Preliminary analysis of the AKARI FIS BSC

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Abstract. We present a preliminary analysis of AKARI Far-Infrared Surveyor Bright Source Catalog. The AKARI mission collected data on 63,370 bright IR sources. Galactic spatial distribution of different flux quality types was studied. The surface density shows correlation with already known places of IR bright galactic regions. Difference between the spatial distribution of different flux quality objects is not notable. This research is part of the AKARI Mission Program "Star Formation".

1. Introduction

The AKARI astronomical satellite onboard with the Far-Infrared Surveyor accomplished a full-sky survey. The survey is similar to former IR all sky surveys like 2MASS (Skrutskie et al., 1995) and IRAS Sky Survey (Beichmann, 1988) but with a sensitivity one order of magnitude better and resolution a few times higher than IRAS (Yamamura et al., 2008). Galactic IR-bright sources are mainly late type stars, circumstellar disks and clouds of interstellar dust and gas. Extragalactic objects like LMC and SMC may also have strong IR emission. Full-sky surveys are useful tools for unbiased studies of various types of objects. Our aim is to classify different types of objects with a special attention to YSOs. We investigate the galactic distribution of AKARI point sources and compare it to the interstellar CO distribution (Dame et al., 2001), a good tracer of cold ISM.

2. Observations

The main objective of the AKARI (Murakami et al. 2007) infrared astronomical mission was to carry out the All-Sky Survey with the Far-Infrared Surveyor (FIS; Kawada et al. 2007), and with the Infrared Camera (IRC; Onaka et al. 2007). AKARI is the second space mission for infrared astronomy in Japan. AKARI has been developed by members of JAXA/ISAS and collaborators. We used the data of Far-Infrared Surveyor (FIS). It provides four photometric bands between 50 and 180 µm, two broad bands and two narrow bands. The N60 and WIDE-S detectors are Monolithic Ge:Ga detectors while the WIDE-L and N160 detectors are Stressed Ge:Ga detectors (Yamamura et al., 2008). For more details see Table 1.
3. AKARI FIS BSC
The AKARI FIS Bright Source Catalogue (BSC) is currently the primary catalogue of the AKARI survey. It is also referred to as "AKARI point source catalogue". The β-1 version contains 63370 point sources. The average position uncertainty is 8”, and the estimated absolute flux uncertainty is 20-25% (Yamamura et al., 2008). The catalogue lists position, flux densities, flux qualities, number of scans and number of readouts for each source. The calibrated fluxes measured by the detectors have 3 flux quality classes. These classes are based on the flux uncertainties. The highest value of 3 means the best quality. The evidence of the data is described with LogEvidence value. The value 3 means that LogEvidence ≥ 10.0. If LogEvidence < 10.0 than the value of the flux quality is 2. Flux quality 1 means that the data is not reliable. For future classification one should use the most reliable data where flux quality is 3. All of the point sources have at least one flux quality which equals 3, in 11905 cases at least two, in 3758 cases at least 3 and in 3401 cases all of the measured fluxes have the best quality.

4. Galactic distribution of AKARI point sources
4.1. Distribution as a function of galactic latitude
The galactic distribution of AKARI point sources is shown in Fig. 2. The histogram was made with 10° wide bins. The distribution shows a strong maximum in the direction of the galactic midplane. The width at half-maximum is 4°. There is a local maximum at −30° < |b| < −40° on both panels, that is at the latitude of the LMC. The number of the sources where the WIDE-S and WIDE-L flux qualities are the best (hereafter *33* sources) has a powerful maximum in the direction of the galactic plane (Fig. 2).

4.2. Distribution as a function of galactic longitude
The distribution of the sources as a function of galactic longitude is shown in Fig. 3. The *33* sources' distribution has 2 minima. First is at the galactic anticentre 120° < |l| < 200° region in spite of the many YSOs seen at the Tau-Aur-Per complex. The other minimum is at 220° < |l| < 260°, where also the amount of the interstellar medium is low, so YSOs cannot form in a large number. Similar distribution can be seen for the 3333 sources figure (right panel of Fig. 3).
5. Discussion

The IR bright sources are mainly young stars or galaxies. The infrared excess of YSOs is caused by the pre-main sequence state, where the observed temperature is lower than in MS stars. The surrounding dust and gas also radiates on these wavelengths and the emitted light is also scattered on small particles. Extragalactic sources can have a notable amount of dust and cool gas, too, while their distance and the intergalactic matter causes a similar scattering effect. Stars are born where the quantity of gas is enough for star formation. These conditions are mainly available in the galactic disk, near the galactic plane (Dame et al., 2001). We note that 81.04% of the sources are between $-5^\circ$ and $5^\circ$ galactic latitudes, 12.34% of the sources are at medium galactic latitude ($5^\circ < |b| < 30^\circ$) and only 6.62% are at high $|b|$ values. See Fig. 1 and Fig. 2. The galactic distribution of the AKARI FIS BSC point sources shows strong correlation with the galactic distribution of CO (Dame et al., 2001). Looking at the distribution as a function of the galactic latitude both the point source distribution and the CO distribution has a maximum at $-10^\circ < b < 10^\circ$. The distribution of the AKARI FIS BSC point sources and the CO are also similar along galactic longitudes. One can see plateau at the inner Galaxy ($0^\circ < l < 60^\circ$ and $300^\circ < l < 360^\circ$) and a local minimum at $220^\circ < l < 260^\circ$ on Fig. 3 and Fig. 4.
Table 1. Main parameters of the AKARI FIS filters*

| Band    | N60 | WIDE-S | WIDE-L | N160 |
|---------|-----|--------|--------|------|
| Wavelength range (µm) | 50-80 | 60-110 | 110-180 | 140-180 |
| Central wavelength (µm) | 65 | 90 | 140 | 160 |
| Band width (µm) | 21.7 | 37.9 | 52.4 | 34.1 |

* Yamamura et al., 2008

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Figure 4. Histogram of the Whole-Galaxy velocity integrated CO map (Dame et al., 2001). Left: galactic latitude dependence of the velocity integrated CO line area. Right: galactic longitude dependence of the velocity integrated CO line area.