EPSC Abstracts
Vol. 13, EPSC-DPS2019-9-1, 2019
EPSC-DPS Joint Meeting 2019

EPSC
EPSC-DPS Joint Meeting 2019
15–20 September 2019 | Geneva, Switzerland

Detection of Longitudinal Albedo and Metallicity Variations of Asteroids with Ground-Based, Part-Per-Million Polarimetry

Sloane J. Wiktorowicz (1), Joseph Masiero (2), and Jay Goguen (2)
(1) The Aerospace Corporation, USA, (2) Jet Propulsion Laboratory, USA (sloane.j.wiktorowicz@aero.org)

Abstract

The linear polarization and albedo of rocky solar system bodies is anticorrelated: dark surfaces, dominated by single scattering, are strongly polarized, but multiple scattering in bright surfaces randomizes the electric field orientation and reduces polarization. As an asteroid rotates, both shape changes and surface albedo variations affect reflected light flux, causing difficulty in the identification of albedo variations. Polarimetry, however, is insensitive to shape changes: as total flux varies with instantaneous cross-sectional area, fractional polarization does not. Thus, rotational variability in linear polarization is a hallmark of albedo inhomogeneity, and it cannot be identified with photometry alone.

Until now, polarimeters have only discovered high significance rotational variation of linear polarization for (4) Vesta. We report on Lick 3-m observations of Main Belt asteroids with the POLISH2 polarimeter, which utilizes photoelastic modulators instead of a waveplate. We have not only confirmed rotational variations in (4) Vesta, but we have also discovered variations in (1) Ceres, (3) Juno, and (7) Iris. The amplitude of variations for (3) Juno, (4) Vesta, and (7) Iris are stronger than those of (1) Ceres due to the latter's relatively homogeneous surface.

Circular polarization, which may originate from multiple scattering or from the phase retardance introduced by a metalliferous surface, has been observed in nearly all Solar System bodies except for asteroids. POLISH2 simultaneously measures linear and circular polarization, and we report the discovery of non-zero circular polarization from both (7) Iris and the metallic (216) Kleopatra. This is in stark contrast to the non-detection of time-averaged circular polarization from the differentiated (1) Ceres and (4) Vesta. Therefore, optical circular polarization may provide a new way to identify metalliferous asteroid surfaces.