

Near-infrared spectral measurements of zodiacal light by CIBER rocket experiments

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We have observed the cosmic near-infrared background light as the integrated light along the line of sight, which is the near-infrared diffuse radiation in wide range of the cosmic structure from the solar system to extragalactic universe, with the CIBER (Cosmic Infrared Background ExpeRiment) rocket experiments. One of scientific objectives of CIBER is to measure the zodiacal light in the near-infrared, which is the scattered sun light by interplanetary dusts. From the results of CIBER, we first observed the zodiacal light spectrum and its polarization in the near-infrared range from 0.8 to 2 microns. In this paper, we present the observation results.

CIBER is an international collaboration study among Japan, US and Korea, and a sounding rocket program by NASA. In a term from 2009 to 2013, we have carried out four times of launch and obtained high quality data at the altitudes above 200 km with no contamination by the earth atmosphere. In order to measure the extragalactic background light, we selected the observation field to have solar elongation over 90 degrees with relatively low brightness. We extracted the zodiacal light component from the total sky brightness by using the ecliptic latitude dependence. As the result, we could obtain information of spectrum, polarization and seasonal variation of the zodiacal light.

The observed infrared spectrum shows neither ecliptic latitude dependence nor time variation, and reddened color compared with the solar spectrum at wavelengths below 1.5 microns. From this result, size of interplanetary dust is larger than the order of micron, and there may be absorption of dust minerals at shorter wavelengths. We found the polarization of 20-25% at the maximum at the north ecliptic pole, which is higher than that previously observed in the visible wavelength range. The polarization result also suggest that the majority of the dust size is much larger than the observation wavelength.

In this paper, we report the observation result, and we discuss the optical properties of interplanetary dust by comparing our result with the spectral reflectance of meteorites and cometary dust.

Keywords: zodiacal light, interplanetary dust, infrared, observation