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A 1200 μm MAMBO Survey of the ELAIS N2 and Lockman Hole East Fields

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Abstract. Using the MPIfR Max Planck Millimeter Bolometer array (MAMBO) on the IRAM 30m Telescope we have mapped the ELAIS N2 and Lockman Hole East Fields at 1200 μm to a rms noise level of $0.8-1.0$ mJy per $11''$ beam. The areas surveyed are 326 arcmin^2 in the ELAIS N2 field and 212 arcmin^2 in the Lockman Hole[1], and cover the 260 arcmin^2 previously observed by SCUBA [5].

The 1200 μm number counts derived from the survey are shown in Fig. 1a (Greve et al. in prep.). At flux levels $\lesssim$ 3.5 mJy the power-law slope of the number counts is about $\alpha \sim -1.6$, while at the brighter end there is evidence for a turn-over in the number counts, as is illustrated by the fact that the data are well matched by an integrated Schechter function with a knee at 3.5 mJy. At a redshift of 2.5, this corresponds to a far-IR luminosity of $10^{13}\,L_\odot$ assuming a modified black body law with $\beta = 1.5$ and $T_d = 40$ K. For comparison we have also plotted the 850 μm counts from the HDF-N SCUBA Supermap [1], scaled by a factor of $S_{850\mu\mathrm{m}}/S_{1200\mu\mathrm{m}} = 2.5$ which is expected for a starburst galaxy at $z = 2.5$ [2]. Even though this scaling-factor is highly uncertain, the agreement between the 1200 μm and scaled 850 μm counts in terms of the shape of the number counts is remarkably good.

Deep radio observations currently provide the most efficient way of determining the exact positions of (sub)-mm sources, and thus positively identifying them in the optical/NIR [3,6]. Using deep Very Large Array radio maps [4] we have searched for statistically robust radio counterparts within $6''$ of each of the MAMBO sources in our sample. We find that about two-thirds of the MAMBO sources have counterparts in the radio, which is comparable to the radio-identification fraction found for SCUBA sources [4]. The MAMBO source shown in Fig. 1b is associated with a very strong radio counterpart ($S_{1.4\,GHz} = 189\,\mu$Jy) which lies on top of a compact optical/NIR galaxy. A Keck LRIS-B spectrum of this source reveals that it is a type II QSO at $z = 2.6$ (Ivison et al. in prep.). This source lies well within the SCUBA map yet is not included in the $\geq 3.0\sigma$ SCUBA catalogue [5]. While it is conceivable that a certain fraction of the 1200 μm sources might be at extremely high redshifts ($z > 8$) and

[1] The Lockman data are part of the MAMBO 1sq. deg. survey (Bertoldi et al. in prep.)

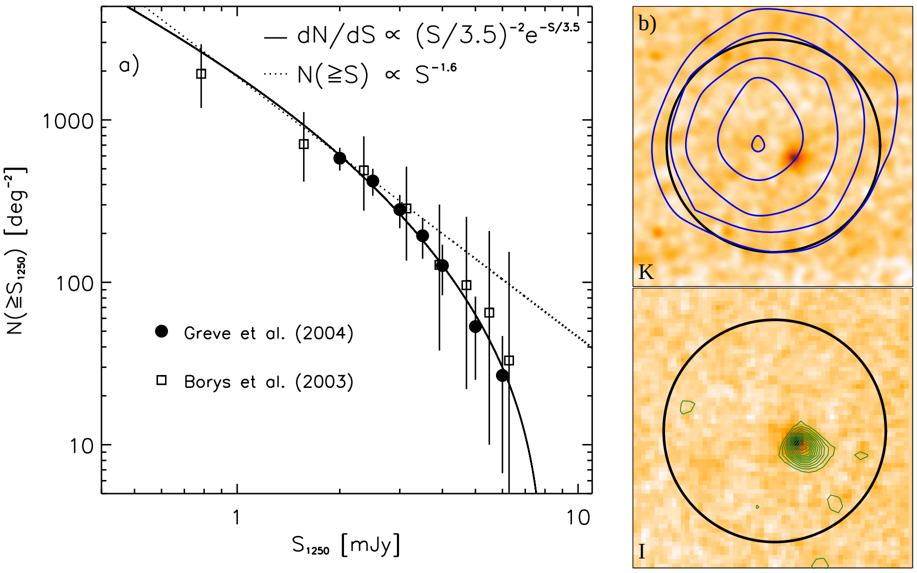

Fig. 1. a) Preliminary cumulative number counts at 1200 μm (filled circles) based on $\geq 3.5\sigma$ sources extracted from our MAMBO map of the ELAIS N2 and Lockman Hole East fields. 850 μm counts based on the HDF-North SCUBA Super-map are shown as squares (see Borys et al. (2003) for details). Note the 850 μm fluxes have been scaled by a factor of $1/2.5 = 0.4$. **b**) An example of a MAMBO source with a strong radio counterpart. *Top:* The 1200 μm-emission shown as blue contours: 3.5,4.0,4.5,5.0, 5.5$\times\sigma$ with $\sigma = 0.8$ mJy; *bottom:* Radio (1.4 GHz) contours (green) starting at 3σ and increasing in steps of $\sigma = 9.5\,\mu$Jy. The thick black circle is the $6''$ search radius adopted.

thus can 'drop-out' at 850 μm if the dust is cold [2], it is clearly not the case here since it is detected in the I-band which is shortward of 912 Å for $z > 8$. Comparing the MAMBO and SCUBA maps we find that, although a few MAMBO sources are not detected by SCUBA and vice versa, there is a fair overall correlation between the 1200 μm and 850 μm counts and galaxy positions, suggesting that both surveys are tracing the same high-redshift dusty population (Greve et al. in prep.). If this is the case, the faster mapping speed (about a factor of $\times 6$) and smaller beam size of IRAM 30m/MAMBO over that of JCMT/SCUBA make the former the facility of choice for wide-field extragalactic surveys.

References

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