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SSHADE in H2020: Development of an European Database Infrastructure in Solid Spectroscopy

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Abstract

SSHADE (http://blog.sshade.eu) is an European project of a set of databases to provide to the community with a large number of spectra of solids (ices, minerals, organics, cosmomaterials, …) of astrophysical and terrestrial interests in the X-ray to sub-mm range. The first of these databases is *GhoSST* (http://ghosst.osug.fr). The SSHADE consortium has currently 20 partner groups in 18 laboratories from 8 different European countries. This project will be developed as part of the VESPA activity within the Europlanet-RI Horizon 2020 program (09/2015-08/2019).

1. Introduction

Spectroscopy and spectro-imagery are increasingly used in space missions, in orbit or *in situ*, to study the solid phase of the objects of the solar system (e.g. VIMS/Cassini, DISR/Huygens, VIRTIS/Rosetta, RALPH/New Horizons, …): icy, mineral or organic surfaces and grains, dust particles, aerosols, etc. Infrared, Raman, fluorescence and X-rays micro-spectroscopies are used to study meteorites and cometary dusts in the laboratory and onboard some space missions for *in situ* measurements. A major contribution to the analysis of these observations is the measurement in the laboratory of UV, Visible, IR, Raman and XANES spectra of a variety of materials (ices, minerals, organics, …) expected to be present at the surface of THE bodies of the solar system or in their ejected grains (e.g. comets, asteroids, TNO, icy satellites, Pluto, Mars, …).

A large number of laboratories in Europe have developed experiments to measure and study the spectroscopic properties of a variety of solid materials of astrophysical interest, either natural (terrestrial or extra-terrestrial) or synthetics. The amount of data collected is huge and several of these laboratories boast leading-edge expertise in some solid spectroscopy fields. However most of these data, although published, are very difficult to access in an usable form (i.e. electronic) to compare with observation or to use in radiative transfer codes.

We thus decided to extend our datamodel (SSDM) and expand the GHOSST database structure in order to build a database infrastructure able to gather and distribute the spectroscopic data of most of the European laboratories working on solids of any type with astrophysical and terrestrial applications.

2. What is SSHADE?

SSHADE ("Solid Spectroscopy Hosting Architecture of Databases and Expertise") is a project of a set of databases on solid spectroscopy that will start its development in September 2015.

The SSHADE databases will cover laboratory, field, airborne as well as simulated and theoretical spectral data with their corresponding spectra and their various types of products (ex: transmission, absorbance, absorption coefficient, optical constants, band list) for many different types of solids: ices, snows and molecular solids, minerals, rocks, inorganic solids, natural and synthetics organic and carbonaceous matters, meteorites and other cosmomaterials, … with a wide range of measurement technics: transmission, bidirectional reflection, Raman, fluorescence, … and over a wide range of wavelengths: from X-rays to millimeter wavelengths (can be extended up/down).

It is based on the GhoSST database developments (Europlanet + VAMDC 2009-2012). The SSHADE database infrastructure will be hosted at the OSUG Data Center (University of Grenoble Alpes). The SSHADE project was initially boosted by INSU/CNRS who asked us to develop a "thematic

pole on planetary solids" within the new framework of observation services of INSU. The SSHADE development is part of the VESPA activity within the European e-infrastructure Europlanet-RI of the Horizon 2020 program (09/2015-08/2019).

The SSHADE consortium has currently 20 partner groups in 18 laboratories from 8 different European countries (F, UK, I, D, E, HU, PL, CH). News about this project can be followed on the SSHADE blog (http://blog.sshade.eu).

3. SSHADE infrastructure

The SSHADE infrastructure will have:

- A common 'solid spectroscopy' interface
- A common Import / Search / Visualization / Export engine
- A common fundamental database (species, publications, objects, band list, …)
- A set of spectral databases: one per group/laboratory (GhoSST is one of them)

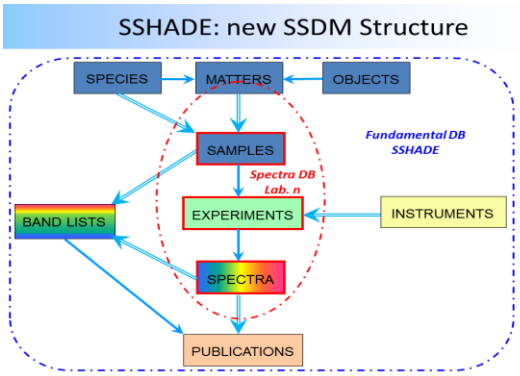

Figure 1: Schematic structure of SSDM for the SSHADE infrastructure

It will be possible either to search all databases at the same time with various filters (spectrum type, species or material type or name, …), and from different points of view (spectra, band lists, publications, objects, …), or to select the target database(s).

SSHADE will be also a service for Virtual Observatories (VESPA, VAMDC, ...).

The transformation of the GhoSST database structure into the SSHADE infrastructure will need a number of modifications such as the separation of the fundamental databases (species, publications, objects, …) from the individual spectroscopic databases (one per laboratory) and the rewriting of the data queries (mono to multi DB). Each database will be also customized to its effective content (types of solids, of spectra, …) for easier search. This work will be mostly devoted to Coriolys SCOP.

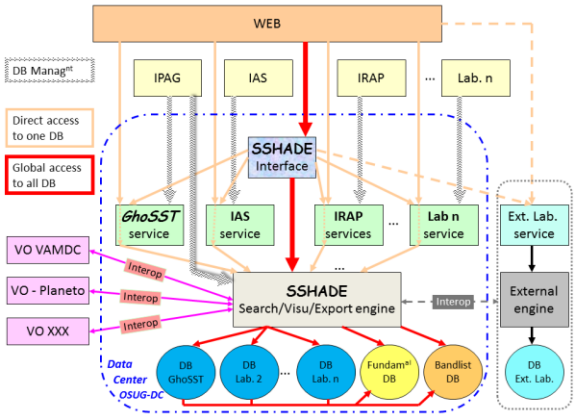

Figure 2: Schematic structure of SSHADE infrastructure

4. Databases implementation

The databases of each of the 20 partners of the SSHADE consortium will be progressively implemented in the SSHADE infrastructure all along the 4 years of the program. Each of the groups have a Scientific manager (responsible of the scientific content of the database and it quality) and a database manager (responsible of the ingestion of the data in the database), as well as contributors (experimentalists who produce data) to develop the content of their database. They will also contribute to the common 'band list' database of molecular solids by providing band parameters data or critical reviews of published data. They will be trained to the tools developed for data preparation, validation, ingestion and management. Tutorials for the database users will be also organized mostly during major planetary sciences and astrophysics conferences. The SSHADE web site will contain all documentation on the SSDM data model, the use of the SSHADE database, tutorials, as well on the experimental systems and cells used to record the spectra.

Acknowledgements

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