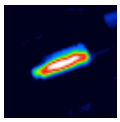
Characteristics of the IRAS Data

Point Spread Function (PSF)



12 µm point source generated by FRESCO

Infrared Astronomical Satellite (IRAS) point sources do not appear circular, primarily because the detector apertures were rectangular. In fact, the PSF of an IRAS source is determined both by the detector mask shape and the geometry of the scans covering the source. Thus, in a raw IRAS image point sources appear elongated, with the narrow dimension in the scan direction and the larger dimension determined by the cross-scan width of the detector. Click here for an illustration of the focal plane indicating the detector sizes. Near the ecliptic poles, the PSF may even be X-shaped! This is because the survey strategy allowed nearly orthogonal scan directions near the poles.

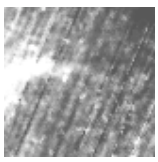
For unenhanced coadded images (e.g., FRESCO) the resolution is approximately 1' by 5', 1' by 5', 2' by 5' and 4' by 5' at 12, 25, 60 and 100 µm, respectively. For "medium resolution" images (e.g., the IRAS Sky Survey Atlas [ISSA]) all four bands are smoothed to the 100 µm resolution. For HIRES images, the resolution varies in a complicated way.

The AC/DC Effect

The IRAS detectors had a dwell-time dependent responsivity change. Hence, the gain changes as a function of source size: at the IRAS survey speed of 3.85 arcminute/s, the gains leveled off for structure on the order of 30' in extent. This effect was band-dependent and largest at 12 µm. Thus, there are two calibrations for the IRAS data, the calibration appropriate for point sources, known as the AC calibration, and the calibration appropriate to very extended structure, known as the DC calibration. To bring point source fluxes measured from DC-calibrated products to the AC (same as the Point Source Catalog V2.0 [PSC2]) calibration, the fluxes must be divided by 0.78, 0.82, 0.92 and 1.0 at 12, 25, 60 and 100 µm, respectively.

All non-point-source-filtered IRAS image products produced before April 1993 were DC calibrated. This includes early HIRES and FRESCO images and ISSA. After April 1993, FRESCO and HIRES images were switched to the AC calibration. Point source fluxes obtained by aperture photometry with appropriate background subtraction on AC calibrated images should be consistent with the PSC2. It should be noted that neither calibration is strictly correct for structure on spatial scales intermediate between point sources and 30'. Intermediate-scale corrections must be derived from inspection of the plots in the *IRAS Catalogs and Atlases: Explanatory Supplement* (1988, ed. C.A. Beichman, G. Neugebauer, H.J. Habing, P.E. Clegg and T.J. Chester, Washington, DC: GPO).

Stripes



A 2 degree ISSA-reject patch in the ecliptic plane

Stripes are streaks in the scan direction (i.e., orthogonal to the wide dimension of the PSF) that are brighter or fainter than the background in the adjacent scans. They are the result of detector response variations and real background/foreground variations from scan-to-scan during the survey.

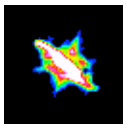
Much effort has gone into developing methods to minimize the effect of scan-to-scan variations. These techniques are collectively known as de-striping. Comparing the original Sky Brightness Maps (SKYFLUX, also sometimes called the HCON Images because a separate set was created for each hours-confirming coverage) with the new ISSA images provides a dramatic demonstration of the efficacy of de-striping! Nevertheless, IRAS images often retain striping at some low level. HIRES may tend to amplify any low-level striping present, particularly in relatively featureless fields.

Flux-dependent Responsivity Changes

The survey array detectors exhibited non-linear responsivity variations with the total flux falling on the detector. This effect can be quite large at 60 and 100 μm, but is not well characterized.

Because the zodiacal background observed by IRAS varied substantially during the survey, this means there are calibration differences between different observations of the same source at different times. This can be particularly obvious when HCON 3 images are compared to or combined with HCON 1 and HCON 2.

Optical Crosstalk



NGC 253 at 60 μm, 20-iteration HIRES

Very bright (> 500 Jy) pointlike sources may have a characteristic six-pointed star shape. This is due to reflection from the telescope secondary mirror struts. Approximately 5% of the peak flux may be contained in the star pattern. There is no known method for removing this effect. Resolution enhancement, e.g. with HIRES, may enhance or break up the crosstalk pattern if it is present.

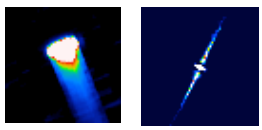
Saturation

The survey detectors tended to saturate for sources brighter than 1000 Jy.

Hysteresis Effect: Shadowing

Shadows or trails are produced in the scan directions at 60 and 100 μm, particularly upon crossing the galactic plane, especially near the galactic center. The most recent (Pass 3) calibration alleviated this effect to some extent.

Hysteresis Effect: Point Source Tails



Two images showing 12-µm point source tails. To the left is a FRESCO, to the right, a 12 µm HIRES of B Gru, with both ascending and descending scans. Each image is about 30' across.

Bright point sources may appear to be smeared out in the scan direction(s). This can happen in any band, but is most dramatic at 12 and 25 µm. In extreme cases the point source "tail" may extend for a degree or more. If the source was scanned both descending and rising, it will have tails in both directions, and the tails may resemble stripes; tails can be distinguished from stripes because they diminish with distance from the bright source. This effect is not well enough modeled to be removed from the data.

Glitches/Bad Data

Radiation hits on detectors occasionally remain in the data and appear as very transitory spikes. Occasionally a bit of debris may have lit up the entire focal plane simultaneously, causing a non-physical regular pattern in the images.

<-- Previous Section
(IRAS Satellite & Mission Strategy)

Next Section -->
(IRAS Sky Survey Atlas - ISSA)

IRAS Documentation Site Map

IPAC | IRSA | IRSA Services | Missions | IRSA Support

Contact IRSA User Support if you have questions or problems with any of our services.

This site has been optimized for Netscape Communicator 7.x and Microsoft Internet Explorer 6.x. JavaScript should be enabled in order for the site to display properly. Contact irsadmin@irsa.ipac.caltech.edu for technical problems with this website.

This page last updated: Friday, June 23, 2006 .