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NEO Characterization

CALIBRATE THE POLARIZATION-ALBEDO RELATIONSHIP FOR NEOS BY COMBINING RADAR, POLARIMETRIC AND OPTICAL LIGHTCURVES DATA

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ABSTRACT

The degree of linear polarization of the sunlight scattered by an asteroid surface is primarily dependant on its albedo [1]. There exists an anti-correlation where high albedo results in low polarization while low albedo provides high polarization. Polarization is also dependant on the phase angle at which the target is observed. If the albedo-polarization relationship has been calibrated for main-belt asteroids observed at low phase angle (< 30°) [2], this relationship remains to be accurately calibrated for higher phase angles at which most of the NEOs can be observed. We present here the first result of a multi-year observation campaign to obtain polarimetric and photometric observation of NEOs aiming to calibrate the albedo-polarization relationship for NEOs. We are also making use of archived observations from the Arecibo Observatory.

The Arecibo Observatory accumulated radar observations of hundreds of NEOs during its years of operation. To complement this dataset, we are regularly acquiring optical lightcurves and polarimetric observations on objects previously observed in radar, allowing a more complete characterization. The lightcurves are obtained using the TRAPPIST-South and -North 0.6-m telescopes [3] located at the La Silla Observatory, Chile, and the Oukaïmeden Observatory, Morocco, respectively. Polarimetric observations are conducted with the ToPol polarimeter [4] mounted on the Omicron-West 1-m telescope at the Calern Observatory, France.

Dense optical lightcurves covering a complete rotation are obtained at different solar phase angles to accurately determine the rotation period and for shape modelling purposes. Together with the rotation period from lightcurves, the radar data allow us to better constrain the size of our targets. The lightcurves and delay-Doppler radar images are then used with the SHAPE software [5] to derive the spin axis orientation and to reconstruct a shape model. Polarimetric observations are obtained at various

solar phase angles to characterize the phase-polarization curve and constrain the albedo. We are also looking for large-scale features present on the radar images and the shape model that could be linked to rotational variation of the degree of linear polarization. We will present the results of the characterization of 12 NEAs including 8 potentially hazardous asteroids that were observed in 2022.

[1] Belskaya, I. et al. Asteroids IV 151–163 (2015).
[2] Cellino, A. et al. Monthly Notices of the Royal Astronomical Society 451, 3473–3488 (2015).
[3] Jehin, E. et al. The Messenger 145, 2–6 (2011).
[4] Devogèle, M. et al. Monthly Notices of the Royal Astronomical Society 465, 4335–4347 (2017).
[5] Magri, C. et al. Icarus 186, 152-177 (2007).

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Comments:

Oral presentation preferred, if possible