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NEOROCKS project: results from photometric survey of Near-Earth objects

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Due to their proximity Near-Earth objects (NEOs) provide us with a unique opportunity to investigate asteroids with diameters down to dozens of meters. Moreover, NEOs create a constant potential hazard to the Earth, and thus the study of their physical properties is crucial for estimating the potential risks. A new photometric survey was carried out in the framework of the NEOROCKS (NEO Rapid Observation, Characterization, and Key Simulations) project funded by the European Union's Horizon 2020 program with the aim to derive the visible colors of NEOs and perform the initial taxonomic classification.

The photometric survey was performed with a use of a 1.2m telescope at the Haute-Provence observatory and a 1.0m telescope at the Pic du Midi observatory, both located in France. Standard broadband Johnson-Cousins and Sloan photometric systems were used.

Color indexes were measured for a total of 51 NEOs. Among them, 24 objects belong to a group of potentially hazardous asteroids (PHAs). The majority of objects have absolute magnitude H in a 17-20 mag range.

The preliminary taxonomy was done following the classification by [1] using M4AST service [2]. In order to have better statistics only the main taxons S-, C-, and X-complexes, and A-, D-, V-types were considered. Fig. 1 shows color-color diagrams for the observed NEOs. One can see that different classes of objects are concentrated in the different areas of the plots, which suggests that our taxonomic classification is rather reliable. Additionally, our taxonomic classification was confirmed by albedo values that are available for about a third of objects in our sample. About 43% of objects in our sample belong to the S+Q-complex, about 19% to X-complex, 16% to C-complex, 12% were classified as D-types, and, finally, 6% and 4% as A- and V-types, respectively. The found distribution is in a general agreement with the previous works (e.g. [3, 4, 5]).

