

## THE BESS DATABASE: A SSAP IMPLEMENTATION FOR BE STARS

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### ABSTRACT

We present the BeSS database, which contains a catalogue of all known Be stars and a large collection of their spectra of any wavelength and from various sources, from amateur astronomers to professional high-resolution high S/N Echelle spectra. Efficient data retrieval is essential for such a heterogeneous data collection. We exploit the wide range of querying capabilities provided by the recent version of the IVOA Spectra Simple Access Protocol (SSAP) to take advantage of the complete metadata available for our spectra. We present our SSAP service implementation and usability of more precise BeSS queries.

Key words: Virtual Observatory.

### 1. BE STARS

Be stars are non-supergiant B stars that at least once have displayed Balmer line emission. This property applies to about 20% of all B-type stars in the field of our galaxy and can concern an even larger fraction of B stars in other environments. Some late O and early A stars also show such emission and are considered as an extension of Be stars. The phases of emission in the optical and infrared lines of hydrogen and several ions, called the Be phenomenon, most likely reflect changes in the structure of the circumstellar envelope created by episodic ejections of mass. The origin of this phenomenon is still unexplained but probably related to the high rotational velocity of Be stars, their pulsations and/or the presence of a magnetic field.

Be stars undergo variations at all timescales. First of all, rapid periodic variations are related to pulsations and rotation. Moreover, long-term variations are associated to the stellar wind and the disk. Finally, ejections of material from the star into the disk produce sudden episodic variations. Therefore, neither two Be stars nor two spectra of a given Be star are identical. Although the short-term variations of Be stars can easily be studied by observing them during a few days or weeks, the study of

longer term phenomena requires the collection of data over several decades. This is why it appeared important to put all available spectra of Be stars in one place, in one unique format, together with all relevant information for the analysis, and to allow easy exchanges between professional and amateur spectra.

### 2. BESS

BeSS is accessible at <http://basebe.obspm.fr> or via the Virtual Observatory. It is a new tool to be used by the whole community working on Be stars. It contains a catalogue of all known (~2000) Be stars with their stellar parameters and collects available Be stars spectra obtained by professional as well as amateur astronomers.

BeSS is a two-way database: data can be retrieved and spectra can also be uploaded. It thus allows the whole community to share data on Be stars. Queries can be performed either by star name or by parameters (e.g. stellar magnitude, coordinates, site of observation, ...; cf. Fig. 1). Anyone can query the database to obtain either a list of Be stars or a list of Be stars spectra to be downloaded. The user can also obtain additional information about the stars, spectra, instruments, sites of observation and observers. Professional or amateur astronomers in possession of Be stars spectra can also upload them in BeSS to enrich the database. The format of the spectra is automatically checked at upload and its science content is checked by the administrators. The spectra uploaded in BeSS must follow the BeSS format specifications, i.e. they must be simple fits spectra with a header including at least a few mandatory keywords. Moreover, while uploading spectra, the user is asked for details concerning the instrument used to obtain the spectra, the observation site and the author(s) of the spectra, if these details are not yet registered in BeSS.

For more details on BeSS, see Neiner et al. (2007).

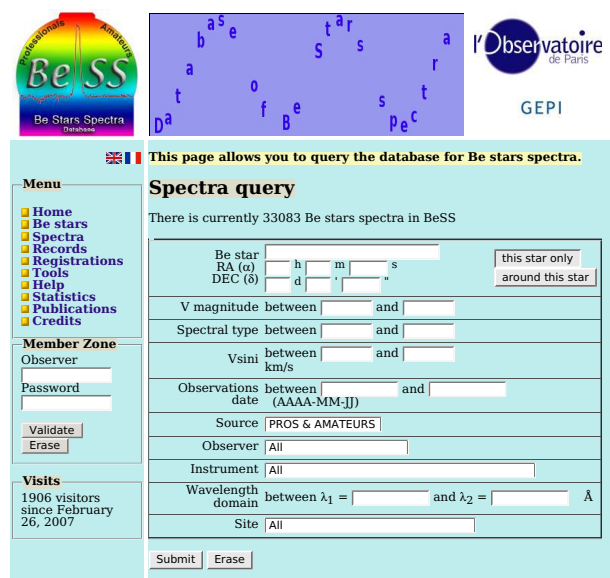


Figure 1. Screenshot of the web page to query BeSS for spectra.

### 3. SSAP: SPECTRA SIMPLE ACCESS PROTOCOL

The prototype of the SSAP implemented in client softwares such as VOSpec, Specview, or SPLAT only allows access by position on the sky and Region Of Interest (cone search). Access to about 20 services using the SSAP prototype is implemented. 4 of them are available through the VO-Paris data center.

However, for databases such as BeSS, in which lots of metadata are available, the SSAP-prototype-based access is rather limited compared to the queries which are possible for this database using SQL. The recent version of SSAP 1.0 allows to take advantage of the complete metadata querying.

We have thus developed a server which provides separate services for both the prototype of SSAP and SSAP version 0.97 for BeSS. SSAP 0.97 access to the BeSS database is available via this URL:

<http://basebe.obspm.fr/cgi-bin/ssapBE.pl>

For example, to constraint the spectral bandpass and period of observations one could use:

<http://basebe.obspm.fr/cgi-bin/ssapBE.pl?POS=102.89,-6.97&SIZE=0.1&BAND=6.4e-7/6.7e-7&TIME=2006-11-01/2006-11-30>

Fig. 2 shows an example of a VOSpec query to BeSS. The server for SSAP version 1.0 is under development and will be available soon.

### 4. FUTURE DEVELOPMENT

We developed the BeSS database and two SSAP servers (prototype and 0.97) for BeSS. The IVOA SSAP 0.97

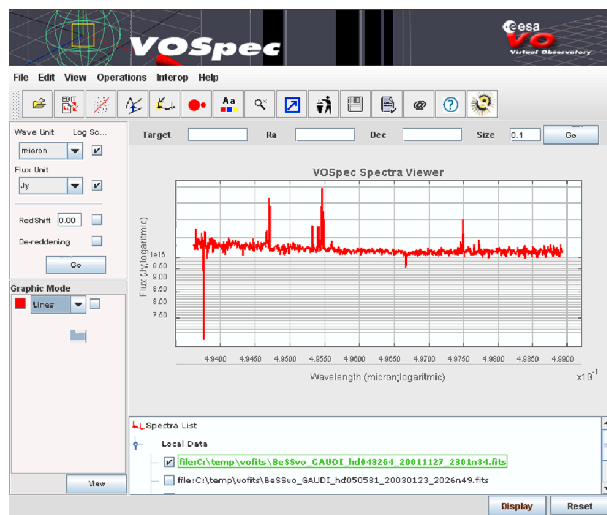


Figure 2. Screenshot of the VOSpec query of a BeSS spectrum.

draft has recently been replaced by the stable version 1.0 (and soon 1.1) and thus most clients will implement this protocol. Our server will then be available to test and answer those clients. However, analysis tools for spectra of particular databases also have to be interfaced with the new SSAP to take advantage of VO interoperability.

### REFERENCES

Neiner, C., de Batz, B., Mekkas, M., et al. 2007, A&A, submitted