Bulletin of the AAS • Vol. 54, Issue 8

Polarimetry as a tool for physical characterization of potentially hazardous NEOs

Maxime Devogele[1] Joseph Masiero[2] Nathalia Vega Santiago[3] Philippe Bendjoya[4] Jean-Pierre Rivet[4] Alberto Cellino[5] Marin Ferrais[6] Emmanuel Jehin[7] Isabella Macias[2] Joahan Castaneda Jaimes[2] Nicholas Moskovitz[8] Galin Borisov[9]

[1]Arecibo Observatory, [2]Caltech/IPAC, [3]University of Puerto Rico, [4]Observatoire de la Côte d'Azur, [5]INAF - Osservatorio Astrofisico di Torino, [6]Laboratoire D'Astrophysique de Marseille, [7]Université de Liège, [8]Lowell Observatory, [9]Institute of Astronomy with NAO, Bulgarian Academy of Sciences

Published on: Oct 20, 2022

URL: https://baas.aas.org/pub/2022n8i104p02

The degree of linear polarization of sunlight scattered by an asteroid contains valuable information for rapid characterization of the surface properties of Near-Earth objects (NEOs). In the case of atmosphereless bodies the state of linear polarization varies as a function of the phase angle (α) and is described using the so-called Pr parameter [1].

The properties of the phase-polarization curve of an asteroid are mostly defined by its albedo (pV). Numerous calibrations between polarization and pV have been proposed for main-belt asteroids [2, 3]. However, main-belt asteroids rarely exceed phase angle > 30° while near Earth objects can be observed at phase angle as large as 100°[4]. These observations at higher phase angles allow for deeper characterization of the observed object, but there is currently a lack of observations of NEOs in polarimetry to accurately calibrate the albedo-polarization relationship at high phase angles.

We recently started a survey of Near-earth Objects in polarimetry to characterize their phase-polarization curve at high phase angle in order to calibrate the relation between polarization and albedo. These polarimetric observations are complemented with visible photometry, thermal infra-red, spectroscopy, and/or radar observations to obtain independent characterization of the size, shape, albedo, and other surface properties of the objects observed in polarimetry.

In this presentation, we will present the polarimetric observations obtained so far. We describe the large variety variety of polarimetric response at high phase angle with polarization ranging from 1 to 50% when observed at the same phase angle. We also discuss the first results using physical characterization using radar, photometric, and thermal observations and how these can be used to calibrate the relation existing between polarimetry and albedo.

[1] I. Belskaya, A. Cellino, R. Gil-Hutton, et al., Asteroid Polarimetry, Asteroid IV, (2015) 151-163

[2] A. Cellino, R. Gil-Hutton, A. Dell'Oro, et al. A new calibration of the albedo-polarization relation for the asteroids, JQSRT 113 (2012) 2552–2560.

[3] A. Cellino, S. Bagnulo, R. Gil-Hutton, et al., On the calibration of the relation between geometric albedo and polarimetric properties for the asteroids, MNRAS 451 (2015) 3473–3488.

[4] M. Devogele, A. Cellino, G. Borisov, et al. The phase-polarization curve of asteroid (3200) Phaethon, MNRAS, 479 (2018) 3498-3508