THE GSO DATA CENTRE

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Abstract. Hereafter we describe the activities of the *Grand Sud-Ouest* Data Centre operated for INSU (CNRS) by the OMP–IRAP and the *Université Paul Sabatier* in Toulouse, in a collaboration with the OASU–LAB in Bordeaux and OREME–LUPM in Montpellier.

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1 Introduction

The GSO Data Centre (hereafter OV–GSO) was officially set-up in 2013, after approval by INSU of CNRS. Its role is to support more specific and so-called "reference services" which provide dedicated and communautary services, in relation with relevant astrophysical data. OV–GSO also promotes and encourages the deployment of virtual observatory (VO) techniques, at the regional level.

The actual distribution of regional data centres at the national level can be seen in Fig. (1). OV–GSO covers all the *open and "science ready" data*, and VO-oriented activities of Bordeaux (LAB), Montpellier (LUPM) and Toulouse (IRAP) laboratories for astrophysics.

2 Reference services

2.1 Bass 2000

Bass 2000 was originally set-up in 1996 for the archival and diffusion of all the solar data collected from ground-based observatories having a national participation. At this time, it was essentially giving direct support to the Thémis solar telescope located at the *Observatorio del Teide*, Tenerife (Spain).

The progressive decline of the Thémis community, and the evolution of data management at the era of virtual observatories makes that this service will now focus on the only support to the ground-based instrument under responsability of the *Observatoire Midi–Pyrénées*, that is the CLIMSO set of coronagraphs and narrow-band solar (disk) imagers located at the summit of *Pic du Midi de Bigorre*.

2.2 CDPP

The CDPP is the national centre of expertise concerning terrestrial and planetary plasma data. It was created in 1998 by CNRS/INSU and the French space agency CNES. It assures the long term preservation of data obtained primarily from instruments built using French resources, and renders them readily accessible and exploitable by the international community. The CDPP also provides services to enable on-line data analysis (AMDA, see `amda.cdpp.eu`), and 3D data visualization in context (3DView, see `3dview.cdpp.eu`).

The CDPP also plays an important role in the development of interoperability standards (see e.g., Génot et al. 2014).

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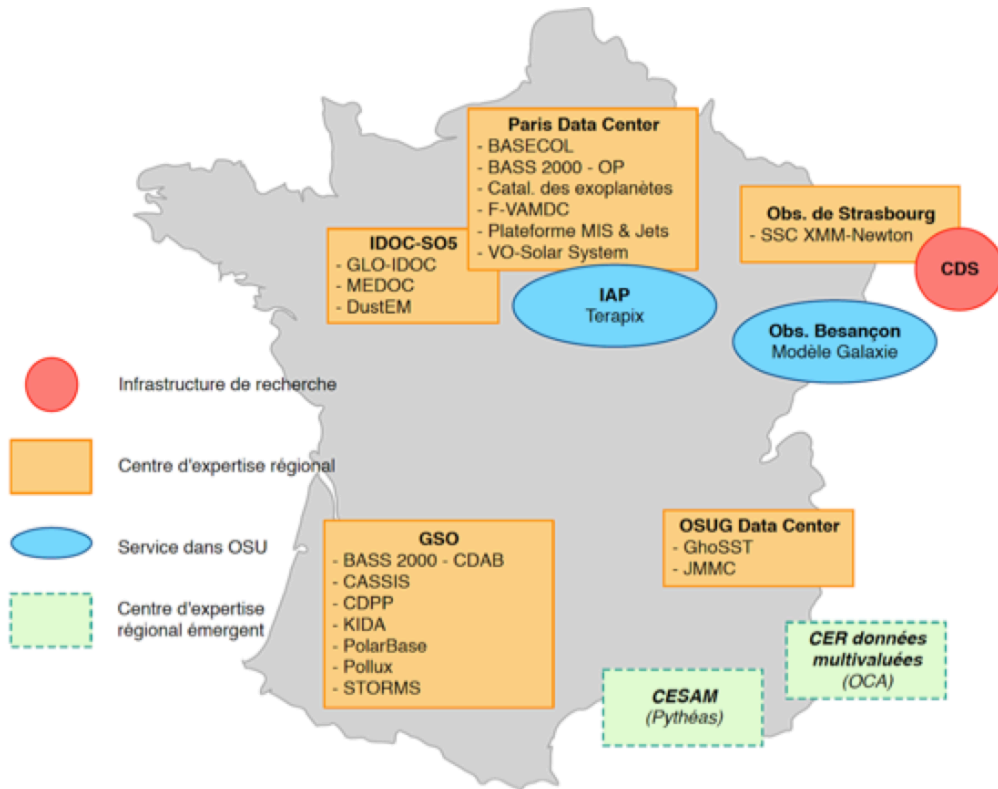[3] Université de Bordeaux, LAB, CNRS, F–33270 Floirac, France

