The 12 um contribution of nearby galaxies to the infrared background

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SUPPLEMENTARY NOTES

ABSTRACT
The forty ultraluminous galaxies in the IRAS Bright Galaxy Sample of sources were mapped with 0.25 second resolution at 8.44 gigahertz. Twenty five contain diffuse radio sources. These are almost certainly starburst galaxies. The IRAS flux densities for all galaxies detected in the Faint Source Survey have been obtained. The data contains a total of 1544 galaxies. The detection rate in the FSS improves substantially by a factor of three or more for the short wavelength bands at 12 and 25 microns. This sample will form the basis for studies of the far infrared properties of optically selected galaxies.

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Research Highlights

1. Compact starbursts in ultraluminous infrared galaxies (publication 3, reprint enclosed)

   The 40 ultraluminous [log(L_{FIR}/L_{\odot}) \geq 11.25] galaxies in the IRAS Bright Galaxy Sample of sources stronger than S = 5.24 Jy at 60 \mu m were mapped with \approx 0:25 resolution at 8.44 GHz. Twenty-five contain diffuse radio sources obeying the FIR-radio correlation; these are almost certainly starburst galaxies. Fourteen other galaxies have nearly blackbody FIR spectra with
cooler temperatures $60 \, \text{K} \leq T_\text{c} \leq 80\, \text{K}$ so their (unmeasured) FIR angular sizes must exceed $\theta \geq 0'25$, yet they contain compact (but usually resolved) radio sources smaller than this limit. The unique radio and FIR properties of these galaxies can be modeled by ultraluminous nuclear starbursts so dense that they are optically thick ($\tau \geq 1$) to free-free absorption at $\nu \sim 1.49 \, \text{GHz}$ and dust absorption at $\lambda \sim 25 \, \mu\text{m}$. Only one galaxy (UGC 08058 = Mrk 231) is dominated by a variable radio source too compact ($\leq 1\text{pc}$) to be an ultraluminous starburst, it must be powered by a "monster".

2. A catalog of IRAS fluxes for galaxies in the northern sky brighter than $m_B = 14.5$ (publication 4, reprint enclosed).

We have obtained IRAS flux densities for all galaxies in the Center for Astrophysics (CfA) magnitude-limited sample ($m_B \leq 14.5$) detected in the IRAS Faint Source Survey (FSS), a total of 1544 galaxies. The FSS is an attempt to reach lower sensitivity limits than the Point Source Catalog (PSC) in the IRAS data by generalizing the coadding method to the whole sky. The detection rate in the FSS is slightly larger than in the PSC for the long wavelength 60 and 100 $\mu\text{m}$ bands, but improves substantially (by a factor of $\sim 3$ or more) for the short wavelength 12 and 25 $\mu\text{m}$ bands. 63% of all 2445 CfA galaxies were detected in at least one IRAS band in the FSS, and, compared to the PSC, we have added $\sim 50\%$ more flux densities, with the additions coming essentially all in the short wavelength range.

This optically selected sample consists of galaxies which are, on average, much less infrared-active than galaxies in infrared-selected samples. It possesses accurate and complete redshift, morphological and magnitude information, along with observations at other wavelengths, and forms the basis for studies of the far-infrared properties of optically selected galaxies in a forthcoming series of papers.