

A Population of Distant Luminous Infrared Galaxies Revealed by 15 μm ISOCAM Deep Surveys

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Abstract. The counts derived from the five mid-IR 15 μm (12-18 μm LW3 band) ISOCAM Guaranteed Time Extragalactic Surveys performed in the regions of the Lockman Hole and Marano Field, the HDF-North and South (plus flanking fields), together with those of the lensing cluster A2390 at low fluxes and those of IRAS at high fluxes, cover four decades in flux from 50 μJy to ~ 0.3 Jy. The roughly 1000 sources detected with ISOCAM, 600 of which have a flux above the 80 % completeness limit, guarantee a very high statistical significance for the integral and differential source counts from 0.1 mJy up to ~ 5 mJy. The slope of the differential counts is very steep ($\alpha = -3.0$) in the flux range 0.4-4 mJy, hence much above the Euclidean expectation of $\alpha = -2.5$. When compared with no-evolution models based on IRAS, our counts show a factor ~ 10 excess at 400 μJy , and a fast convergence, with $\alpha = -1.6$ at lower fluxes.

Multiwavelength studies of a subsample of the ISOCAM sources in HDF and CFRS fields indicate that they are intrinsically bright galaxies (Luminous Infrared Galaxies, LIRGs), with median redshift 0.7. These galaxies, despite their low surface density, are responsible for a large part of star formation at $z < 1$ and contribute substantially to the cosmic infrared background at 140 μm .

Discussion

Charley Lineweaver: Your first conclusion was that you are seeing a factor of 8 in excess compared to “non-evolution”. Do you mean “non-evolution” or “passive evolution”?

Catherine Cesarsky: I mean compared to what we would see if everything were like the local environment.

Eli Dwek: To understand the nature of the objects responsible for the excess of 15 μm sources one needs to compare the observed number counts with those predicted by *passive* evolution models instead of models with *no* evolution. Could you comment on whether such a comparison has been done?

Cesarsky: Yes, long before we did our observations, Alberto Franceschini had developed passive evolution models for us. But this is mainly interesting for the study of ellipticals observed at 7 μm . There is no way you can do passive evolution of starbursts. Note that we do not assume a priori that many of our galaxies are LIRGs; we derive their FIR luminosities using a correlation which holds also for normal galaxies and most of them turn out to be LIRGs.

Mike Werner: Was the three times greater star formation rate inferred from the mid-IR, as contrasted to H- α data, obtained *after* the H- α was corrected for extinction?

Cesarsky: Yes, after the correction for extinction. A similar result is obtained by Poggianti and Wu (Poggianti, B. M., & Wu, H. 2000, ApJ, 529, 157) for local LIRGs. The interpretation is that you have heterogenous dust: some of the star formation is completely invisible in the optical, as in the Antennae galaxies.

Alberto Carramiñana: The ISOCAM results are limited to redshifts in the range 0.8 to 1.5 by the observing method, so one can expect this to continue to higher redshifts (1.5, 2.25, ...).

Cesarsky: Yes, of course. The $z = 1.5$ limit is due to the range of ISOCAM, which could only observe up to 18 μm . With the 24 μm wavelength that will be observed with SIRTf, this type of study can be extended to $z \sim 2.5$.