A PHYSICAL MODEL OF THE ZODIACAL THERMAL EMISSION

S. M. Kwon[1] and S. S. Hong[2]

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

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

Small dust particles scatter light and absorb it as well. The odiacal light (ZL) is known to be the sunlight scattered by nterplanetary dust particles (IPDs), and the absorbed portion of he impinging solar radiation manifests itself in the infrared as he zodiacal thermal emission (ZE). The visible ZL and the nfrared ZE are thus two different phenomena caused by the same articles. Consequently, their brightness distributions over the ky ought to be related to each other very closely. Making a full use of the physical connection between them, we have constructed an IR model for the all-sky distribution of the zodiacal emission.

From the observed distribution of the scattered visible ZL we have probed the three-dimensional distribution of the IPD number density, $n(r)$, in the interplanetary space. On the other hand, an annual variation of the difference in the ZE brightness, observed by the IRAS, between the north and south ecliptic poles enabled us to locate the plane of maximum IPD density, in terms of the ecliptic longitude, Ω, of the symmetry plane ascending node and the inclination angle, i, of the plane. The IRAS mission observed the ZE brightness over the solar elongation ranging from 60° to 120° along the ecliptic plane. Although this elongation coverage is rather limited, we were able to retrieve from the IRAS observation the heliocentric variation, $T_{IPD}(r)$, of the IPD mean temperature. With these pieces of information, $n(r)$, Ω, i, and $T_{IPD}(r)$, on the IPD cloud, we have calculated theoretically the ZE brightness all over the sky at a few selected IR wavelengths.

The resulting model is shown to reproduce faithfully the DIRBE observations of the ZE at the COBE IR wavelengths. We will compare our physical model of the ZE distribution with the empirical one by Kelsall et al. (1998). Small scale features like the asteroidal dust bands, the Earth mean motion resonance ring, and possible cometary trails will eventually be incorporated into current version of the physical ZE model. Then the model is expected to provide us with an efficient means of correcting the ZE for the all-sky far IR survey of the ASTRO-F mission in year 2004.