VESPA in EPN2024
(Virtual European Solar & Planetary Access)

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EuROPLANET

EPN 2024 kick-off
27/2/2020
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VESPA includes 19 contributing participants (labs) in 14 institutes:

Observatoire de Paris (IMCCE, LESIA, PADC)
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Jacobs Univ. Bremen
CNRS (CDS IPSL IPAG IRAP)
IWF Graz
IASB-BIRA Brussels
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UPV/EHU Bilbao
Univ. Bristol
UCL London
SINP-MSU Moscow
Univ. Heidelberg

Universidad del Pais Vasco
Euskal Herriko Unibertsitatea
University of Bristol
UCL
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l’Observatoire de Paris
CBK

IWF Graz  
IASB-BIRA Brussels
SpaceFrog Toulouse
OATS/INAF Trieste
DLR Berlin

VESPA Europlanet-2024 / Participants

+ Contributions from the community
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- Univ. Bristol
- UCL London
- SINP-MSU Moscow
- Univ. Heidelberg

+ Contributions from the community
VESPA-2020: What has been provided to the community?

1- A user interface to search data based on science parameters:
   VESPA portal  http://vespa.obspm.fr

2- A set of data services provided by VESPA participants and other teams:
   52 data services open at the end of EPN2020
   Includes ESA’s PSA (10+ million files!)
   New or updated infrastructures: SSHADE, PVOL, AMDA

3- Connection with powerful display and analysis tools:
   Tools from astronomy (VO, with planetary science updates)
     + Earth observation (GIS) + space archives (PDS)
   (plus the required infrastructure and standards, docs)
   (plus dissemination & intense networking in community and consortia)

=> Open Science system, providing FAIR access to the data
User's experience

- User
- User's experience
- Data exchange
- Visualization and other tools
- Specialized tools, GIS
- Queries
- Answers
- Data access
- Catalogue / Registry
- Space agency archives
- Data bases
- User's experience
- SSODnet
- GhoSST
- KIDA
- EPN
- PSA
- PDS
- AMDA...

Data exchange
Visualization and other tools
Specialized tools, GIS
VESPA in EPN 2024: status, objectives

Continuation of successful activity in EPN2020

=> Extension of Virtual Observatory for Planetary Science & solar system studies

• Evolution from Data stewardship to Enabling data analysis
  Strong action about sustainability of data services
  Coupled with upper level functions, e.g. Machine Learning…

• No more training/dissemination (no founding)
VESPA 2024 structure

**Coordination:** S. Erard / B Cecconi, A. P. Rossi, H. Rothkaehl
VESPA JRA task2: Infrastructure

Making data more FAIR; adding processing functions

• **Move to EOSC**

=> Data services on cloud; processing close to the data

Parallel activity: EOSC early adopters programme (VESPA-Cloud, selected)

• **Code on line**

=> Adapt OPUS platform from CTA & ESCAPE (on local cluster then EOSC); authentication supported by GEANT

Applications to radio observations and atmospheres (incl. exoplanets)

• **doi infrastructure**

=> adapted from CNES dev. Will connect data and publications

• **NoSQL/ElasticSearch applications of EPNCore**

Will improve informal searches in data services

=> e.g. to set up a bridge with NASA PDS4 archives
A Virtual Observatory in Planetary Science

Built on astronomical VO developments
+ previous European programs: IMPEx, HELIO, VAMDC...
+ interfaces with: PDS, GIS/OGC, etc...

http://vespa.obspm.fr
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[Diagram of EPN-TAP services, PDAP services, IVOA databases, VESPA client, etc.]

http://vespa.obspm.fr
VESPA JRA task3: Tools and interfaces

Improve visu and analysis functions

• Upgrade VESPA portal
  => Improvement of interfaces via User Experience analysis

• Upgrade of VO tools
  => Involves main VO tools (Aladin, CASSIS, TOPCAT) and servers (DaCHS)
  New functions related to handling of footprints, adaptive resolution, etc

Based on upgraded data description

• Support for new access modes
  => Will improve data file support
<table>
<thead>
<tr>
<th>EPN Resources</th>
</tr>
</thead>
<tbody>
<tr>
<td>abs_cs - Data for numerical modeling of planetary atmospheres</td>
</tr>
<tr>
<td>AMDA - Planetary and heliophysics plasma data at CDPP/AMDA</td>
</tr>
<tr>
<td>APIS - Auroral Planetary Imaging and Spectroscopy</td>
</tr>
<tr>
<td>BASECOM - The Nançay Cometary Database</td>
</tr>
<tr>
<td>bass2000 - Bass2000 solar survey archive</td>
</tr>
<tr>
<td>BDIP - Base de Données d'Images Planétaires</td>
</tr>
<tr>
<td>cassini_jupiter - Cassini RPWS/HFR Calibrated Jupiter Flyby Dataset</td>
</tr>
<tr>
<td>CLIMSO - CLIMSO coronagraphs at pic du midi de Bigorre</td>
</tr>
<tr>
<td>cpstasm - CLUSTER STAFF-SA Spectral Matrix Data</td>
</tr>
<tr>
<td>DynAstVO - Asteroid orbital database and ephemerides</td>
</tr>
<tr>
<td>ExoPlanet - Extrasolar Planets Encyclopaedia</td>
</tr>
<tr>
<td>expres - ExPRES Simulation Database</td>
</tr>
<tr>
<td>HFC1AR - Heliophysics Feature Catalog active regions</td>
</tr>
<tr>
<td>HFC1T3 - Heliophysics Feature Catalog type 3 radio bursts</td>
</tr>
<tr>
<td>hisaki - Hisaki Planetary Database</td>
</tr>
<tr>
<td>hrsc3nd - HRSC nadir images of Mars</td>
</tr>
<tr>
<td>hst_planeto - Planetary data from the Hubble Space Telescope</td>
</tr>
</tbody>
</table>

