Probing the sub-millimeter properties of the faint high-redshift infrared galaxies

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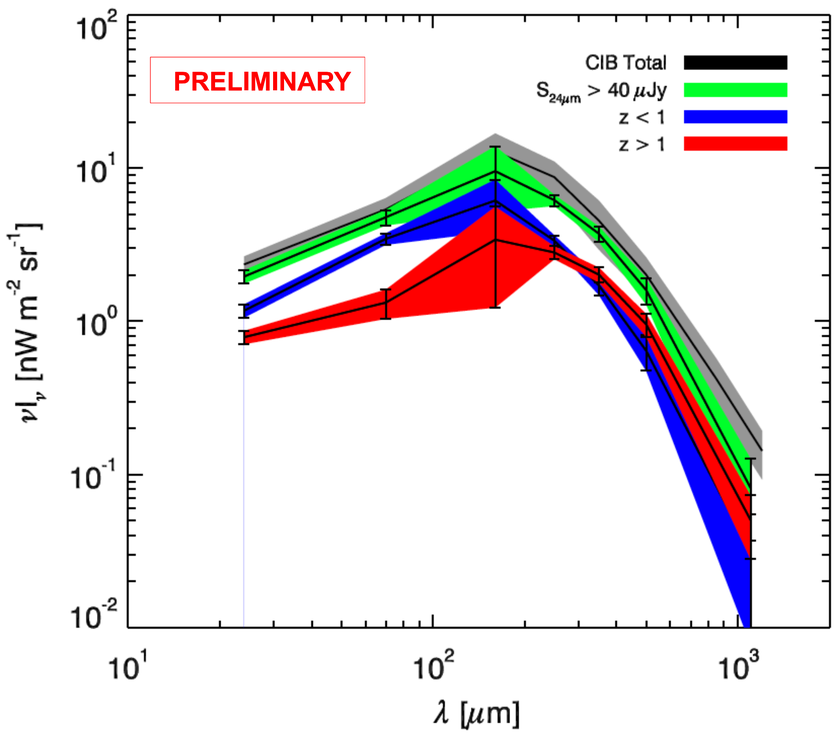
Redshift evolution of the cosmic infrared background

Vieira, Béthermin, Bock, Marsden, Viero and HerMES (in prep.)

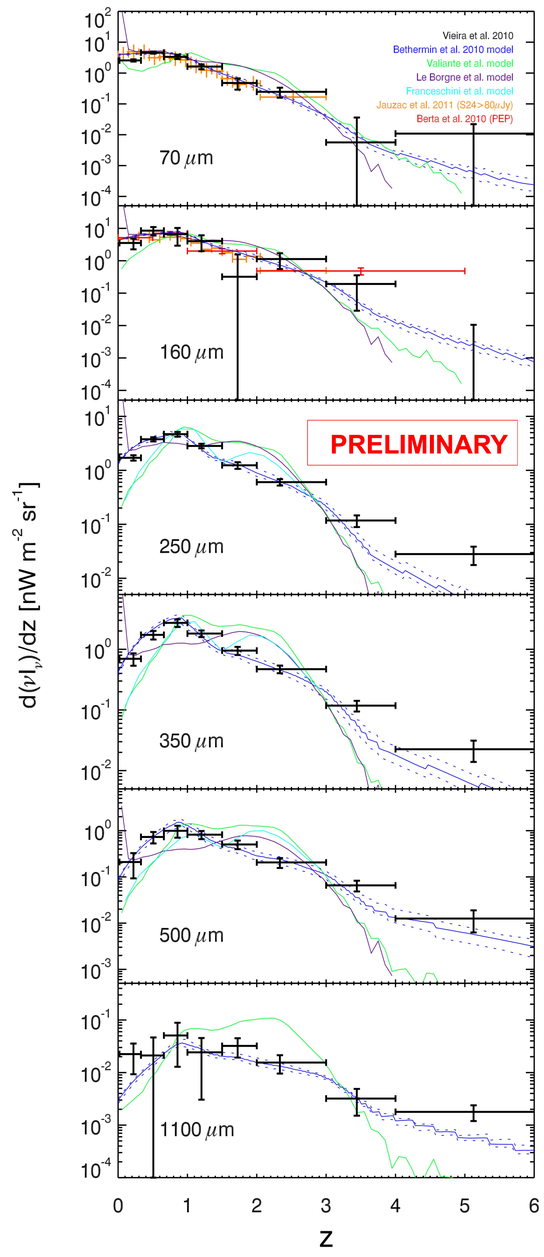
→ We combine deep public data sets (Spitzer/MIPS 24 microns catalog, spectroscopic redshift, photometric redshifts), and associate a redshift to 99.9% of the 1420 S24 >40 uJy sources in the GOODS-N field. We use this catalog to perform a stacking analysis and study the redshift evolution of the cosmic infrared background (CIB).

