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THE NEO PHYSICAL PROPERTIES DATABASE: FUTURE PERSPECTIVES OF THE NEOROCKS EU PROJECT

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Extended Abstract—

The EU funded NEOROCKS project (Near-Earth Objects Rapid Observation, Characterization and Key Simulations) (GA n. 870403) focuses not only on improving knowledge on physical characterization of Near-Earth Objects (NEOs) for planetary defense, but also on the development and the deployment of a NEOs physical properties database (PPDB). Astronomical observations (and the related modelling to derive their dynamical and physical properties) can support a pragmatic planetary defense approach, i.e. providing operational loops and information systems to protect us and our ground infrastructures from potential threats. The increasing NEO discovery rate, dominated by small-size objects, represents the major challenge for planetary defense. In particular, “imminent impactors”, with short warning times, are a major threat and the international coordination is fundamental to speed-up response times.

Due to the lack of a unique database for all different data products resulting from physical characterization of NEO observations, the deployment of a NEO PPDB is one of the main outcomes of the NEOROCKS project. A data model has been designed following the well-defined IVOA (International Virtual Observatory Alliance) standards. This implies the possibility to envisage the ability to store, maintain, give access and be regularly updated at all different levels of processing (from raw data to final products), in order to be compliant with existing virtual observatory (VO) services. The NEOROCKS database is integrated within the project Technical Web Portal and available only to the consortium partners to date. However, the final goal is to permanently guarantee the access to external users and the necessary maintenance to the portal (Figure 1) and database (Figure 2) beyond the nominal life end of the project. In this light, NEOROCKS results will provide the scientific community - involved in Near-Earth Objects physical characterization - with an enduring repository, on-line tools and a facility able to support and maximize the scientific exploitation (and return) of their data and to optimize follow-up observations.

This will be achieved through the long-standing experience in hosting data by a permanent infrastructure devoted to space-data management: the Space Science Data Centre (SSDC), a facility of the Italian Space Agency (ASI) (https://www.ssdc.asi.it), which is equipped with necessary HW/SW resources.

The ASI-SSDC expertise in managing data -produced by several astronomical missions- makes this data center the proper facility to take up the role of maintaining and disseminating data and tools

developed within the NEOROCKS project [1]. Over the decades, ASI-SSDC has acquired, managed, processed and distributed space mission data following FAIR (Findable, Accessible, Interoperable, Reusable) principles [2], i.e. using international standards which assure both the long-term archive preservation and the interoperability with other data centers. The NEOROCKS project will greatly benefit of the opportunity to perpetuate the results obtained within the project by the migration of the data and of the tools developed to the ASI-SSDC.

The access to external users will be provided after the forthcoming migration of both portal and database. This relocation will extend the maintenance and the operability of the database, beyond the duration of the NEOROCKS project, meeting one of the major goals of the EU Horizon 2020 Programme.

The possibility of having a reference repository of NEO physical properties data from raw images to final products – hosted by an existing well-established astronomical data center (ASI-SSDC) – will ensure that the efforts carried out during the project will remain publicly available to the international astronomical community and further enhanced in the future. In this light, NEOROCKS proposes an advanced approach - focused on data dissemination and aimed to optimize observational activities - enhancing modelling and simulation tasks, fostering international coordination, and exploiting results in order to speed-up response times. Finally, a permanent facility enhances the experience gained during the project at a global level, paving the way toward an international cooperation on NEO physical characterization and, hence, providing roadmaps of the next steps. The project looks at working in synergy with other initiatives undertaken at European and international level (i.e., NEO Segment of the ESA SSA (European Space Agency Space Situational Awareness) programme and the UN Office for Outer Space Affairs (UNOOSA)).

Since the NEO discovery scenario will be dramatically modified by the incoming next generation of sky surveys, both from the ground [3] [4] and in space [5], the expected sharp increase in the discovery rate calls for an equally efficient follow-up observational network in order to secure the orbit and perform physical characterization. Yet, while the NEO orbital data policy is established by the International Astronomical Union (IAU) with the Minor Planet Centre (MPC) routinely collecting, storing and distributing all solar system small bodies astrometric observations as well as computing the corresponding orbital catalogues. On the other hand, the management of the NEO physical properties does not follow an organized data dissemination structure. The observed NEO physical properties are the result of scientific research and published as such. Only a minor fraction is available on-line.

