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DISCUSSION OF THE ROCKET PHOTOMETRY OF THE ZODIACAL LIGHT

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Abstract:

The measurements of the zodiacal light at elongations $\varepsilon \approx 15^{0}$ to 30^{0} performed by the ESRO rocket experiment R - 214 were discussed on the basis of model calculations.

The total amount and the shape of the brightness decrease outside the ecliptic plane were used to test assumptions on the three dimensional spatial distribution of interplanetary dust. Models which give the decrease of dust density as a function of the height above the ecliptic only are unacceptable as well as models for which the lines of equal spatial density are ellipsoids. To represent the inner zodiacal light a "fan - like" spatial distribution is required, where the decrease of dust density is a function of the angular distance from the ecliptic as seen from the sun. A fit to the observation yields $n(r,z) \sim r^{-1} \exp\left[-2.6\ (z/r)^{1.3}\right]$.

The observed deviation of the brightness maximum from the ecliptic plane can be quantitatively explained by symmetry of the interplanetary dust inside 1 A.U. with respect to the plane $\Omega = 66 \pm 12^{0}$, $i = 3.7 \pm 0.6^{0}$. This is a significant deviation from the invariant plane of the solar system, generally believed to be the plane of symmetry, towards the planes of the inner planets and the solar equator.

The reddening observed in the inner zodiacal light is only compatible with a flat size distribution of interplanetary dust, e.g. $n(a)\,da \sim a^{-2.5}\,da$.

The comparatively high degree of polarization at 15^{0} is compatible with scattering by micronsized slightly absorbing silicates ($m = 1.5 - 0.03\,i$)

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