STRUCTURES IN THE MEAN VOLUME SCATTERING PHASE FUNCTION OF THE INTERPLANETARY DUST PARTICLES

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

[1]Astronomy Program, SEES, Seoul National University, Seoul 151-742, KOREA

[2]Department of Science Education, Kangwon National Universit

[3]Space Astronomy Laboratory, 3440 Quinn Ridge Drive, Snellville, Georgia 30039, USA

On the basis of a recently obtained fine resolution distribution of the zodiacal light (ZL) brightness (Kwon, Hong, and Weinberg 2000), we have determined the scattering characteristics of interplanetary dust particles (IPDs). A linear combination of three Henyey-Greenstein functions is substituted for the mean volume scattering phase function $\Phi(\Theta)$ in the brightness integral of the zodiacal light, and residuals are calculated by comparing the observed ZL brightness in the ecliptic with the result from the brightness integral. Minimization of the residuals has led us to the best representation of the scattering phase function, which improved our previous knowledge on the IPD's scattering characteristics markedly by removing an unrealistic feature from the phase function and revealing heretofore unknown structures in it. The new $\Phi(\Theta)$ is consistent with the previous one in that they both show a rapid rise toward the forward direction $\Theta = 0^{\circ}$, an isotropic behavior at intermediate scattering angles, and a mild enhancement in the backward direction $\Theta = 180^{\circ}$. The $\Phi(\Theta)$ obtained in 1985 was based on the zodiacal light distribution by Levasseur-Regourd and Dumont (1980), with which one could not avoid having an unrealistic feature of a sharp reversal in the rising trend toward the forward direction, if the distribution $n(r) = n_o(r_o/r)^{\nu}$ of the IPD's volume density $n(r)$ varies with heliocentric distance r more steeply than $1/r$. However, the Helios space observations strongly indicate $\nu \simeq 1.3$. The newly reduced two dimensional distribution of the zodiacal light has removed such unrealistic feature from the resulting scattering phase function. Furthermore, its spatial resolution is so fine and noise level is so low that the new $\Phi(\Theta)$ reveals even small amplitude structures at large scattering angles. These improvements have brought us a strong confidence on the new distribution of the zodiacal light brightness over almost an entire sky. Implications of the structures will be discussed for the nature of IPDs.