→ We measure the total contribution of the 24 um sources CIB by stacking in the Spitzer/MIPS (70 and 160 μm), Herschel/SPIRE(250, 350 and 500 μm), and AzTEC (1.1mm) maps. We are able to resolve the majority (~70%) of the CIB. (Fig. 1). The longer wavelengths probing the high redshift CIB and fully sampling the peak in the CIB SED.

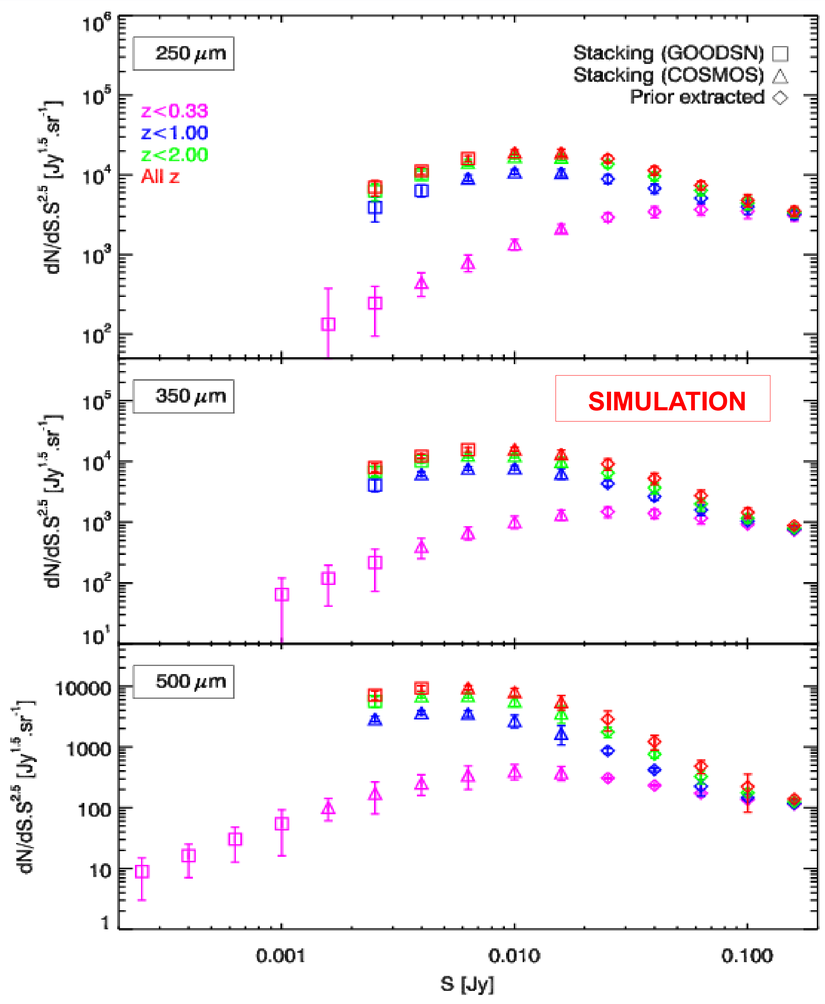
→ We break the sample in redshift bins to study the evolution of the CIB, and detect a peak in the CIB at z~1. These measurements will help fine tune evolutionary models of the CIB (see Fig. 2).

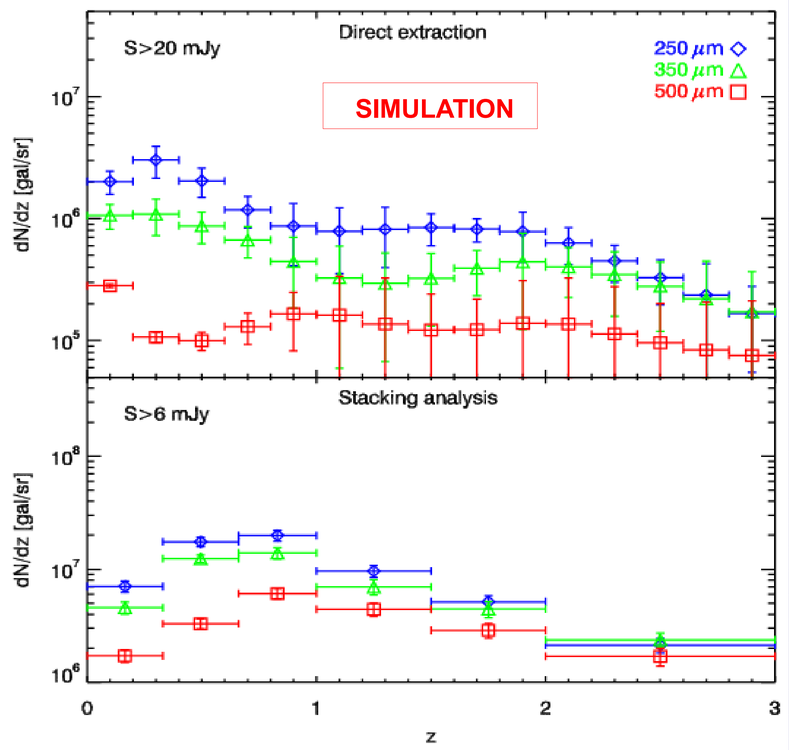


TOP LEFT: Fig. 1: Spectral energie distribution of the cosmic infrared background. In green: contribution of the S24>40μJy sources measured by stacking. In blue: contribution of the z<1 sources. In red: contribution of the z>1 sources. In grey: estimated total background (from Bethermin+2010a, Pénin+2011a, Lagache+2000).