Fig. 1. Actual map of astronomical data services in France. OV–GSO covers the whole south-west area i.e., the (open) data-oriented activities of Bordeaux (LAB), Toulouse (IRAP) and Montpellier (LUPM) astrophysics laboratories.

2.3 STORMS

STORMS, which stands for *Solar Terrestrial ObseRvations and Modeling Service*, is a new public service providing tools and data to perform studies in heliophysics and space weather, and to study and model the influence of solar activity on the geospace environment, as well as on planets or any other solar system bodies (comets, asteroids or spacecrafts).

The main tool it provides so far, `propagationtool.cdpp.eu`, was jointly developed with CDPP. It is meant for the tracking of solar storms, streams and energetic particles in the heliosphere.

2.4 PolarBase

PolarBase was officially opened to the public in 2013. This service distributes high resolution optical stellar spectra from the Espadons@CFHT and Narval@TBL spectropolarimeters.

Reduced spectra, in various Stokes parameters, are delivered to the community, as well as standardizely extracted polarized signatures. A complete description of the database can be found in Petit et al. (2014).

2.5 POLLUX

Pollux is a stellar spectra database proposing access to *theoretical* data. For that purpose, high resolution synthetic spectra and spectral energy distributions have been computed using the best available models of atmosphere (CMFGEN, ATLAS and MARCS), performant spectral synthesis codes (CMF_FLUX, SYNSPEC and TURBOSPECTRUM) and atomic linelists from VALD database and specific molecular linelists for cool stars. Spectral types from O to M are represented for a large set of fundamental parameters: T_{eff}, $\log g$, [Fe/H], and specific abundances (Palacios et al. 2010).
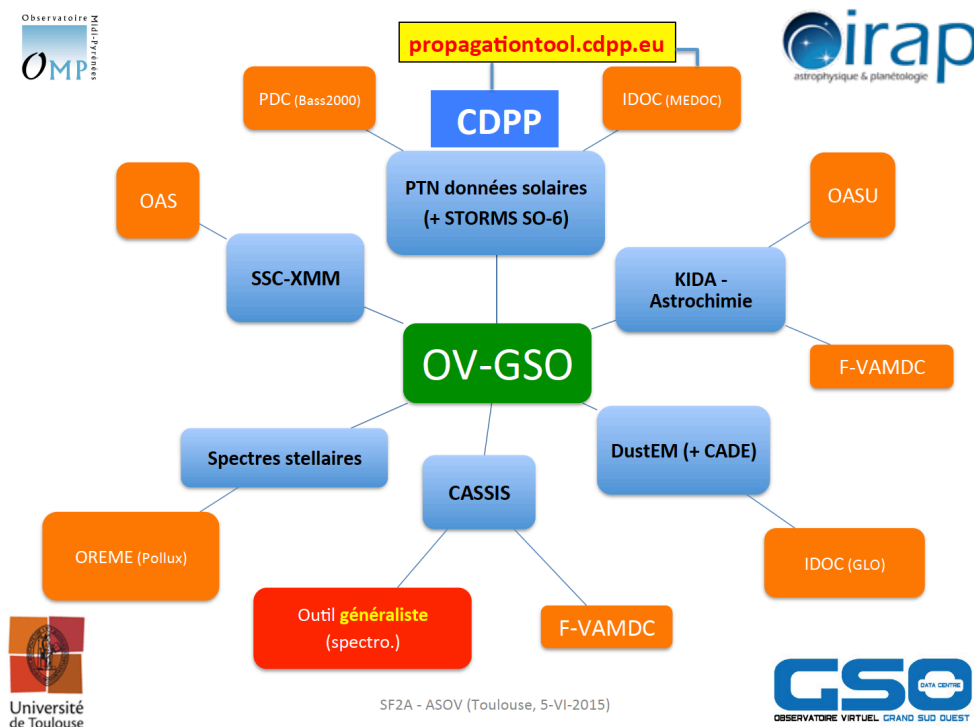
Fig. 2. Connections between OV–GSO and other services and institutes at the national level.