VESPA portal
http://vespa.obspm.fr
**EPN Resources**

- **abs_cs** - Data for numerical modeling of planetary atmospheres 13 results
- **AMDA** - Planetary and heliophysics plasma data at CDPP/AMDA 1217441 results
- **APIS** - Auroral Planetary Imaging and Spectroscopy 55371 results
- **BASECOM** - The Nançay Cometary Database 15611 results
- **bass2000** - Bass2000 solar survey archive 313365 results
- **BDIP** - Base de Données d'Images Planétaires 16906 results
- **cassini_jupiter** - Cassini RPWS/HFR Calibrated Jupiter Flyby Dataset 7 results
- **CLIMSO** - CLIMSO coronagraphs at pic du midi de Bigorre 808951 results
- **cpstasm** - CLUSTER STAFF-SA Spectral Matrix Data 11688 results
- **DynAstVO** - Asteroid orbital database and ephemerides 20859 results

**Results in service VEx**

<table>
<thead>
<tr>
<th>id</th>
<th>dataproduct_type</th>
<th>target_name</th>
<th>time_min</th>
<th>time_max</th>
<th>access_url</th>
</tr>
</thead>
</table>

**Example queries**

- **Saturn in March 2013**

**VESPA portal**
http://vespa.obspm.fr
### EPN-TAP compilation results

**PDAP Resources (by dataset)**

- **PSA**: 396 results
- **DARTS**: 2 results

Generated PDAP request:

```
TARGET_NAME=MARS&RESOURCE_CLASS=DATA_SET
```

### NASA PDS Query

- [https://pds.nasa.gov/services/search/search?q=target%3AMars](https://pds.nasa.gov/services/search/search?q=target%3AMars)
- `target:Mars`
New functions in VESPA

Support for extended pixels in TOPCAT
(Bristol Univ.)

Position is defined by a quadrilateral instead of a point

 Particularly useful for imaging spectroscopy and to display image footprints

HRSC/MEx observations of Mars, image footprints

VIRTIS/Rosetta observations of 67P, individual pixels
VESPA JRA task4: Design of internal services

Set up computational / unusual services
& workflows to support specific data types

Split in sub-tasks, e.g.:

• VO-GIS bridge => follow on of previous activity; use of common CRS in VO and OGC/GIS tools; improvements in GDAL lib (fits support)
• Surfaces => 3D views (DTM); imaging spectroscopy data model; interface with USGS and GMAP services
• Time series => das2 in AMDA and other tools
• Global Climate Models: setup for Venus, upgrades for Mars
• VizieR Solar System catalogues: prepare future EPN-TAP service
etc
VESPA VA task2-3-4: New data services

30-50 new services

- **task2**: internal services
  => From VESPA and other beneficiaries
  Includes data generated in TAs and NA2, as per DMP
- **task3**: AO and implementation workshops
  => First workshop in Toulouse, early April; focus on H2020 / ERCs
- **task 4**: amateur services
  => PVOL enlargement; RadioJove upgrade;
  A 3rd one TBD: could be radio observations of meteorite trails, comet observations, Zooniverse projects...
Data services connected via EPN-TAP / field

Atmospheres
- Titan profiles - CIRS (Cassini, LESIA)
- Venus spectroscopy - VIRTIS (VEx, LESIA)
- Mars Climate Database (modeling, LMD-LESIA)
- Venus profiles - SPICAV/SOIR (VEx, IASB-BIRA)
- Mars profiles - SPICAM (MEx, LATMOS)
- All MEx derived atmospheric products (via MEx IDS)
- Venus cloud products (LATMOS)

Small bodies
- M4ast (ground based spectroscopy, IMCCE)
- 1P/Halley spectroscopy - (IKS / Vega-1, LESIA)
- BaseCom - (Nançay obs, LESIA)
- TNOs are cool - (Herchel & Spitzer + compilation, LESIA & LAM & Utinam)

* - SBNAF - (outcome of the H2020 prog, Konkoly Obs)
* - Cometary lines catalogue (IAPS)
* - Vesta & Ceres spectroscopy - VIR/DAWN (IAPS)
* - DynAstVO: NEO refined parameters (IMCCE)
* - MPCorb: Small bodies orbital cat (MPC/Heidelberg)
* - Rosetta ground-based support (via C. Snodgrass)
* - 67P illumination config (IRAP)
* - Meteor_shower predictions (IMCCE)