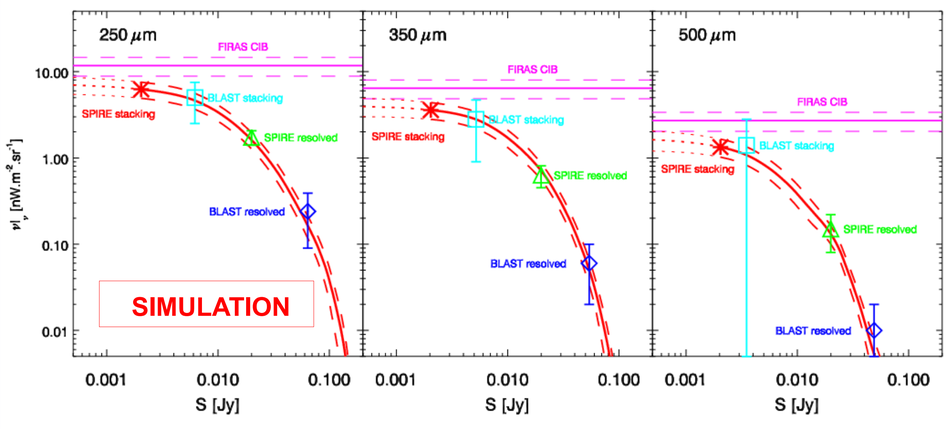
RIGHT: Fig. 2: Contribution of the S24>40μJy to the cosmic infrared background as a function of redshift at 70, 160, 250, 350, 500, and 1100 μm. **In black:** our measurement. Comparison with the measurements of Berta+2010 and Jauzac+2011. Comparison with the models (Le Borgne+2009, Valiante+2009, Franceschini+2010, Béthermin2011+).





TOP LEFT: Fig. 3: Number number counts at 250 (top), 350 (center), and 500 μm (bottom) for z<0.33, z<1, z<2 and all sources. The counts measured by prior extraction are plotted with diamonds. The counts by stacking are represented with triangles (COSMOS) and squares (GOODS-N). The positions of the points come from the Béthermin+2011 model and the error bars from a simulation.

TOP RIGHT: Fig. 4: Redshift distributions of the SPIRE sources at 250, 350, and 500 μm for a flux cut of 20 mJy (top) and 6 mJy (bottom). The positions of the points come from the Béthermin+2011 model and the error bars from a simulation.



BOTTOM LEFT: Fig. 5: Cumulative contribution to the CIB as a function of the flux at 250 (left), 350 (center) and 500 μm (right). The positions of the points come from the Béthermin+2011 model and the error bars from a simulation. In red: SPIRE measurements by stacking. The asterisks represents the faintest flux probed by stacking. In violet: FIRAS absolute measurement (Lagache+2000). In blue: BLAST resolved sources (Béthermin+2010b). In green: SPIRE resolved sources (Oliver+2010). In cyan: BLAST stacking (Béthermin2010b).

Ultra deep number counts at 250, 350 and 500 μm and CIB build-up

Béthermin, Le Floc'h, Ilbert, Roseboom, and HerMES (in prep.)

→ In COSMOS, we use the S24>80 uJy catalog matched with the photometric redshifts (Le Floc'h+2009, Ilbert+2009) to probe source counts below the Herschel/SPIRE confusion limit.

→ We extract sources from the SPIRE map using the 24 m fluxes and redshifts as a prior. This method enables a measurement the counts per redshift slice down to 20 mJy in the SPIRE bands.

→ We determine the mean color and the scatter of the 24 μm sources in several flux and redshift slices, and reconstruct the SPIRE source counts below the confusion limit (~6 mJy). We expect to reach 2 mJy in GOODS-N. Fig. 3 shows the counts of Béthermin+2011 model with the error bars coming from a simulation.

→ Using the same methods, we measure the redshift distribution of the resolved SPIRE sources. The Fig. 4 shows the counts of Béthermin+2011 model with the simulated data and error bars.

→ Finally, we integrate the number counts to estimate their contribution to the CIB (see Fig. 5), and compare the results with the previous measurements (Béthermin+2010b, Oliver+2010).