



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

Stéphane Erard (1), Baptiste Cecconi (1), Pierre Le Sidaner (2), Angelo Pio Rossi (3), Michail Minin (3), Maria Teresa Capria (4), Bernard Schmitt (5), Vincent Génot (6), Nicolas André (6), Ann Carine Vandaele (7), Manuel Scherf (8), Ricardo Hueso (9), Anni Määttänen (10), Benoît Carry (11), Nicholas Achilleos (12), Chiara Marmo (13), Ondrej Santolik (14), Kevin Benson (12), and Pierre Fernique (15)

(1) LESIA, Obs. Paris/PSL/CNRS/UPMC/U. Paris-Diderot, Fr (stephane.erard@obspm.fr), (2) DIO-VO, UMS2201 Obs. Paris/CNRS, Fr, (3) Jacobs University, Bremen, Ge, (4) INAF/IAPS, Rome, It, (5) IPAG UGA/CNRS, Grenoble, Fr, (6) IRAP/CNRS, Toulouse, Fr, (7) IASB/BIRA, Brussels, Be, (8) OeAW, Graz, Aust, (9) UPV/EHU, Bilbao, Spain, (10) LATMOS/CNRS, Guyancourt, Fr, (11) OCA, Nice, Fr, (12) University College London, UK, (13) GEOPS/CNRS/ U. Paris-Sud, Fr, (14) IAP, Prague, Cz R., (15) Observatoire de Strasbourg/UMR 7550, F

The Europlanet2020 program, started Sept 1st, 2015 for 4 years, includes an activity adapting Virtual Observatory (VO) techniques to handle Planetary Science data. The objective of this activity, VESPA, is to facilitate searches in big archives as well as sparse databases, to provide simple data access and on-line visualization, and to allow small data providers to make their data available in an interoperable environment with minimum effort. This system makes intensive use of studies and developments led in Astronomy (IVOA), solar Physics (HELIO), and space archive services (IPDA).

The VESPA data access system, based on a prototype developed in a previous EU program, has been hugely improved during the first two years of Europlanet2020 [1]: the infrastructure has been upgraded to describe data in many fields more accurately (Data Model and EPN-TAP access protocol); the main user search interface (<http://vespa.obspm.fr>) has been redesigned to provide more flexibility; alternative ways to access Planetary Science data services from VO tools have been implemented (in TOPCAT, Aladin, CASSIS, 3Dview, etc) in addition to receiving data from the main interface; connection with VO tools are being improved to handle specificities of Solar System data, e.g., measurements in reflected light, coordinate systems, etc; current steps include the development of a connection between the VO world and GIS tools, and integration of Heliophysics, planetary plasma, and mineral spectroscopy data to support of the analysis of observations.

Besides, existing data services have been updated, and new services have been designed and installed. The global objective is already overstepped, with 37 services open and about 15 more being finalized.

A procedure has been identified to install data services with little resources, and hands-on sessions are organized twice a year at EGU and EPSC conferences in Europe; this is expected to favour the installation of services by individual research teams, e.g. to distribute derived data related to a published study. In complement, regular discussions are held with big data providers, starting with space agencies (IPDA). Common projects with ESA and NASA's PDS have been started, with the goal to connect PDS4 and EPN-TAP. In parallel, a Solar System Interest Group has been started at the IVOA, where several VESPA partners contribute; the goal here is to adapt existing astronomy standards to Planetary Science.

The Europlanet 2020 Research Infrastructure project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 654208.

[1] Erard et al 2018, Planet. Space Sci.150, 65-85. 10.1016/j.pss.2017.05.013. ArXiv 1705.09727