Diversity among the Polarization Opposition Effects for High-Albedo Atmosphereless Solar System Bodies

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The negative polarization (meaning that the electric field vector component parallel to the scattering plane dominates the perpendicular component) has been observed near opposition for objects of quite varying nature, such as Mars, Mercury, planetary satellites and rings, asteroids, cometary and interplanetary dust as well as meteorites and laboratory samples. The angular dependence of negative polarization depends strongly on albedo of bodies. It can exhibit a wide, almost parabolically shaped negative polarization branch (NPB) with a minimum near 5°−12° (e.g., for regolith of moderate- and low-albedo asteroids, cometary, interplanetary and perhaps circumstellar dust) while some high-albedo bodies display an asymmetric NPB with a sharp minimum centered at about 0.5°-2° (e.g. Jupiter's satellite Europa) – called the polarization opposition effect (POE). What are the differences in the negative polarization branch and the polarization opposition effect for different high-albedo bodies? To answer this question the additional observations near opposition are required.

We present the results new near-oppositions polarimetric observations of high-albedo E-type asteroids 44 Nysa (the geometric albedo is p_v=0.55) and 64 Angelina (p_v=0.48), the Galilean satellites of Jupiter Io (p_v=0.62), Europa (p_v=0.68), Ganymede (p_v=0.44), the Saturn's high-albedo satellite Enceladus (p_v=1.04) and Rhea (p_v=0.70) as well as bright trailing hemisphere of Iapetus (p_v=0.6) obtained in 2010-2013. The measurements of linear polarization for satellites and asteroids were carried out at the 2.6-m telescope of the Crimean Astrophysical Observatory in the R and RW filter (550–750 nm) and with the photoelectric polarimeter at the 0.7-m telescope of the Chuguyev Observation Station (Institute of Astronomy of Kharkiv National University) and at the 1-m RC telescope of the Crimean Astrophysical Observatory (Simeiz) in the V and R filters.

We will discuss the results of observations as well as why different objects with high albedo show differences in the shape and parameters of the POE ranging from a sharply asymmetric NPB (e.g. Enceladus, Rhea and Iapetus) to a secondary minimum of negative polarization distinctly separated from the main NPB minimum (e.g. asteroids 64 Angelina and 44 Nysa).