The Stellar Seismic Indices Data Base: D3.7 Report: Opening of the data base

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Abstract

The Stellar Seismic Indices database (hereafter SSI) aims at providing stellar seismic indices of solar-like oscillating stars as well as other stellar indices such as the main characteristics of stellar granulation. These indices are extracted using an automatic method, which is able to derive simultaneously the seismic and granulation parameters. This method was applied to almost all *Kepler* long-cadence light-curves and to almost all CoRoT targets observed in the faint fields. A total of about 320 000 targets have been analyzed, among which seismic indices and granulation parameters have been extracted for about 18 000 redgiants. These indices have fed the SSI database, which is accessible from the SSI website at `http://ssi.lesia.obspm.fr`. An official announcement of the opening of the database was published on the website[1] of the Observatoire de Paris and a wider official announcement was broadcast on 25 November 2016 through the "kascnews" mailing list. This document briefly presents the data base content, its interface, the documents availaible for download for the users as well as some illustrative results.

1 Stellar parameters extraction

The seismic indices and stellar granulation parameters are extracted for red-giant stars by fitting their power density spectrum (PDS) using a semi-empirical model, which is illustrated in Fig. 1. The latter is composed of an activity component (green line), a granulation component (blue line), and an oscillation pattern (red line). More details are provided in de Assis Peralta et al (de Assis Peralta et al. 2016). Subsequently, three seismic indices are extracted from the fitted PDS:

- The peak frequency, $\nu_{\rm max}$: it is defined as the frequency at which the oscillation spectrum maximum peaks in the PDS;
- The mean large separation, $\Delta\nu$: this quantity corresponds to the mean frequency spacing between two consecutive p-modes (with same angular degree). It is derived using the Universal Pattern as proposed by (Mosser et al. 2011) ;
- The height of the oscillation envelope, $H_{\rm env}$.

Together with the seismic indices, two parameters characterizing the stellar granulation background are also extracted from the PDS:

- The "e-folding time", $\tau_{\rm eff}$, which corresponds to the time the granulation signal loose its coherence (e.g. Mathur et al. 2011; Kallinger et al. 2014). This time is also believed to represent the typical granule lifetime ;

[1] `https://www.obspm.fr/la-base-d-indices-sismiques.html?lang=en`

- The variance of the integrated brightness fluctuations, σ^2, which corresponds to the total integrated energy within the granulation background.

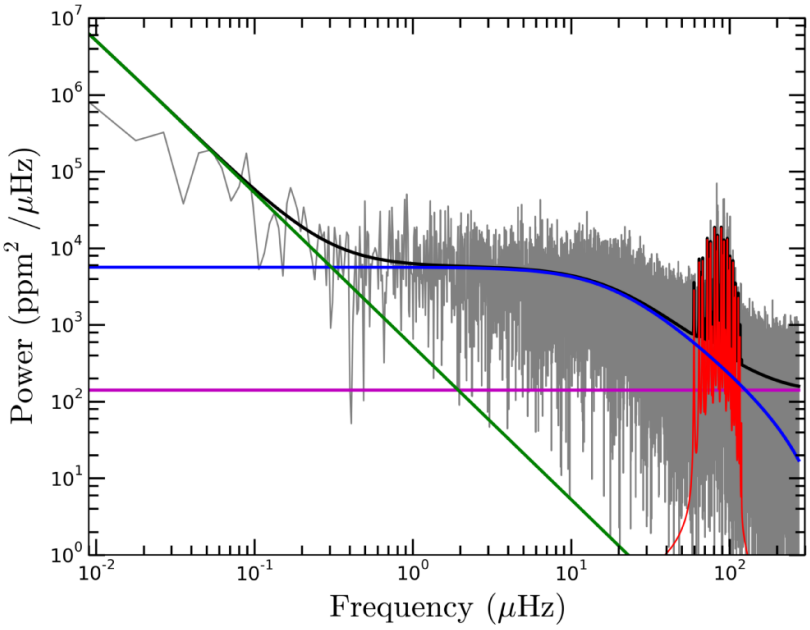

Figure 1: Result of the fit of the power density spectrum (PSD) associated with a *Kepler* red giant target (KIC 5527304).

