The Interstellar Medium viewed by the AKARI Far-Infrared All-Sky Survey

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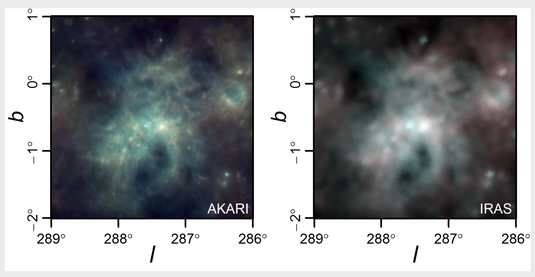
Abstract

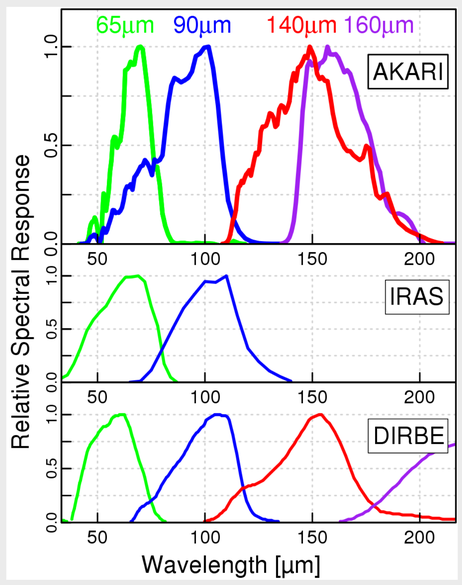
We present a far-infrared all-sky atlas made from a sensitive all-sky survey using the Japanese AKARI satellite. The survey covers > 99% of the sky in four photometric bands centred at 65μm, 90μm, 140μm, and 160μm with spatial resolutions ranging from 1 to 1.5 arcmin. Having four to five times better spatial resolution as well as data at longer wavelengths compared to IRAS, the data provide crucial information for the investigation and characterisation of the properties of dusty material in the Interstellar Medium (ISM). The comprehensive wavelength coverage from 50 μm to 180 μm provides SED information at the peak of the dust continuum emission, enabling us to make a precise evaluation of its temperature, which leads to a detailed investigation of the total amount of dust particles, and their irradiation environment. The large-scale distribution of dust in interstellar clouds, their temperatures and column densities, can be investigated in great detail from the largest spatial scales of entire giant molecular clouds down to those as small as individual molecular cloud cores. In addition to the point source distribution, the large-scale distribution of ISM cirrus emission, and its filamentary structure, are well traced. We have made the first public release of the full-sky data to provide a legacy data set for use by the astronomical community. The AKARI FIR images are a new powerful resource from which to investigate the detailed nature of ISM from the smallest scales that trace individual star forming cores, to the complex structures revealed that span the full sky.

The AKARI Far-Infrared All-Sky Survey

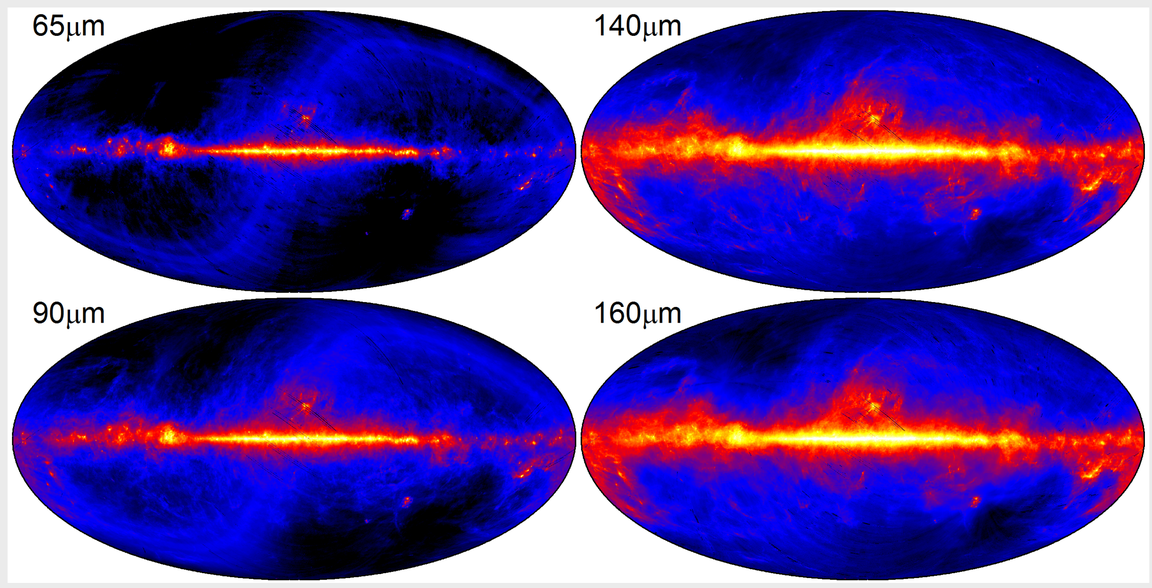
- All-sky photometric survey in 65μm, 90μm, 140μm, and 160μm
- Spatial resolution: 63"@65μm, 78"@90μm, 88"@140μm & 160μm
- improved spatial resolution and sensitivity, extended wavelength coverage comparing to IRAS (see comparison of η Car images below)



