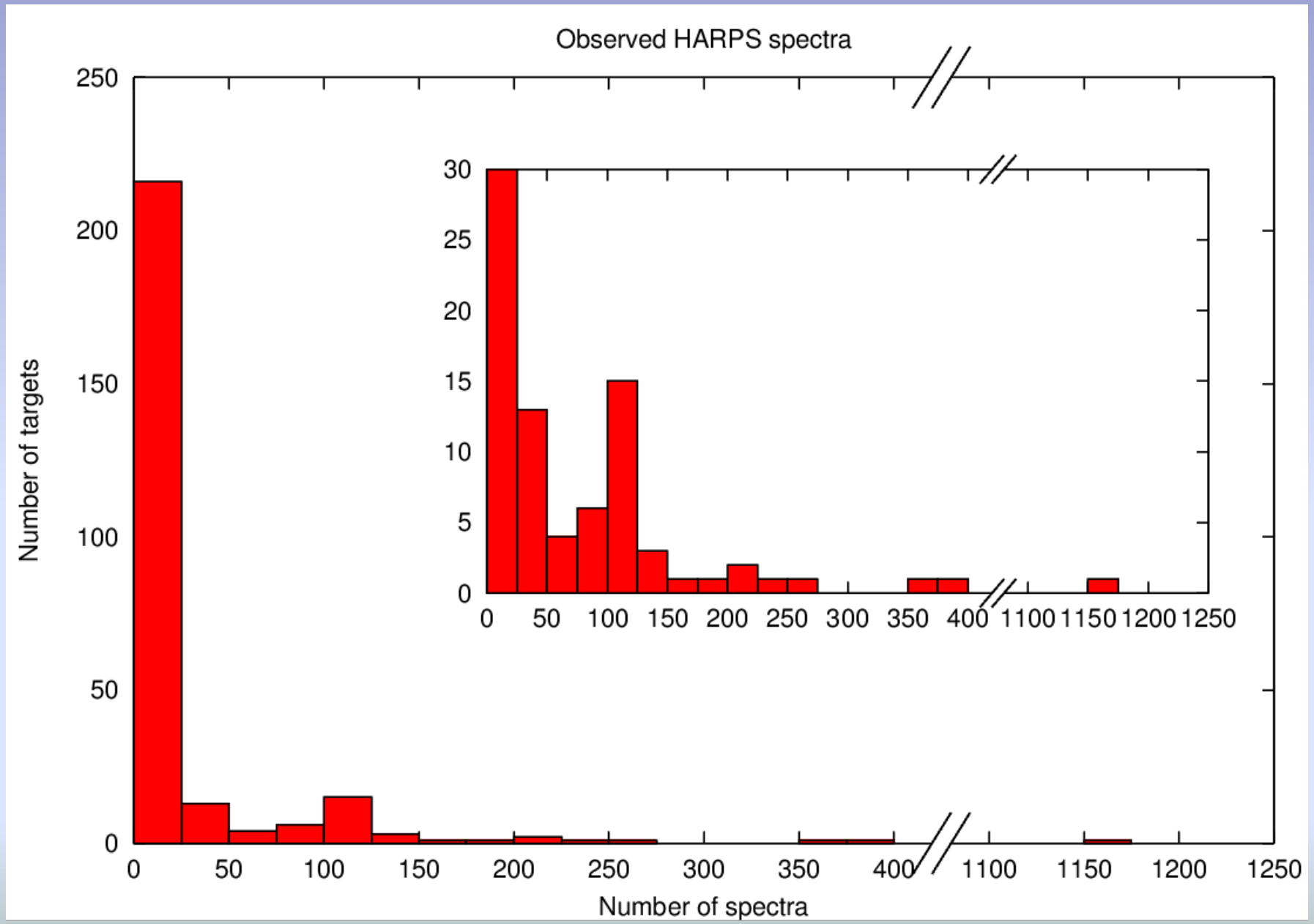


HD 46375.
HARPS@ESO spectra show
both solar-like
oscillations and orbital motion





P_{orb}=3.024 d
2K=70 m/s


Observed HARPS spectra
Number of targets
Number of spectra
0
50
100
150
200
250
300
350
400
1100
1150
1200
1250
0
5
10
15
20
25
30

SPACEINN

COOPERATION THEME 9 "SPACE"
Call 5: FP7-SPACE-2012-1/CP-FP

Proposal full title:

Exploitation of Space Data for Innovative Helio- and Asteroseismology

Proposal acronym:

SPACEINN

Preliminary logo

Type of funding scheme:
Collaborative Project (small or medium-scale focused research project)

Work programme topics addressed:
SPA.2012.2.1-01: Exploitation of space science and exploration data

Name of the coordinating person:

The HARPS data collected will be made available to the whole scientific community in a VO-complaint archive in the framework of the SPACEINN project approved by the European Union (started on January 1, 2013).

The whole CoRoT community will contribute with several archives (WP3, Task responsible E. Michel)

The SPACEINN Consortium

1	Kiepenheuer-Institut für Sonnenphysik, Freiburg, Germany	KIS
2	Instituto de Astrofísica de Canarias, La Laguna, Spain	IAC
3	Commissariat à l'Energie Atomique et aux Energies Alternatives, Saclay, France	CEA
4	Max-Planck Institute for Solar System Research, K.- Lindau, Germany	MPG
5	Istituto Nazionale di Astrofisica, Italy	INAF
6	Katholieke Universiteit Leuven, Instituut voor Sterrenkunde, Belgium	KUL
7	Observatoire de Paris, Meudon, France	OPM
8	Universidade do Porto, Centro de Astrofísica, Porto, Portugal	CAUP
9	University of Birmingham, United Kingdom	UOB
10	Aarhus Universitet, Institut for Fysik og Astronomi, Århus, Denmark	AU
11	Institute Astrophysique Spatial, Orsay, France	IAS
12	Université Paul Sabatier (Toulouse III), France	UPS
13	Instituto de Astrofísica de Andalucía, Granada, Spain	IAA
14	Royal Library Copenhagen, Denmark	KB-DK
15	National Solar Observatory, Tucson, USA	NSO
16	High Altitude Observatory, Boulder, USA	HAO
17	Konkoly Observatory of the Hungarian Academy of Sciences, Hungary	KO

SPACEINN

The HARPS archive, subtask of WP3, will contain:

- the reduced spectra, both with separated orders (normalised and non-normalised) and with the orders merged (normalised).
- star information, such as physical parameters, variable classification, and so on;
- time series information, in order to give an idea of the pulsational content of the time series;
- singular spectrum additional information, (vrad, vsini, ...)

HARPS observations
HARPS+CoRoT publications

PI : INAF-OA Brera, on behalf of the CoRoT Consortium :
Meudon Observatory, Leuven and Liege Universities, Bruxelles Observatory,
Instituto de Astrofisica Andalucia , IA Canarias, Vienna University, IRAP Toulouse, …

LP178.D-0256	FEROS	2.2m	60 nights in 4 semesters (2007-08)
LP182.D-0365	HARPS	3.6m	45 nights in 3 semesters (2009-10)
LP185.D-0056	HARPS	3.6m	90 nights in 6 semesters (2010-13)

30 papers on major peer-reviewed journals starting from 2009 (A&A special issue). Well-stabilized rate: 7.5 papers/year

FINAL GOAL of the HARPS archive : to move from a star-by-star study to systematic, comprehensive studies.