2 Website and search interface

The SSI database and associated website is located at http://ssi.lesia.obspm.fr. It provides access to the data and a brief description of the database and its content. An User Guide is also available for download.

Data retrieval is possible through the Search interface. It allows the users to perform queries using star ID, star properties (e.g. $T_{\rm eff}$, log g, spectral type, ...), and finally stellar indices (seismic indices and granulation parameters). A list of star ID can be provided by downloading a file containing these ID. Access to the data is also possible through a VO-compatible web service as well as through the Seismic Plus portal (http://voparis-spaceinn.obspm.fr/seismic-plus/).

3 Query results and some illustrations

The results of the request are displayed in the browser through a paginated data table (see the illustration of Fig. 3). They can be filtered and sorted by any parameters. All parameters are by default not displayed but by clicking on "Show/hide columns", it is possible to choose the parameters to be displayed. The results are displayed for a limited number of stars. The complete set can, however, be downloaded on demand in a CSV file.

The SSI pipeline was applied to about 114,000 stars observed by CoRoT in the exo- planet field and 210,000 stars observed during up to 4 years by *Kepler*. The corresponding light-curve were selected on the basis of their total duration (longer than 50 days) only, and accordingly without any prior concerning the evolutionary status of the targets. Stellar indices (seismic and granulation parameters) were then extracted for a total number of 18,000 red giants. Among the

