

**EXPLORE – Innovative Scientific Data Exploration and Exploitation Applications for Space Sciences – The lunar case**  
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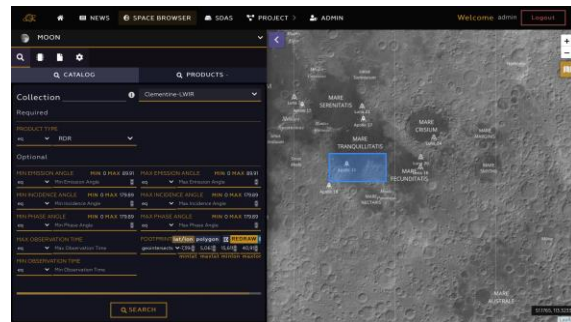
**Introduction:** In this contribution we present the EXPLORE Horizon 2020 Research & Innovation project and its first outcomes. EXPLORE's main objective is to develop and deploy a suite of scientific data applications (SDAs) to foster exploitation of scientific data from planetary space & astrophysics missions. EXPLORE is placed in a broader landscape of new open science platforms, and initiatives such as the European Open Science Cloud [1].

**Scientific Data Applications:** Within EXPLORE six scientific data applications (SDAs) will produce new scientific data products and offer new scientific services. Two applications, L-Explo and L-Hex, integrate data from a range of lunar missions to focus on characterisation of the Moon's surface and potential human landing sites. The other four applications leverage data primarily from Gaia, developing tools to study the evolution of our galaxy, interstellar dust clouds, and support the discovery, classification, and characterisation of stars. The SDAs utilise state-of-the-art machine learning and visual analytics to enhance scientific return and discovery of space science missions.

**EXPLORE platform:** To support the development and testing of the SDAs we set-up a virtual platform, <https://explore-platform.eu> which, in addition to running SDAs for users the platform, also has a space browser functionality to easily find data for a selected number of planetary missions (Figure 1: EXPLORE platform space browser). The final goal is to deploy the SDAs, under open-source licences, on different cloud science platforms where and when possible (e.g. ESA Datalabs [2] and ESCAPE Science Analysis Platform [3]) to stimulate uptake and sustainability of both SDAs and these platforms.

**Lunar SDAs:** The L-Explo service will be for large scale mapping and geology with visualisations in 2/2.5D. L-Hex focusses on the smaller scale features that are of interest to local, small scale (human and robotic) exploration, with visualisations extending to 3D. Both SDAs interface to standard backends in order to query and access ingested planetary data, and aim to be complementary to existing initiatives such as Moon

Trek [4], QuickMap [5], and Orbital Data Explorer [6]. First proto-types will be deployed mid-2022.



**Figure 1: EXPLORE platform space browser (showing the Lunar map)**

**Summary:** EXPLORE's ambition is to help democratise space science exploration and exploitation with open data and open science. The lunar SDAs are furthermore timely in light of the 50<sup>th</sup> year celebration of the last humans to set foot on the Moon (11 Dec, 2022) and the global renewed interest to visit our celestial sister.

#### References:

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- [5] *QuickMap help*, <https://docs.quickmap.io>
- [6] Wang et al. (2021), *Planetary data search with PDS geosciences node's Orbital Data Explorer*, LPI Contributions, 2549, 7025

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