The NEO Physical Properties Database of the Neorocks EU Project. A. Zinzi, M. Giardino, A. Giunta, E. Perozzi, A. Di Cecco, G. Polenta and the NEOROCKS team, [1]ASI – Space Science Data Center, Via del Politecnico snc, 00133, Rome, Italy, angelo.zinzi@ssdc.asi.it, [2]Agenzia Spaziale Italiana

Introduction: The current discovery rate of NEOs is about three thousand per year and this rate should increase shortly in the next years when the near-future wide-field high sensitivity NEO surveys such as NEOCam, Fly Eye and LSST will come into operation leading a large amount of data. This, together with the fact that observations devoted to NEO physical characterization are inhomogeneous and sparsely distributed, will make the long-term storage and dissemination of this data crucial.

Within the Data Management activities of the EU funded NEOROCKS project (NEO Rapid Observation, Characterization and Key Simulations), the Space Science Data Center of the Italian Space Agency (ASI-SSDC), relying on its long-lasting experience on space-data dissemination, is defining a novel NEO Physical Properties database.

This database will be capable of hosting a great variety of NEO physical characterization data products, ensuring an efficient dissemination, their scientific exploitation and their long-term storage by using an original data model derived from the EPNCore, a well-defined IVOA (International Virtual Observatory Association) standard [1] targeted at maximizing data discovery in science fields related to the Solar System.

The NEOROCKS data model: We are developing a data model derived from well-defined IVOA (International Virtual Observatory Alliance) standards, aiming at making the NEOROCKS database compliant by-design with the set of existing virtual observatory services. This implies the ability to store, maintain, give access and regularly update all different levels of processing, from raw data to final products (e.g. size, rotation, spectral type).

During the data model design process, a main challenging objective has been the inclusion of the several properties to be taken into consideration for an extensive physical description of NEOs, while, at the same time, using the already existing meta data fields defined in the IVOA standards. Starting from a conceptual modelling of the domain, focusing at representing accurately the entities, we then stepped to a logical modelling, taking into account also the implementation constraints to deal with performance issues of the data access layer [2].

For this scope we used sets of parameters already defined in the standard, in particular, apart for those tagged as mandatory in the EPN-TAP Data Model (e.g., target_name, target_class, processing_level, c1min/max, …), we used a list of parameters from the "Common" and "Solar System Objects" thematic extensions (e.g., eccentricity, id_mpc, albedo, …), together with some defined in particular EPN-TAP resources, such as LOFAR_Jupiter, APIS and PVOL.

In this way, both observations and physical properties can be adequately described, without losing precious information.

During the lifetime of the NEOROCKS project, this data model is representing the foundation for the database schema development. A data access layer based on the Java language is defined on top of the database to enable both query and upload functionalities provided in the NEOROCKS technical web portal, planned for a public release at the end of the project itself.

Data sources: NEO data (orbital elements and physical properties) will be initially imported from existing sources, such as the NEO Coordination Center (NEOCC) of the European Space Agency (ESA), including the European Asteroids Research Node (EARN) NEO catalog no longer updated since 2016.

In a second phase the database will be instead updated regularly by the NEOROCKS users after performing new observations throughout the project duration. The NEOROCKS consortium in fact, either through competitive proposal or by direct funding, has access to a wide variety of observational assets developed and operated within the framework of European and international research collaborations as well as national assets in order to perform spectroscopic, photometric, polarimetric and radar observations for physical characterization.

Apart from the people directly belonging to the NEOROCKS project, additional "external partners", whose contribution to the project has been approved by the consortium, shall be involved in order to allow receiving contributions from other collaborating observers and amateurs.

In addition the Solar System Objects (SSO) NEO physical properties in the Gaia DR2 [3] and DR3, including positions, parallaxes, proper motions, G-band fluxes as well as integrated red (RP) and blue-band (BP) fluxes of thousands of asteroids will be imported and integrated into the NEOROCKS Physical Properties Database.

Finally there is a tremendous amount of data stored in the archives of ground and space based telescopes with wide fields of view such as LBT, VST and CFHT.

Carrying out a fundamental activities of data mining will be possible to retrieve additional and important physical information for NEOs serendipitously observed which could also be stored in the database.

The orbital elements will then be regularly updated from the NEOCC source to let the users exploit the most accurate results based upon the latest version of dynamical data.

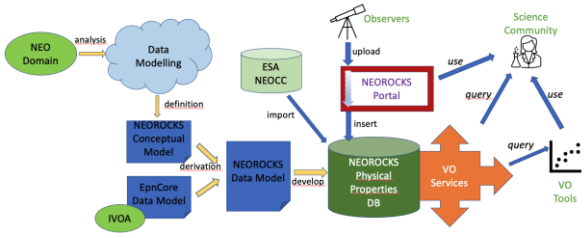

Figure 1: Overview of the NEOROCKS technical web portal

The technical portal and the future ASI NEO Data Center: The final outcome will be a technical web portal where both authenticated and anonymous users can access data through a query interface, with different access privileges. This portal will allow to display both dynamical and physical properties of any given NEO, or to search for samples within the NEO population satisfying the user desired requirements.

A restricted area will be dedicated to observation upload functionalities, making possible to coordinate observational run and to enrich the database with the outcomes represented by both data files and further refinements of the NEO physical characterization coming from NEOROCKS users.

As we plan to host this center at SSDC, these services will be available beyond the duration of the NEOROCKS project as a reliable and interoperable source of services and data on NEO physical properties.

In this way it will be possible to address the need of a unique database for all different data products resulting from NEO observations well beyond the nominal lifetime of the NEOROCKS project. In fact differently from astrometric observations, which have a centralized data center acting under International Astronomical Union (IAU) mandate, the outcome of ground based NEO observations devoted to physical characterization are inhomogeneous, sparsely distributed, difficult to access and only the final products rarely have been turned into a publicly available database (e.g. EARN catalog).

The web application is based on a "three layers logical architecture" deployed with Liferay DXP on top of an Apache Tomcat installation.

To enhance system modularity, configurability and portability, the web server and the DBMS (Data Base Management System) are being developed as separate virtual machines and, during its final public release, it is foreseen an installation into the SSDC virtualization cluster, taking advantage of its resilient execution environment and a long-term preservation approach given by the Italian Space Agency institutional assignment.

The software development is based on agile methodology principles, using a DevOps approach. The early verification of the source code quality is performed with SonarQube, while for unit testing JUnit is the reference tool. The CI/CD (Continuous Integration/Continuous Delivery) is achieved by means of a tool set to automate building, testing and deployment: BitBucket and Nexus are the software repositories, Bamboo is used for automatic workflows, Jira and Confluence for project management and bug tracking.

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