ON THE POLARIZATION OPPOSITION EFFECT OF E-TYPE ASTEROID 64 ANGELINA. N. N. Kiselev, Max–Planck–Institut für Aeronomie, Katlenburg–Lindau, Germany. N. M. Shakhovskoy, and Yu. S. Efimov, Crimean Astrophysical Observatory, 334413 Nauchny, Ukraine.

The theoretical understanding of the origin of the opposition brightness and negative linear polarization of atmosphereless solar system bodies at small phase angles is not yet properly understood. However, it is evident that there is no unique mechanism covering all of these bodies. Muinonen [1] has suggested that coherent backscattering can account for peculiar reflectance properties of some atmosphereless solar system bodies. Harris et al.[2] have observed a strong and unusually narrow (FWHM = 0.8°) photometric opposition effect (the opposition spike) for high albedo asteroids 44 Nysa and 64 Angelina. Mishchenko [3] has shown that, if the grains covering the surface of E-type asteroids are smaller than the wavelength, the photometric opposition effect should be accompanied by a polarization opposition effect of the same angular semi-width. The polarization opposition effect as well as the photometric opposition effect should be very wavelength-dependent. For low albedo asteroids there is no opposition spike, as was shown by Chernova et al.[4] and the opposition effect is controled by the shadowing mechanism. Therefore observations at very small phase angle, of a few tenths of a degree, are critical for testing the different mechanisms.

To verify the polarization opposition effect predicted by the theory for E-type asteroids the minor planet 64 Angelina was observed. The observations were conducted with the CrAO 1.25m–telescope and UBVRI photopolarimeter [5] during 8 nights from 20 to 28 July 1994 for phase angles of 0.12–2.40°. Most observations were made at bright Moon with low signal to noise ratio. Therefore the accuracy of the measurements was relatively low, especially in the U and B bands. More reliable data were obtained in R and I bands. Unfortunately, the minimum phase angle of Angelina occured on 22 July at the time of full Moon and of small separation (5.0°) from the Moon. Because the sky background changed significantly, the observations for the smallest phase angle are not be reliable. The polarization degree with respect to the scattering plane in R and I bands versus phase angle is presented in Figure I. Data of 64 Angelina and 44 Nysa obtained by Zellner and Gradie [6] are also given for phase angles less than 7°. One can see that our observations at phase angles of about 2° are the continuation of their data. Then the polarization changes sign at a phase angle of about 1.5° and reaches at a maximum value of 0.5% at a phase angle of 0.5°. Such behaviour is quite different from the theoretical prediction and also from observations of the high albedo Saturn's A and B rings [7]. A sharp rise of the negative polarization of Saturn's A and B rings does not lead to a change of the polarization sign. Additional observations of the high albedo asteroids are needed.

References.

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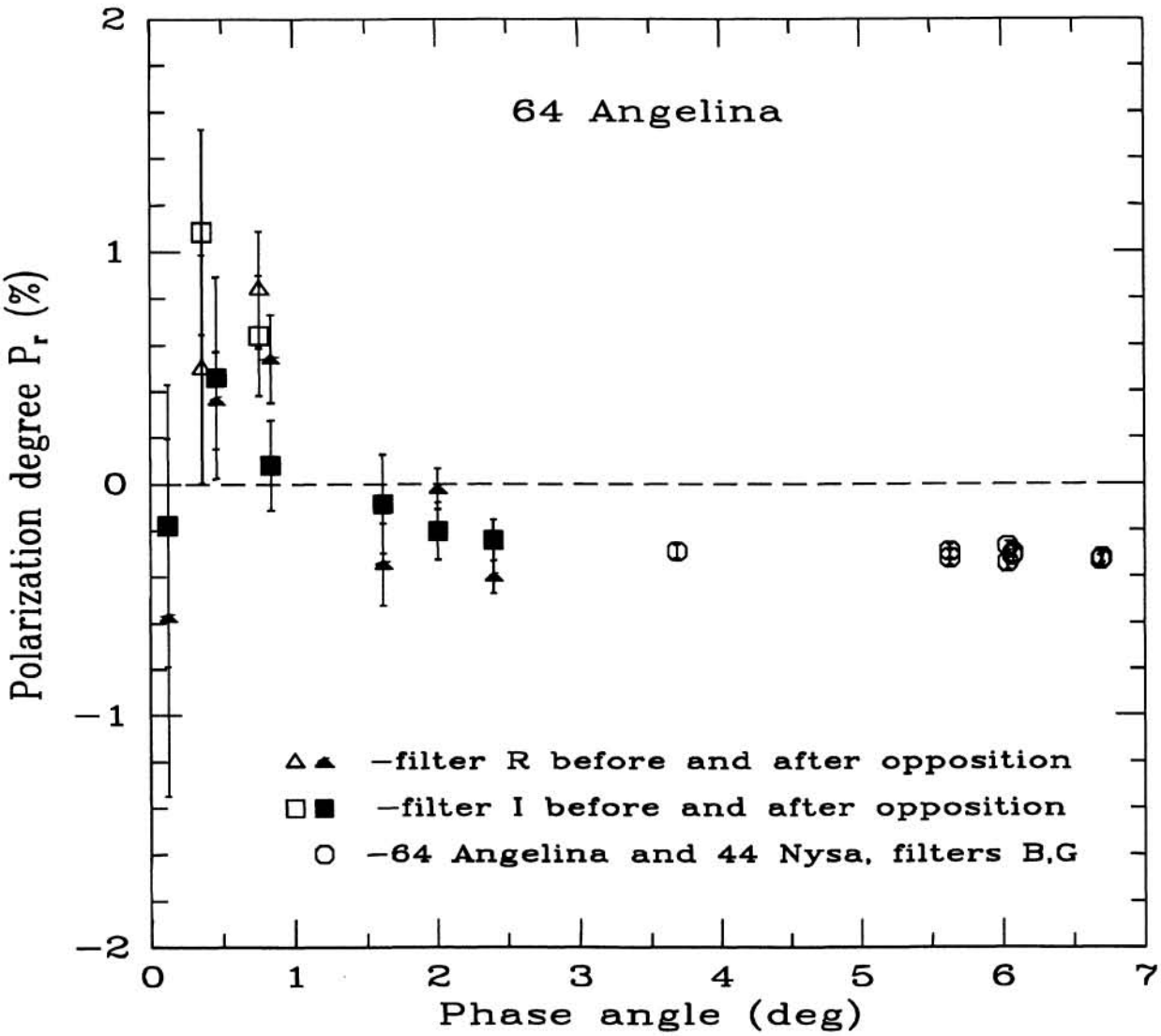


Fig. I. Polarization of 64 Angelina rersus phase angle. Triangles and squares are the Crimean data; circles are data by Zellner and Gradie (1976).