VESPA (Virtual European Solar & Planetary Access): a Planetary Science Virtual Observatory cornerstone

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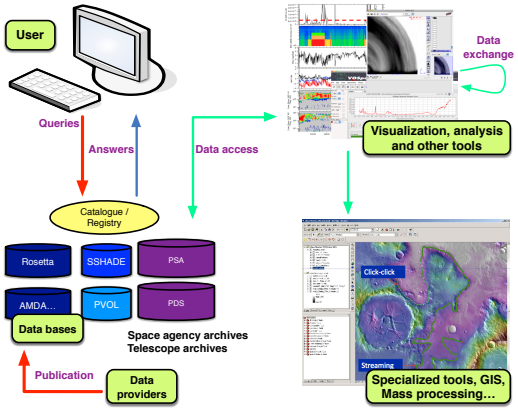
VESPA functionalities

VESPA provides:
1) an integrated search interface to identify data of interest in many databases simultaneously, based on science-related parameters

2) A connection to powerful and generic visualization and analysis tools, based on standards from the Astronomy VO (IVOA) with extra functions for planetary science

3) A simple and handy way to publish your data and make them searchable, according to FAIR principles and the Open Science policy

The overall scope of VESPA includes planetary science, heliophysics and exoplanets



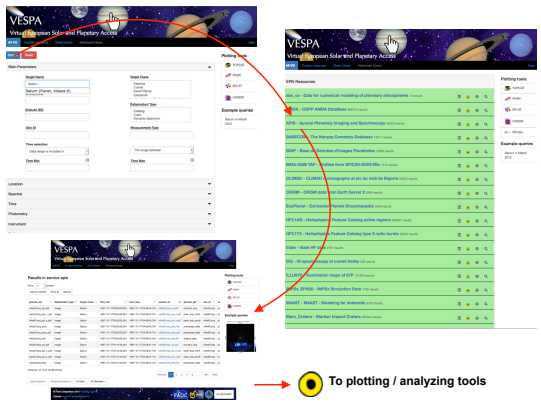
VESPA search portal

The VESPA interface queries the connected services using science-related parameters from a user-friendly interface http://vespa.obspm.fr

The result is a list of services containing answers; when browsed, individual files are listed.

Powerful alternative access modes are available from the command line, VO tools, python, or Jupyter notebooks.

Other protocols are supported by the portal to query space agency archives.



VESPA data services

Currently, 61 data services are connected through the EPN-TAP protocol and queried by the VESPA portal.

These include:
• small, topical services related to an experiment or an observatory program

• large contributive repositories such as AMDA (planetary plasmas)
PVOL (amateur planetary images)
SSHADE (lab spectroscopy of solids)
VizieR (published catalogues)

VESPA

The goal of VESPA (Virtual European Solar and Planetary Access) is to build a Virtual Observatory (VO) for Solar System Sciences. The infrastructure is developed in the series of Europlanet programmes, reusing mechanisms which have been developed for the Astronomy VO. In particular, the EPN-TAP is currently a Proposed Recommendation at IVOA.

Europlanet H2024 EU program

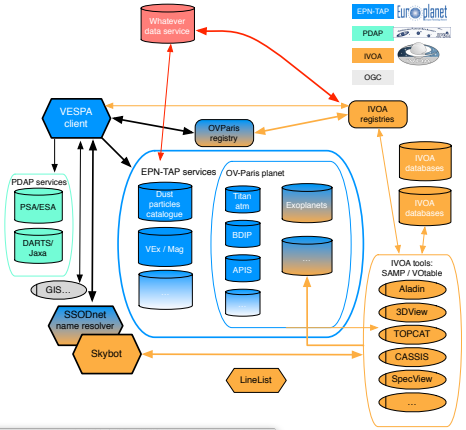
The Europlanet H2024 program is a EU-funded initiative dedicated to providing a research infrastructure to Planetary Science in Europe. VESPA, a large part of the program, is related to providing easy and efficient access to observational, modeled, and experimental data in the field. The program started on Feb 1st, 2020 for a 4-years period.

VESPA architecture /service installation

VESPA makes intense use of preexisting mechanisms, which are adapted to the specific needs of Planetary Science.
The original ingredients consist in a Data Model (EPNcore) to describe planetary data content, associated to the standard TAP protocol, ADQL language, and the IVOA registry of services.
EPNcore makes use of predefined lists, e.g., to identify targets, spacecraft, observatories, coordinate systems [3], etc. In most cases those are based on IAU standards.

Any data provider can benefit from VESPA's infrastructure by providing an EPN-TAP interface to their database and declaring their service in the registry - contact our team!

