Fine Spatial Resolution Distributions of The Zodiacal Light Brightness and Polarization

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By adopting a semi-empirical methodology for correcting the atmospheric diffuse light (Hong et al. 1999) and using an improved technique for subtracting individual stars, we have isolated the zodiacal light brightness in photo-polarimetric observations of the night sky at Mt. Haleakala, Hawaii. We also developed an efficient routine for reducing the polarization channels of the Hawaii observations (Lee at al. 2000). With the reduction routine we determined the polarized intensity of the zodiacal light and the direction of the polarization vector. Two-dimensional distributions will be presented for the total and polarized brightness and also for the direction of polarization vector with a spatial resolution better than 2 degrees over most of the night sky that can be observed from the ground. Advantages of the new reduction methodology compared to previous schemes will be pointed out, and comparisons will be made with previous zodiacal light brightness distributions. Because of the fine spatial resolution the newly derived distribution of the zodiacal light brightness is a sensitive observational criterion that any three-dimensional models of the interplanetary dust cloud should satisfy. The resulting picture of the interplanetary dust cloud will play a pivotal role for correcting the infrared observations of the IRIS on board ASTRO-F. Since the polarized brightness of scattered light depends on scattering angle more sensitively than the total brightness does, the elongation dependent degree of polarization is a new source of information on the nature of interplanetary dust particles, particularly of those particles that produce the mean motion resonance features and the IRAS bands as well.