A Planetary Science Virtual Observatory prototype (and follow-on)

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+ Many contributions from
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Planetary Science VO — Objectives in Europlanet (FP7: 2009-2012)

- Make data search in archives easy
- Allow quick-look visualisation of data
- Allow external users to include their data
- Make "small" derived data sets accessible
- Develop specific processing/visualisation tools

Initial set-up in Europlanet

Contributions by external users

Constraint: minimise developments

Success: the user doesn't see the infrastructure
VESPA access
- Global search interface for Planetary Science services
- Supports EPN-TAP + PDAP

http://voparis-europlanet-new.obspm.fr/
• **EPN-TAP services:**
  
  Public services at VO-Paris:
  
  - APIS: Aurorae images/spectra data base (HST)
  - BDIP: Historical planetary images in Meudon (ground-based)
  - Encyclopedia of Extra-Solar Planets (compilation of published data)
  - Atmospheric profiles of Titan (Cassini/CIRS)
  - IKS / Halley (Vega-I), M4ast (asteroid spectrosc.)
  - BaseCom (comets from Nançay), Jupiter radio observations (from Nançay)
  - Solar features catalogue (from HELIO program)

  Projects at VO-Paris (from existing databases):
  
  TNO data compilation, VIRTIS/VEx & Rosetta, mineral spectroscopy…

  Other services in development: Rome, Toulouse, Graz

• **Other targeted data centres/services** (with specific interfaces):
  
  AMDA (under test), ESO archive, GhoSST

• **Space data centres accessible by VESPA** (via **PDAP**):
  
  PSA and DARTS (ESA & JAXA archives, with minimal interface)
Visualization tools: IVOA

**Aladin:**
- plots images/cubes
- handles sky/spheroid coordinates

**TOPCAT:**
- Handles tables
- 2D/3D plots
Visualization tools: others

3Dview / CNES:
Spacecraft trajectories + data
Used for Rosetta lander

Uranus magnetic field / Voyager-2 from AMDA in 3Dview
Visualization tools / GIS (OGC standards)

**QuantumGIS:**
- plots image layers
- uses OGC standards
- expects specific format

AMIE/Smart-1 image frames on Clementine basemap in QuantumGIS
IVOA loan standards

LEVEL 2
All standards
Altogether

- Very efficient data mining & quick-look system
  Planetary science supported from Europlanet developments
  Based on IVOA standards & tools + IAU references
  Some areas to be optimized in collaboration with IVOA / IPDA / IAU
  (e.g. description of coordinate systems)

- Science value increases with number of connected services
  Related data services increase science coverage
  Services can provide extra information on same objects (exoplanets),
  or same information on new objects (small bodies)
  Need for reference laboratory data (e.g. mineral spectroscopy)
    + modeling (e.g. GCM)
    + ground support observations for space missions (Venus?)

- Currently in basic form => new data services to be implemented

=> Europlanet #3 pgr being set up for Horizon 2020 (2015-2019?)
  Europlanet/IDIS package to evolve into a full VO activity: VESPA
  Coordination: VO-Paris - Identification of new objectives / partners / activities
Science case: Titan atm.

*Titan GCM* [with VO interface]

then check regional radar maps during the period, etc…
Search function in a PDS dataset

Archive file VIRTIS_INDEX.TAB => service catalogue in database

All files/sessions are described using:
- UTC / location / local time / tangent altitude
- Instrument parameters (including integration time / quality code)
VESPA can use those as search parameters

example on VIRTIS/VEx archive at PSA
Some objectives for H2020
- Increase number of data services
  Handled by thematics
  Link to large topical services (AMDA, GhoSST/SSHADE…)
  + calls open to external partners
  + some selected amateur resources
- Tools update + adaptation
  Specific functions in Aladin / TOPCAT / DS9?
  Use 3Dview (or other…) to visualize asteroid/comet shape models?
  VESPA client to be upgraded
- VO / GIS link
  Includes use of FITS kw for planetary mapping
- Refine standards
  Have EPN standards validated by IAU whenever relevant
  ADQL update? (uppercase support required for target names…)
- Extra references
  Complete list of observatories + viewing capacities
  List of coordinate systems in the solar System
...
## Extra information

**EUROPLANET RI**
- Host Institute: Obs. de Paris
- Search

**DATA RESOURCES**
- Meteorites & lunar samples
- Ices & minerals spectra
- Ephemeris
- Exoplanets

**VO ARCHITECTURE**
- Technical docs
- Use cases/Tutorials

**SERVICES**
- VO demonstrators

**TOOLS**
- Visualisation tools
- Spaceborne Data

**DATA**
- Data Access
- External services
- Local databases

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**A Virtual Observatory in Planetary Science**

The following documents illustrate how to work with the planetary VO, based on real science cases.

### Help/tutorials for VO users

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<tr>
<td>EPN client &amp; TOPCAT</td>
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### EPSC 2013 use cases (videos)

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