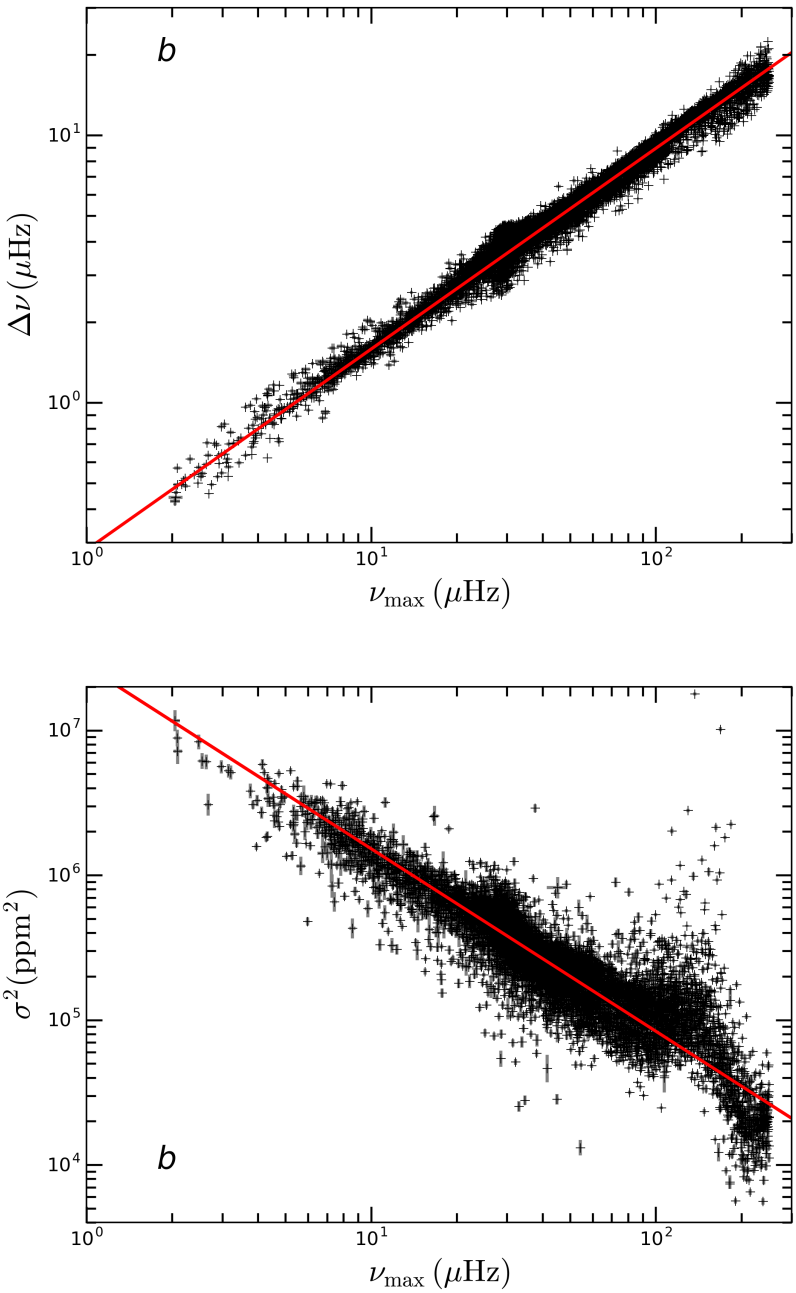

Figure 2: **Top:** $\Delta\nu$ as a function of ν_{max} for about 13,000 *Kepler* red giants. **Bottom:** σ^2 as a function of ν_{max}.


Download as csv file Show 10 entries Show / hide columns

StarID	Origin	alpha [deg]	delta [deg]	teff [K]	grav [cm/s2]	mag_v	mag_r	specType	lumClass	numax_up [μHz]		Deltanu_up [μHz]		
										value	prec	value	prec	
100402467	corot	290.570746	1.644686	4329		-99	14.12	K	II	18.3	1	2.4912	0.012	8
100412751	corot	290.586053	1.634669	4343		-99	13.43	K	III	15.4118	0.586	1.9552	0.004	8
100422482	corot	290.600554	1.717	4549		-99	12.13	K	III	64.3284	0.963	6.0016	0.004	1
100434740	corot	290.618651	1.62033	5031		-99	12.87	G	V	47.502	0.39	4.1872	0.008	8
100440069	corot	290.626483	1.708309	4487		-99	12.87	K	II	51.6	1	5.605	0.005	8
100440565	corot	290.627243	1.647735	4507		-99	12.15	K	II	27.922	0.46	3.5088	0.004	1
100441421	corot	290.628492	1.636505	4753		-99	12.89	K	III	32.94	0.3	4.4695	0.005	1
100442460	corot	290.629967	1.714166	4549		-99	13.79	K	II	28.4526	0.958	3.5328	0.006	1
100448189	corot	290.638332	1.692805	4499		-99	13.53	K	II	16.3917	0.467	2.3356	0.004	1
100480626	corot	290.685877	1.647927	5673		-99	15.26	F	IV	19.1542	0.689	2.1554	0.002	2

Showing 1 to 10 of 4,903 entries First Previous 1 2 3 4 5 491 Next Last

Figure 3: Snapshot showing the query results

Kepler stars for which seismic indices were extracted, about 5,000 of them were not identified in the Kepler Input Catalog (KIC) as red giant. Some illustrative results are presented in Fig. 2.

The seismic indices $\Delta\nu$ and $\nu_{\rm max}$ obey characteristic scaling relations that depend directly on the radius, mass, and effective temperature of the star (for a review see e.g. Belkacem (2012)). From the knowledge of the effective temperature and these two seismic indices, it is then possible to estimate the mass and radius of the star. Note that a tool to derive stellar masses and radii from the seismic indices and effective temperatures is implemented in the Seismic Plus portal.

Concerning the granulation parameters, they also obey characteristic scaling relations that can provide informations about the stars in complement to the seismic indices (see e.g. Mathur et al. 2011; Samadi et al. 2013a,b; Kallinger et al. 2014).

Acknowledgements

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