A 12μm FLUX LIMITED SAMPLE OF GALAXIES: PRELIMINARY RESULTS ON THE IR LUMINOSITY FUNCTION

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ABSTRACT. An all-sky 12μm flux-limited sample of 392 galaxies has been selected from the IRAS Point Source Catalog. More than 20% of the sample harbor active nuclei (with Seyfert 1 or 2 or LINER emission-line spectra). Thus one byproduct of this work is the definition of a large complete sample of bright active galaxies, with roughly equal percentages of Sy 1's, Sy 2's and LINERs. Since we now have virtually all (93%) the redshifts for the sample galaxies, the far-infrared luminosity functions of all classes of galaxies have been derived using IRAS coadded data. Since our luminosity functions for Sy 1 and Sy 2 are indistinguishable from those of the optically selected CfA sample, the 12μm selection appears to be an efficient and complete technique for finding active galactic nuclei. Optical spectrophotometry and near-IR photometry of the sample is being obtained to compute accurate bolometric luminosities.

I. SELECTION CRITERIA AND COMPLETENESS

Most previously studied active galaxy samples suffer from incompleteness and/or selection effects which bias them towards particular types of objects. The IRAS all-sky survey offers for the first time the opportunity to select complete samples of galaxies by their infrared fluxes. To define a more representative sample containing a statistically significant number of active nuclei, we adopted a 12μm flux-density-limit. This is the wavelength which most strongly selects for the hot continua universally produced by active nuclei. Since our criteria enphasize completeness, most of the galaxies are nearby and have good photometric accuracy in the whole IRAS range and can be easily measured at other wavelengths, for determination of bolometric luminosities. We selected all the IRAS sources in the PSC-2 having: a) 12μm flux greater than 0.3 Jy; b) 60 or 100μm fluxes greater than that at 12μm; c) $|b| \geq 25$ °. The limit of 0.3 Jy (a) reflects the compromise needed for a large enough sample of active galaxies at fluxes for which the PSC-2 is relatively complete. The very weak color selection (b) rejects stars, but includes galaxies with far-infrared turnovers at 60 μm. After exclusion of LMC, SMC and M33 sources, S.A.O. stars, and planetary nebulae and inclusion of the galaxies in the IRAS Large Galaxy Catalog, our sample contains 405 objects, 392 of which are galaxies and 13 which are not yet identified. The IRAS fluxes for the whole sample were derived at IPAC (Pasadena) using the addscan software.

By comparing the PSC with the Serendipitous Sources Catalog and measuring the logN-logS slope, we were able to correct for the partial incompleteness between 0.3-0.5 Jy when computing the luminosity functions (the maximum correction factor to the space densities

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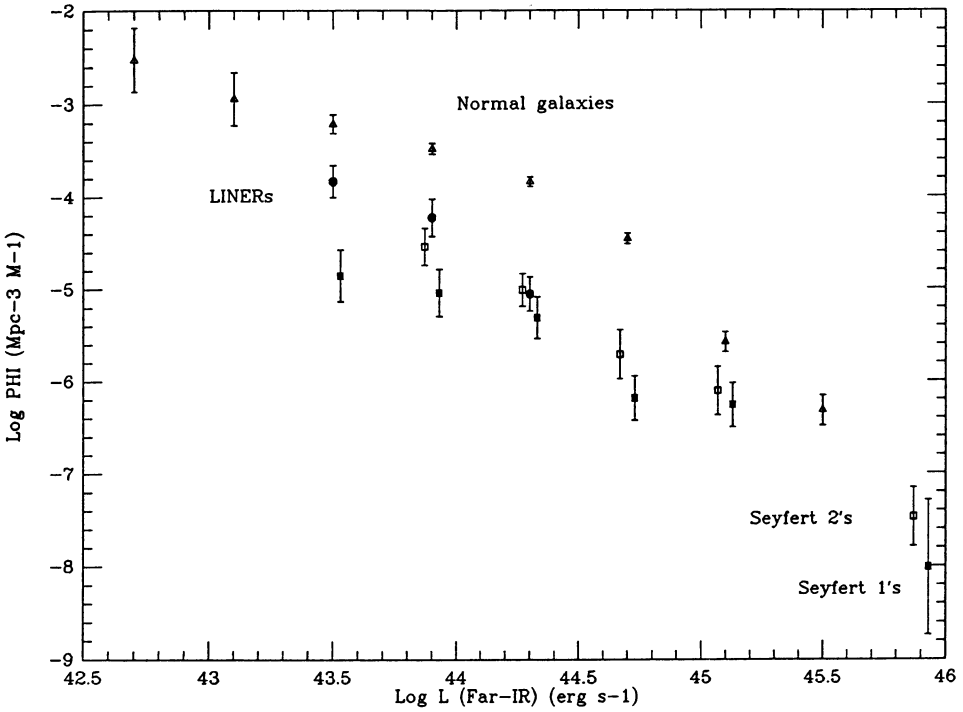
at the 0.3 Jy level was 1.85). However, the final selection of our sample will be made from the Faint Source Catalog that will be complete at 12μm down to 0.2 Jy. A completeness test on a subsample ($|b| \geq 50°$) of the galaxies contained in the FSC confirms our choice of correction factors. We have redshifts for 93% of the galaxies, and for 2/3 of them optical spectrophotometry and near-infrared photometry (collected at Lick, Cerro-Tololo, La Silla and S.Pedro Martir Observatories). The standard volume test gives V / $V_{max} \simeq 0.5$, expected for a uniform distribution. More than 20% of the galaxies for which the redshift is available (367), are active: 26 are Seyfert 1's, 31 are Seyfert 2's and 27 are LINERs.

II. LUMINOSITY FUNCTIONS

The far-infrared luminosity function (hereafter LF) - giving a "first order" estimate of the bolometric LF - has been computed for each galaxy class and plotted in the figure below. Among active galaxies, LINERs dominate the space density only at $L_{FIR} \leq 10^{44}$ erg s^{-1}. The Seyfert 1's and 2's have similar space densities and represent an increasing fraction of the sample at high luminosities. We also calculated 60μm space densities. The shape of our 60μm LF is similar to that of the IRAS Bright Galaxy Sample. However our space densities are 2.5 times lower at high luminosity ($L_{60} \geq 10^{44}$ erg s^{-1}) and up to 7 times lower at low luminosity. Our LFs for Sy 1 and Sy 2 galaxies are indistinguishable from those of the CfA sample. Therefore the 12μm selection appears to be an efficient and complete technique for finding active galactic nuclei.



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