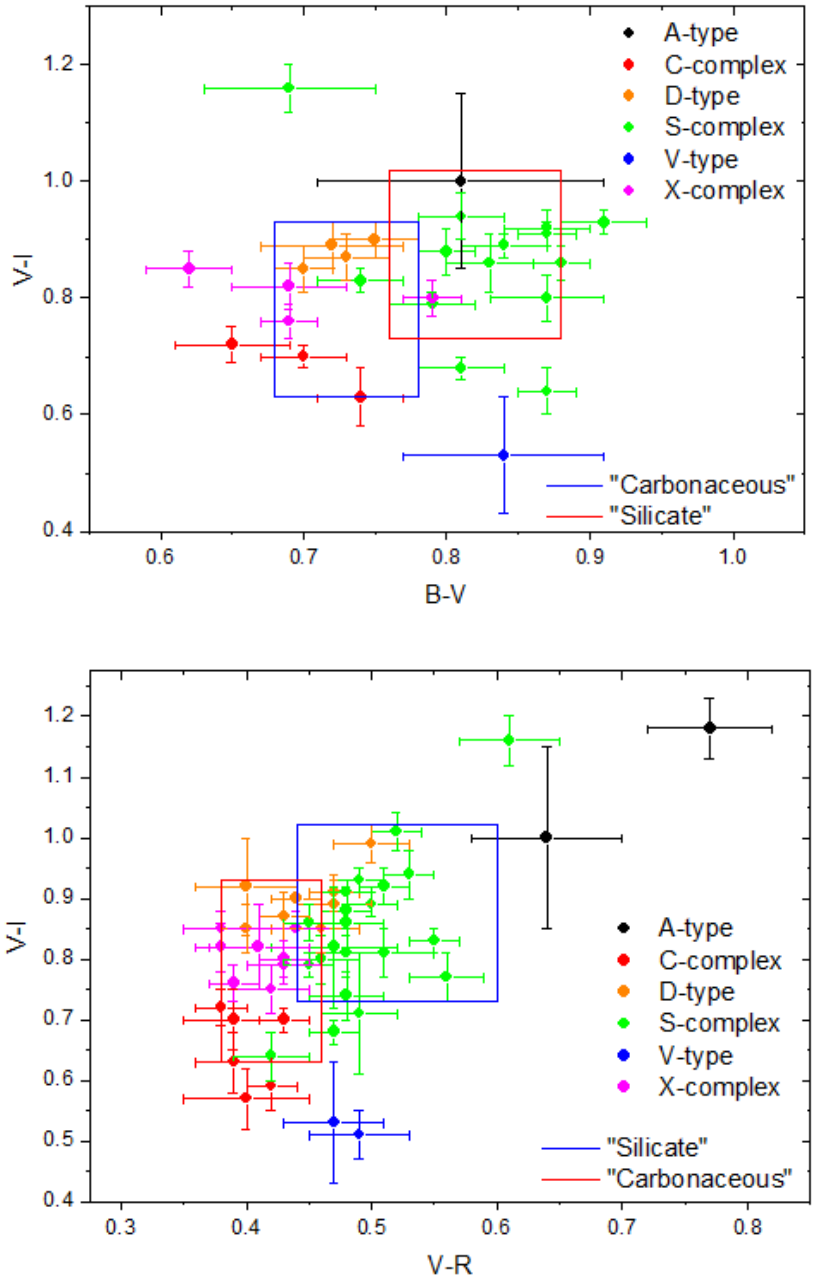

Fig. 1. Color-color diagrams for the objects in our survey showing their classification into the main taxonomic classes. The boxes represent the 1σ deviation from the mean colors for the groups of "carbonaceous" and "silicate" objects.

The median values of absolute magnitudes and estimated diameters vary for different groups of objects in our sample: H=18.10±0.95 and D=1219±729 m for low-albedo "carbonaceous" objects, whereas H=19.50±1.20 and D=344±226 m for "silicate" objects. This could be a result of an observational bias towards higher albedo objects. The absolute magnitude versus Minimal Orbital Intersection Distance (MOID) was also derived (Fig. 2). PHAs by almost 65% represented by "silicate" objects, however there are also a few low albedo objects that could be more challenging in terms of mitigation that relies on the porosity of the object (e.g. [6]).

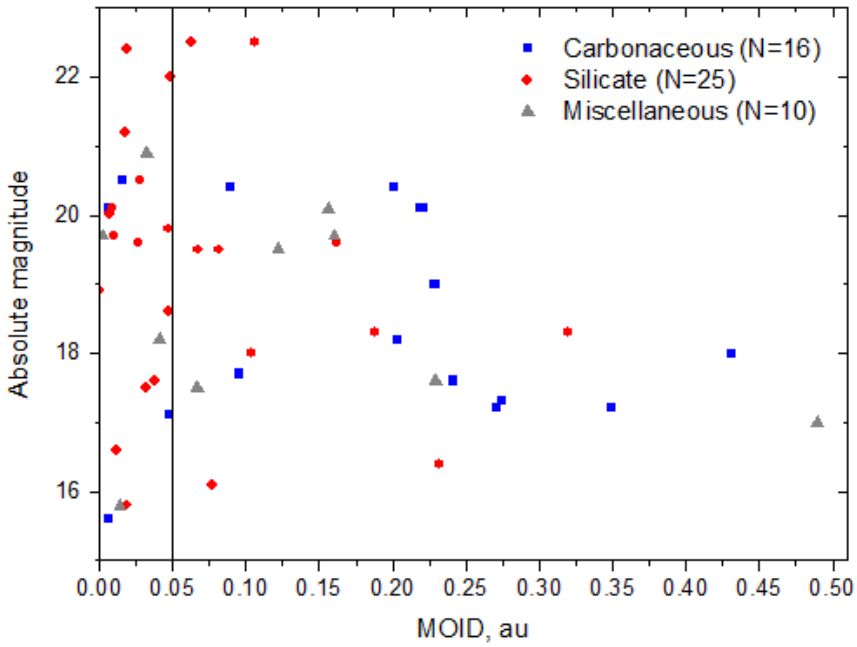

Fig. 2. Earth's MOID vs. absolute magnitude for different groups of NEOs. The line at MOID=0.05 au separates PHAs from the rest of the NEOs.

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