Faint young asteroidal dust bands observed with AKARI

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The zodiacal emission is the thermal emission from the interplanetary dust and the dominant diffuse radiation in the mid- to far-infrared (IR) wavelength region. It was found that there are many small-scale structures in the zodiacal emission distribution, including dust band pairs at the ecliptic latitudes of $\pm 1.4°$, $\pm 2.1°$, and $\pm 10°$, apart from a smooth background distribution. These three major dust-band pairs are well studied and are now considered to be associated with the Beagle, Karin, and Veritas asteroid families, respectively. It is thought that disruption events in the main asteroid belt, which would have occurred within the last 10 Myrs, are major supply sources of dust particles.

In addition to these three bands, several additional faint dust bands are suggested from the IRAS observations. Among them, there are dust bands which do not extend over all ecliptic longitudes. It is suggested that they are young and still in the process of forming. These young and partial dust bands are expected to preserve the original size distribution of the dust population ejected into the cloud by an asteroid disruption. However, the existence of partial dust bands are not well confirmed with the image quality of the IRAS map.

We investigate the geometry of the small-scale dust-band structures in the far-IR all-sky maps observed with the Japanese infrared satellite AKARI. AKARI clearly detects the zodiacal dust-band structure at 65 and 90 μm bands. In the AKARI far-IR map, we confirmed many partial dust bands and identified the dust bands at ecliptic latitudes of $6°$, $8°$, $13°$, and $17°$, corresponding to the IRAS faint bands (suggested in Sykes 1988, ApJ, 334, L55). We extract faint dust-band structures in the AKARI maps, in addition to the prominent three bands, by using image-enhancing techniques and discuss the formation process and dust properties of partial young dust bands based on the AKARI observations.