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NEOROCKS PROJECT: SPECTROPHOTOMETRY OF SMALL NEAR-EARTH ASTEROIDS

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Extended Abstract—

NEOROCKS project, dedicated to improving knowledge of the physical characteristics of the Near Earth Objects (NEOs) population, was selected following the EU call "SU-SPACE-23-SEC-2019: Advanced research in NEOs and new payload technologies for planetary defense from the Horizon 2020 - Work Programme 2018-2020 Leadership in Enabling and Industrial Technologies – Space". NEOROCKS project, started at beginning of 2020, is devoted to enlarging our knowledge of the NEOs using different observational techniques. Our team at Paris Observatory is taking charge of the photometric properties of small near-Earth objects.

Observations

Photometric observations in France were performed during several observational runs using the 1.2m telescope at the Haute-Provence observatory and the 1.0m telescope at the Pic du Midi observatory.

Up to now, we observed about 150 NEOs with the majority of the objects having a diameter of less than 500m with the objective to improve their surface properties and to select interesting NEO targets for space missions. The project is still ongoing and more observations are planned in 2023.

Results

In this work, we present the obtained results for the 93 small NEOs that has been already analyzed and published in Hromakina et al. (2021, 2023). Figure 1 shows color-color diagram for NEOs with measured B-V-R-I magnitudes.

Based on the obtained magnitudes we estimated the taxonomic classes of the objects following the classification by DeMeo et al. (2009). This was done by transforming the colors into reflectances relative to the Sun by using solar colors from Holmberg et al. (2006) and comparing the resulted spectra with the mean spectra of the taxonomic classes. We used the M4AST service (Popescu et al. 2012) to search for the best match. An example of the spectra of two NEOs together the most fitting taxonomic class is shown in Figure 2.

For classification we used only the main taxonomic classes, such as S-complex (including Q-type), C-complex, X-complex, A-type, D-type, and V-type. The distribution of taxonomic classes is presented in Figure 3. Over 40% of analysed NEOs belong to the S-complex, whereas the fraction of C-, X-complex and D-type is respectively in the 10-20% range. And the fraction of A- and V-type asteroids does not exceed a few percent.

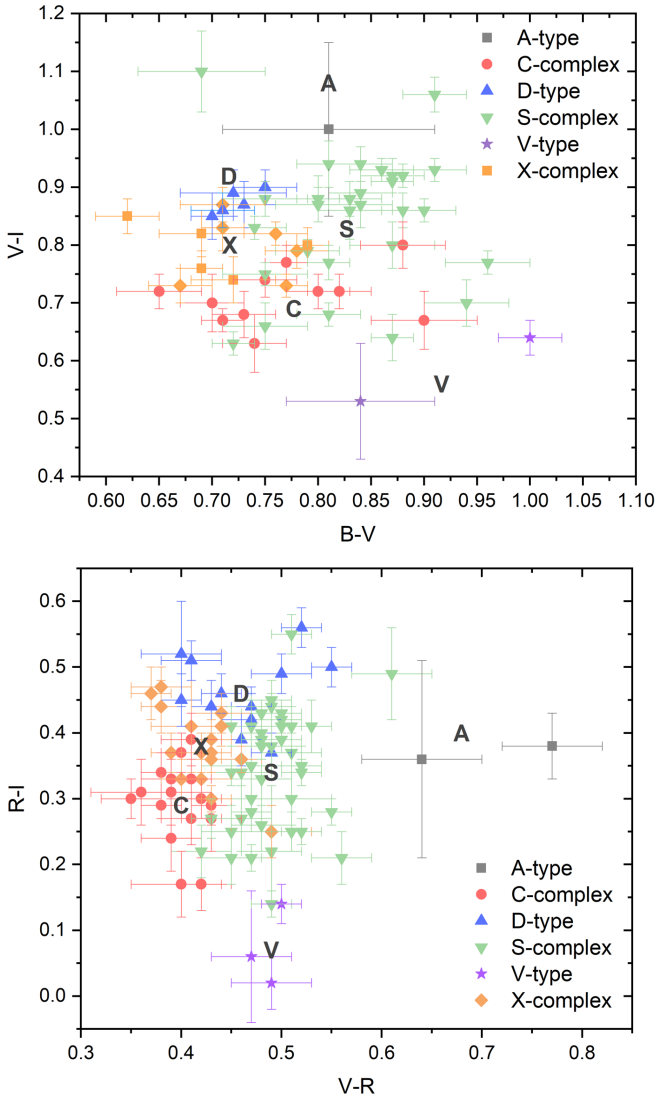

Figure 1. Color-color diagrams showing main taxonomic classes for analyzed dataset. Bold letters indicate the mean values of the corresponding taxonomic classes.

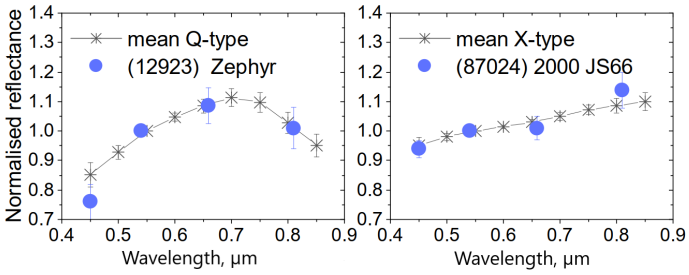

Figure 2. Two examples of individual reflectance spectra together with the mean spectra of the fitting taxonomic class from DeMeo et al. (2009). Spectra are normalized at 0.54 μm.

Following the classification, we estimated the diameters of the observed NEOs by using the calculated absolute magnitudes and assuming the albedo as a mean value of their taxonomic class from Holmberg et al. (2006).

Among the observed NEOs we were also able to select objects that could be easily accessible by a space mission based on their MOID and ΔV values.

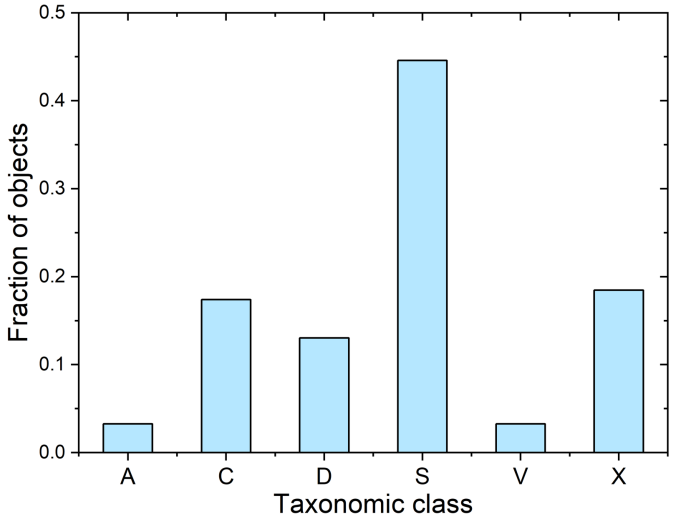

Figure 3. Distribution of the taxonomic classes within the NEOROCKS survey data (N=93 NEOs).

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References

DeMeo F. E., Binzel R. P., Slivan S. M., Bus S. J., 2009, Icarus, 202, 160.

Holmberg J., Flynn C., Portinari L., 2006, MNRAS, 367, 449.

Hromakina T., et al., 2021, A&A, 656, A89.

Hromakina T., et al., 2023, MNRAS, 520, 3143.

Popescu M., Birlan M., Nedelcu D. A., 2012, A&A, 544, A130.

Ryan E. L., Woodward C. E., 2010, AJ, 140, 933.

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