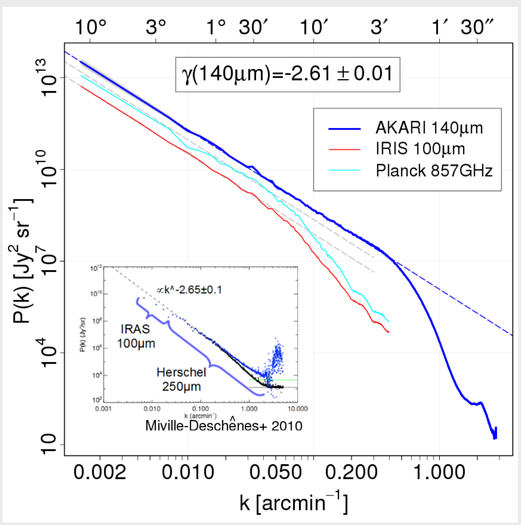
Images of η Car region. Left panel: three-colour composite of AKARI 65μm (blue), AKARI 90μm (green), and AKARI 140μm (red) images. Right panel: composite image of IRIS 60μm (cyan) and IRIS 100μm (red) images for a comparison of spatial resolutions between IRAS and AKARI images.



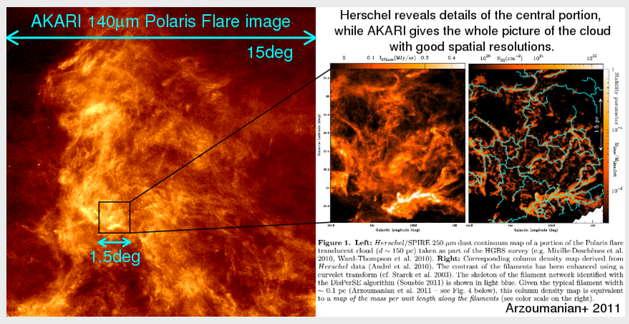
Full sky image in 4bands



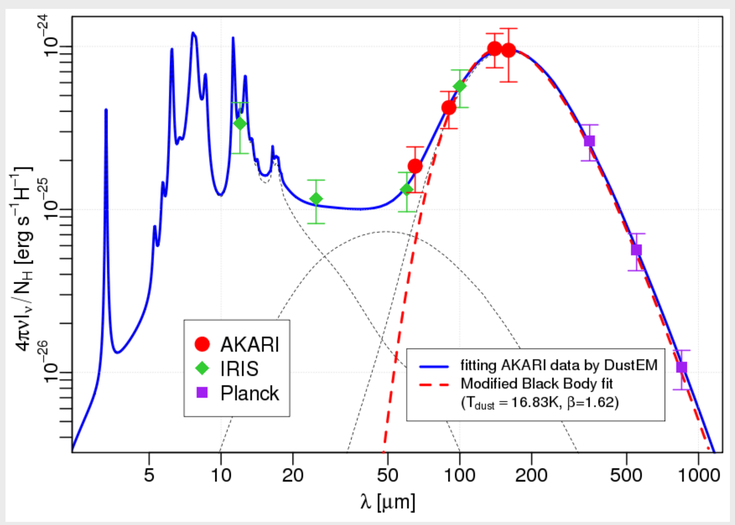
IR cirrus spatial power spectra @ Polaris Flare



