# An Isolation of the Polarized Zodiacal Light in the Observed Night Sky Brightness

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To determine intensity of the polarized night sky brightness one may form six alternative combinations out of three channel deflections in the synchronous detection, and another six to fix the polarization direction. This paper examines how errors in the resulting direction and intensity behave for each combination of the polarization channels. This has led us to an optimal scheme for reducing the polarization from the night sky observations. As a test we have applied our reduction scheme to the night sky observations at Mt. Haleakala, Hawaii, on the night of August 21/22, 1968, and determined the polarization direction and the polarized intensity of the zodiacal light over an extended area of the sky. We specify the polarization direction first in the coordinate frame of azimuth and altitude, and then convert it in the frame of relative ecliptic longitude $\lambda - \lambda_\odot$ and ecliptic latitude $\beta$. In this way the polarization geometry can be described with respect to the scattering plane. Since the ecliptic plane itself becomes the plane of scattering for the zodiacal light along the ecliptic, great circles that pass the north and south ecliptic poles serve a good reference of the polarization direction. Off the ecliptic the plane of scattering made by the Sun, scatterer, and observer varies in a complicated way with $\lambda - \lambda_\odot$ and $\beta$. As expected from the very nature of the zodiacal light, which is known to be the sun light scattered by interplanetary dust particles, the polarization vectors of the inner zodiacal light are well aligned perpendicularly to the ecliptic plane. The alignment is very clear at small elongations and low ecliptic latitudes, where the zodiacal light is strong and scattering geometry is simple. In the outer zodiacal light, however, the polarized intensity is so weak that the polarization direction is not easy to fix, particularly in the region $\lambda - \lambda_\odot \simeq 125^\circ$ where a reversal is expected to occur in the polarization direction. We will discuss how uncertainties due to bright star-crossings can be minimized in the polarization direction and polarized intensity by following up the systematic change in the direction of polarization over the sky.