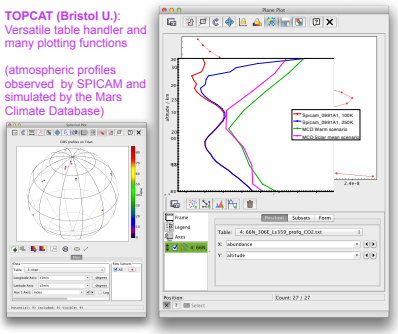
New services can be installed easily and reached from a stable IP address. Most of the set up procedure consists in describing your data in a table with the EPNCore vocabulary. Procedures are identified to build a service from existing databases. A docker container is available to assess the data server and setup procedure.
Native VO formats include fits and VOtable, other formats are supported.

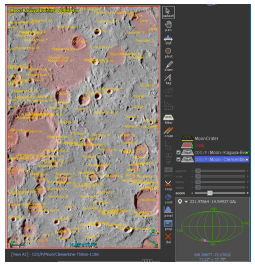


Tools available in VESPA

TOPCAT (Bristol U.):
Versatile table handler and many plotting functions

(atmospheric profiles observed by SPICAM and simulated by the Mars Climate Database)

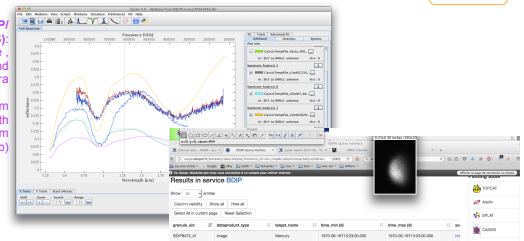




Aladin (CDS/CNRS):
Supports planetary HiPS (multiresolution maps), planetary coordinate frames, TAP client querying VESPA services
(Lunar crater catalogue on on Kaguya HiPS)

CASSIS (IRAP/ CNRS):
Supports radiance , reflectance and emissivity spectra

(spectra of Vesta from M4ast compared with SNC meteorites from PDS speclib)

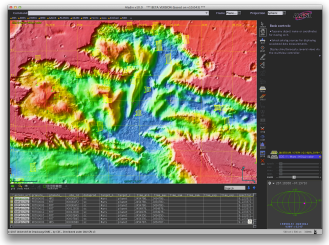


ImageJ (NIH, open source):
Added VO interface on input
Improved fits support
Provides format conversions and image processing functions to the VO

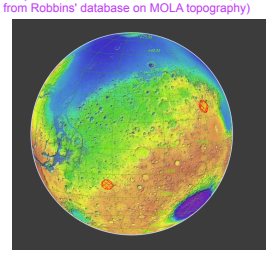
Footprints and spatial searches

Footprints can be plotted to visualize data on planetary surfaces or in the sky.
Powerful spatial searches based on intersections between footprints are available.

Aladin can retrieve and plot arbitrary footprints, and perform searches on spatial intersections (CRISM sessions in Valles Marineris [yellow], on MOLA topography)



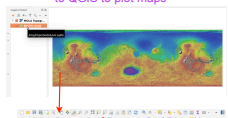
Aladin also computes Multi Order Coverages (MOC) representing a footprint with a list of healpix cells. They can be used to filter another dataset (craters from Robbins' database on MOLA topography)



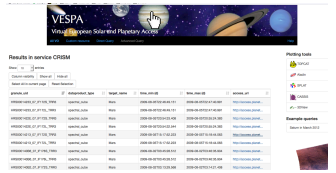
Connection with GIS

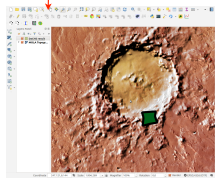
Web services using GIS protocols such as WMS can be presented in a VO-like way so that they can be searched from the VESPA portal or other TAP clients. Results (which include WMS or WCS queries) can be transferred through the SAMP VO interface. A new QGIS plugin will receive such queries and interpret them. Data displayed in QGIS can be sent to Aladin or a spectral tool via another plugin (example based on USGS maps and CRISM cubes).

WMS queries are passed to QGIS to plot maps



The image module downloads the correspon ding previews





WCS queries are passed to QGIS via SAMP to plot CRISM footprints. From here, these can be forwarded to Aladin

References

Erard S. et al (2018) VESPA: a community-driven Virtual Observatory in Planetary Science. PSS 150, 65-85. doi: 10.1016/j.pss.2017.05.013 ArXiv 1705.09727
Erard S. et al (2020). Virtual European Solar & Planetary Access (VESPA): A Planetary Science Virtual Observatory Cornerstone. Data Science Journal, 19(1), p. 22. DOI: 10.5334/dsj-2020-022. arXiv https://arxiv.org/abs/1907.06521

http://www.europlanet-vespa.eu

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