The ALMA frontier fields survey: IV. Lensing-corrected 1.1 mm number counts in Abell 2744, MACS J0416.1-2403 and MACS J1149.5+2223

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Context. Characterizing the number counts of faint (i.e., sub-mJy and especially sub-100 ?Jy), dusty star-forming galaxies is currently a challenge even for deep, high-resolution observations in the FIR-to-mm regime. They are predicted to account for approximately half of the total extragalactic background light at those wavelengths. Searching for dusty star-forming galaxies behind massive galaxy clusters benefits from strong lensing, enhancing their measured emission while increasing spatial resolution. Derived number counts depend, however, on mass reconstruction models that

properly constrain these clusters. Aims. We aim to estimate the 1.1 mm number counts along the line of sight of three galaxy clusters, Abell 2744, MACS J0416.1-2403, and MACS J1149.5+2223, which are part of the ALMA Frontier Fields Survey. We have performed detailed simulations to correct these counts for lensing effects, probing down to the sub-mJy flux density level. Methods. We created a source catalog based on ALMA 1.1 mm continuum detections. We used several publicly available lensing models for the galaxy clusters to derive the intrinsic flux densities of these sources. We performed Monte Carlo simulations of the number counts for a detailed treatment of the uncertainties in the magnifications and adopted source redshifts. Results. We estimate lensing-corrected number counts at 1.1 mm using source detections down to S/N = 4.5. In each cluster field, we find an overall agreement among the number counts derived for the different lens models, despite their systematic variations regarding source magnifications and effective areas. Combining all cluster fields, our number counts span ?2.5 dex in demagnified flux density, from several mJy down to tens of ?Jy. Both our differential and cumulative number counts are consistent with recent estimates from deep ALMA observations at a 3? level. Below ? 0.1 mJy, however, our cumulative counts are lower by ? 1 dex, suggesting a flattening in the number counts. Conclusions. We derive 1.1 mm number counts around three well-studied galaxy clusters following a statistical approach. In our deepest ALMA mosaic, we estimate number counts for intrinsic flux densities ? 4 times fainter than the rms level. This highlights the potential of probing the sub-10 ?Jy population in larger samples of galaxy cluster fields with deeper ALMA observations. © ESO 2018.

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Submillimeter: galaxies

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Gravitational lensing: strong

High resolution observations

Star forming galaxy

Statistical approach

Submillimeter: galaxies

Systematic variation

Galaxies