A Reversal in the Polarization Direction of the Zodiacal Light

C. Lee[1], S. S. Hong[1], S. M. Kwon[2], and J. L. Weinberg[3]

[1]*Astronomy Program, SEES, Seoul National University*

[2]*Department of Science Education, Kangwon National University*

[3]*Space Astronomy Lab, 3440 Quinn Ridge Drive, Snellville, GA 30039, U.S.A.*

The polarization direction of scattered light is generally perpendicular to the scattering plane. For some types of particles, however, it becomes occasionally parallel to it. The direction of polarization vector of the zodiacal light should provide us with some information on the optical properties of the interplanetary dust particles (IPDs), because the zodiacal light is the sunlight scattered by the very IPDs. We have investigated whether a reversal of the polarization direction occurs to the zodiacal light.

Recently we developed an efficient routine for reducing the polarized zodiacal light in photo-polarimetric observations of the night sky. With the routine we have determined both the polarized brightness and the polarization direction for the zodiacal light over almost an entire area of the sky. The direction was first specified in the coordinate frame of azimuth and altitude, and then converted in the frame of the differential ecliptic longitude, $\lambda-\lambda_{\odot}$, and the ecliptic latitude, β. We also have calculated the expected direction of the polarization vector in both the ecliptic and the horizontal coordinate frames by assuming that the direction is perpendicular to the scattering plane. By directly comparing the expected and the observed directions to each other, one could locate the range of solar elongation where the polarization vector becomes parallel to the scattering plane.

The observed directions of the vector turned out to be in good agreement with the expected directions in most range of the solar elongation. However, in the region where $160^{\circ} \lesssim \lambda-\lambda_{\odot} \lesssim 200^{\circ}$, the distribution of the observed directions is too chaotic to determine the polarization direction unambiguously. Particularly large scatter appears at the solar elongation around 160° . Considering the extreme weakness of the polarized brightness at this large elongation angle, we interpret the chaotic behavior of the polarization directions there as an evidence for the reversal.