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AzTEC/ASTE 1.1-mm survey of the AKARI Deep Field South: source catalogue and number counts

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Abstract
We present results of a 1.1-mm deep survey of the AKARI Deep Field South (ADF-S) with AzTEC mounted on the Atacama Submillimetre Telescope Experiment (ASTE). We obtained a map of 0.25-deg^2 area with an rms noise level of 0.32–0.71 mJy. This is one of the deepest and widest maps thus far at millimetre and submillimetre wavelengths. We uncovered 198 sources with a significance of 3.5σ–15.6σ, providing the largest catalogue of 1.1-mm sources in a contiguous region. Most of the sources are not detected in the far-infrared bands of the *AKARI* satellite, suggesting that they are mostly at $z \geqslant 1.5$ given the detection limits. We constructed differential and cumulative number counts in the ADF-S, the Subaru/*XMM–Newton* Deep Field and the SSA 22 field surveyed by AzTEC/ASTE, which provide currently the tightest constraints on the faint end. The integration of the best-fitting number counts in the ADF-S finds that the contribution of 1.1-mm sources with fluxes of $\geqslant$1 mJy to the cosmic infrared background (CIB) at 1.1 mm is 12–16 per cent, suggesting that the large fraction of the CIB originates from faint sources of which the number counts are not yet constrained. We estimate the cosmic star formation rate density contributed by 1.1-mm sources with $\geqslant$1 mJy using the best-fitting number counts in the ADF-S and find that it is lower by about a factor of 5–10 compared to those derived from UV/optically selected galaxies at $z \sim$ 2–3. The fraction of stellar mass of the present-day universe produced by 1.1-mm sources with $\geqslant$1 mJy at $z \geqslant$ 1 is $\sim$20 per cent, calculated by the time integration of the star formation rate density. If we consider the recycled fraction of >0.4, which is the fraction of materials forming stars returned to the interstellar medium, the fraction of stellar mass produced by 1.1-mm sources decreases to $\lesssim$10 per cent.

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