On Measured Direction of the Zodiacal Light Polarization

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In usual practice of reducing the zodiacal light polarization from night sky observations, the light scattered in the Earth's atmosphere has been assumed to be polarized sufficiently weak that the observed polarization is essentially due to the zodiacal light component only. This makes problem so simple that there is no need to measure the polarization direction for the zodiacal light, because the scattering of sunlight by interplanetary dust particles would make the resulting zodiacal light polarized in the direction either perpendicular or parallel to the scattering plane.

Very recently, Lee (2001) did measure the direction of night sky polarization and was surprised to see that the measured polarization direction doesn't corroborate with the usual expectation of scattering theory. The night sky polarization isn't aligned exactly perpendicularly to the ecliptic plane nor parallel to it. Discrepancy between the measured and the expected directions amounts up to 10 degrees even at small elongation angles along the ecliptic, where degree of the zodiacal light polarization is as high as 20 percents. Hong et al. (2002) examined carefully the roles of the scattered atmospheric light and of the diffuse galactic light in modifying the direction and degree of the zodiacal light polarization. By utilizing monitoring polarization observations of the north celestial pole over many nights by Weinberg et al. (1968) they devised a new methodology of correcting the observed night sky polarization for the scattered atmospheric light. With the methodology we have isolated the zodiacal light component from the observed night sky polarization and determined both the polarization degree and direction for the inner zodiacal light at solar elongation angles less than 90 degrees. This paper will demonstrate how closely the atmospheric correction can bring the measured direction of zodiacal light polarization to the expectation of light scattering theory.