2.6 CASSIS

CASSIS started in 2005. It provides an interactive spectrum analyser that was originally proposed for the scientific exploitation of (far-infrared and submillimetric) data from the Herschel Space Observatory. CASSIS allows to visualize observed or synthetic spectra, together with a line identification tool. It can also predict spectra which may be observed by any (single-dish, so far) telescope. Comparison between observations and synthetic spectra (e.g., from Radex) is also possible with the same tool.

CASSIS is now evolving towards a multi-purpose spectral analysis tool, operating beyond its initial range of application.

2.7 KIDA

KIDA is a database of kinetic data of interest for astrochemical (interstellar medium and planetary atmospheres) studies. In addition to the available referenced data, KIDA provides recommendations over a number of important reactions. Chemists and physicists can also add their own data to the database.

KIDA also distributes a code, named Nahoon, to study the time-dependent gas-phase chemistry of 0D and 1D interstellar sources. Details about the KIDA database can be found in Wakelam et al. (2012).

3 Management and operations

As of 2015, operations of OV–GSO involve about 10 technical (IT) personnel, and about 25 scientists in the Bordeaux-Toulouse-Montpellier area. The typical annual budget of the data centre is about 50 kEur. Obviously one of the major task of OV–GSO is to guarantee the continuity of all services, and therefore regular upgrades of all hardware devices are made. Another fundamental task of the data centre is to plan and to increment regularly our data storage capability, in an homogeneous way.

We also regularly contribute to the various virtual observatories communities, both at the national and international levels (e.g., IVOA). This concerns our reccurent participation to the bi-yearly so-called INTEROP

meetings of the IVOA, as well as propositions of tutorials (e.g., SPECFLOW at `euro-vo.org` scientific tutorials page, or Paletou & Zolotukhin 2014).

Locally, we set-up a monthly dedicated seminar, oriented towards the use and implementation of Virtual Observatory standards and protocols. We are also involved in discussions about more general data issues, at the level of the *Université de Toulouse*. Our various activities can be followed at `ov-gso.irap.omp.eu`

4   Perspectives

Figure (2) finally summarizes the various interactions between OV–GSO and other services and institutes, at the national level (and as of 2015).

We are however already supporting several ongoing projects which should transform into new reference services in a near future. It consists in providing data and tools for the study of emissions of the extended sky (`cade.irap.omp.eu`), and a so-called Multi Frequency Follow-up Inventory Service (`muffins.irap.omp.eu`). Projects are also associated with the data management of the MUSE integral-field spectrograph at VLT, as well as high-energy astrophysical data, from spaceborne missions such as XMM (see e.g., `xmmssc.irap.omp.eu`) or Fermi, to the ground-based CTA facility (see e.g., `cta.irap.omp.eu`). An involvement in the data and VO-oriented activities of the space mission EUCLID is also planned.

References

BASS 2000: `bass2000.bagn.obs-mip.fr`
CASSIS: `cassis.irap.omp.eu`
CDPP: `cdpp.eu`
KIDA: `kida.obs-u-bordeaux1.fr`
POLARBASE: `polarbase.irap.omp.eu`
POLLUX: `npollux.lupm.univ-montp2.fr`
STORMS: `stormsweb.irap.omp.eu`
The GSO Data Centre: `ov-gso.irap.omp.eu`

Génot, V., André, N., Cecconi, B., et al. 2014, Astronomy and Computing, 7, 62
Palacios, A., Gebran, M., Josselin, E., et al. 2010, A&A, 516, A13
Paletou, F., Zolotukhin, I. 2014 [arXiv:1408.7026]
Petit, P., Louge, T., Théado, S., et al. 2014, PASP, 126, 469
Wakelam, V., Herbst, E., Loison, J.-C., et al. 2012, ApJS, 199, 21