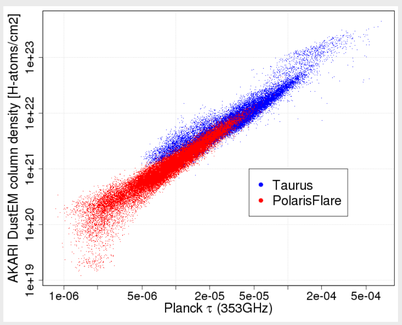
As shown in the left figure, AKARI data trace power-law spectra down to $\sim 2'$ @ 140μm, while IRAS and Planck start losing their spatial information below $\sim 30'$. $\rightarrow$ Huge spatial dynamic range of AKARI data.



Evaluation of dust SED and column density

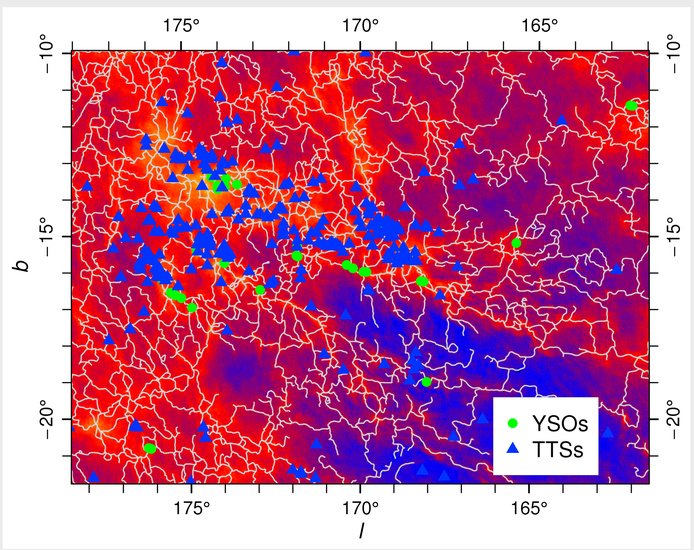


AKARI data give good evaluation of dust SED that show good consistency with IRAS and Planck data. $\rightarrow$ Dust column with high spatial resolution.

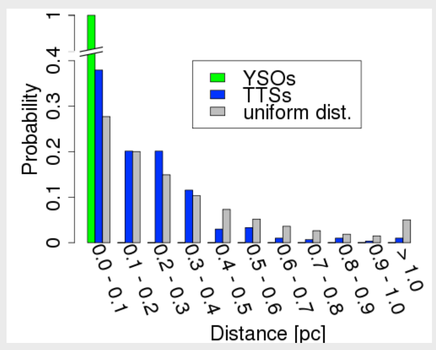


Filament extraction @ Taurus

Typical width of filaments ($\sim$ 0.1 pc) are approximately 2.5$'$ @ 140pc $\rightarrow$ AKARI can trace all the filamentary structures in near-by clouds and study their spatial distribution as well as correlation with YSOs. In Taurus, we find that all the YSOs (30 sources) are on the filaments, while TTSs show a lower, but still statistically significant association, with the filaments.



Distance from the sources to the nearest filament (see figure below) is consistent with 0.1 [km s^{-1}] random motion of TTSs against their natal filaments.



Access to the data and support informations

AKARI data are open to the public and available at
http://www.ir.isas.jaxa.jp/AKARI/Archive/Images/FIS_AllSkyMap/
Visit following site for the list of data mirror sites, detailed description of data and support informations: http://akari.c.u-tokyo.ac.jp/~doi/
Feel free to contact doi@ea.c.u-tokyo.ac.jp for more inquiries.

Summary: the AKARI FIR images

- Multiple-waveband coverage at the peak of the dust SED
  - BGs colour temperature, dust column evaluation
  - Dust composition, evolution
- Good spatial resolution, huge dynamic range
  - From global picture of diffuse ISM/giant molecular complex down to prestellar cores!!
  - Structure formation, phase transition, radiative transfer in denser regions ...
- A new powerful resource to investigate the detailed nature of ISM.