Eventually, according to the several European Union's several R&D actions (e.g. [6] [7]) (NEOROCKS being the most recent), the EU 2021-27 Space Programme including NEOs [8] and the harmonization with ESA activities through Framework Partnership Agreement (FFPA) [9], achieving significant progresses on NEO physical characterization is a major goal with the exploitation of already available technical resources as first step. Building on that, care has been taken to consider the ESA NEO Coordination Centre [10] as a primary data source for the NEOROCKS Technical Portal and database. Nevertheless, the NEOROCKS physical properties database can be easily integrated into future open operational European NEO monitoring systems since the Europlanet [11] guidelines for developing the data access services have been applied.

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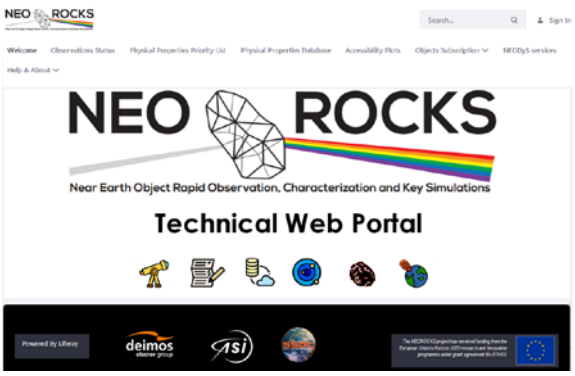

Figure 1 - The graphical user interface (GUI) of the NEOROCKS Technical Web Portal.

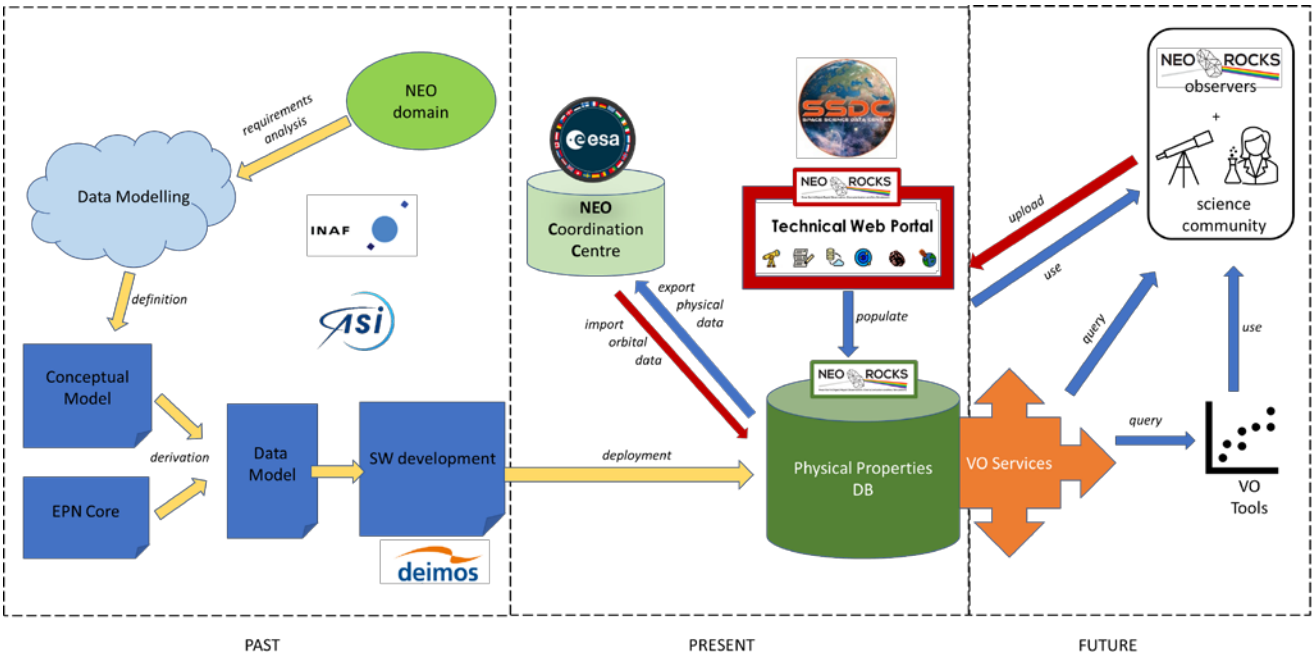

Figure 2 – Current status and future perspectives of the NEOROCKS physical properties database.