Surfaces
- CRISM WMS service (MRO, Jacobs U)
- Mars craters (Jacobs U, + update by GEOPS)

* - USGS planetary maps (Jacobs U)
* - M3 WMS service (Chandrayaan-1, Jacobs U)
* - HRSC data (MEx, Frei Univ)
* - OMEGA cubes and maps (MEx, IAS)
* - VIMS calibrated/geometry cubes (Cassini, LPG)
* - MarsSI GIS (Lyon)

Solid spectroscopy
* - SSHADE: ices & minerals (IPAG & network)
- Planetary Spectral Library (DLR)
* - PDS spectral library (LESIA)
- Berlin Reflectance Spectral Lib (DLR)

Magnetospheres / radio
- APIS (HST/Cassini, LESIA)
- NDA (Jupiter radio Nançay, LESIA)
- AMDA (CDPP / IRAP)
- MAG data (VEx, IWF Graz)
* - MATER & Juno support (LESIA) + associated services
- RadioJove (LESIA & US amateur network)
- - Iltate HF data of Jupiter (Tohoku Univ, Jap)
- - UTR-2 Juno ground support (Kharkiv)
- - MDISC (modeling, UCL)
* - Cluster & Themis data (IAp, Prague)
* - Interface with IMPEX models (IWF Graz)
* - Hisaki (Tohoku Univ., Jap)
* - Transplanet (CDPP / IRAP)
* - LOFAR Jupiter (SRC/PAS, Varsovie)

Exoplanets
- Encyclopedia of exoplanets (compilation, LUTH/LESIA)
- Transit observations (Bern)
- Interface with DACE (Geneva)

Solar
- HELIO AR & 1T3 solar features catalogues (LESIA)
* - Bass2000 (LESIA)
* - Radio Solar db (Nançay, LESIA)
* - CLIMSO (Pic du Midi, IRAP)
* - Iltate AMATERAS (Tohoku Univ, Jap)

Generic / interdisciplinary
- BDIP (LESIA)
- Planets then satellites characteristics (LESIA/IMCCE)
* - PVOL (UPV/EHU & amateur network)
- Gas absorption cross-sections (Granada)
* - Nasa dust catalogue (IAPS)
- Stellar spectra, support for observations & expl. (LESIA)
- Telescopic planetary spectra collection (LESIA)
- Interface with VAMDC (TBD)
* - PSA complete archive (ESA)
* - HST planetary data (LESIA, to CADC archive)
- DARTS (JAXA - currently via PDAP)

Open
Open in test
In development
Being studied

New/updated in 2019/20
Scheduled Data services in EPN2024

As deliverables

- 8 to 10 new databases in SSHADE
- new radio services: MASER
- ARTECS service interface (climate of exoplanets)
- Forecast service of occultations by asteroids & satellites, from Gaia and Hipparcos catalogues
- GEM-Mars GCM products and tools
- Catalogue of exoplanetary disks and related tools
- Simulations of magnetic field inside the Mercurian, terrestrial, Jovian, and Saturnian magnetospheres for various disturbed solar wind conditions
- Global spectral parameters maps of Mercury
- Exoplanet atmospheric composition from observations

+ TAs & NA2 services - one server / WP?
+ Other VAs
VESPA VA task5: Consolidation

Enforcing sustainability of data services

• 3 VESPA hubs

=> ObsParis, Heidelberg, Trieste will backup data services and possibly substitute for failing providers

Other solutions to be studied, including containers (Docker) and EOSC

• Good practices for providers (gitlab, etc)
• Service monitoring, validators...
• Improving description of services & resources
• Contribution to Europlanet DMP
VESPA VA task6: Standards & Sustainability

Sustainability of infra through publication of standards, i.e. those produced in the JRA

• Will prepare docs for EPN-TAP
  but also exoplanets DM, band lists, coord systems, etc

Intense networking with consortia (IVOA, IPDA…)

=> Important to apply to IPDA as Europlanet Society!!!

• Tutorials for users

Focussing on practical situations
2D overlaps based on actual footprints, in TAP

Particularly useful to identify overlapping images / spectral cubes from different services, based on footprints (also with point features)
VESPA vs EOSC

- Assessment installation of VM on EOSC in June 2019
  Test VM on line (server currently off-line)

- First tests in EOSC early adopters programme (VESPA-Cloud)

- EPN-TAP services already included on EUDAT list: [http://b2find.eudat.eu/](http://b2find.eudat.eu/) through the IVOA registry (where they all appear)

This points to the resource list of science services on EOSC with duplicates and missing services => registration process to be improved
  + keywords to be optimized / standardized
Conclusion: VESPA prospects

VESPA next activity:
- More data services
- Will secure existing services
  regional hubs, services on European Open Science Cloud / EOSC, etc
- Will be connected to other “Virtual Activities“:
  codes on line
  machine learning
  planetary mapping
- Will associate non-beneficiary teams/institutes, including outside EU