THE QUEST FOR DUSTY PRIMEVAL GALAXIES

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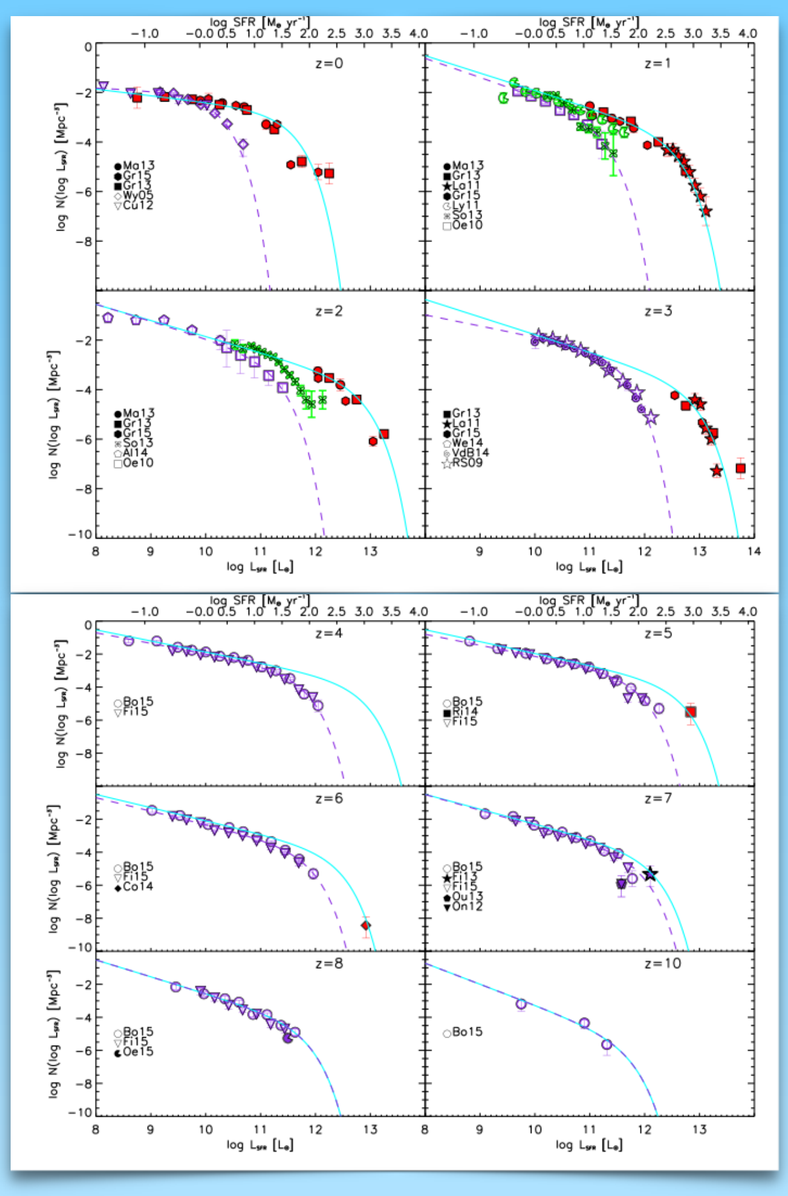

Figure 1: SF[illegible]

Aims and Methods

The history of star formation in massive galaxies (the host of high-redshift quasars) is a fundamental problem in galaxy evolution. We address two important issues: is star formation in galaxies mainly regulated by in-situ processes or by merging? How does the presence of dust affect the statistics of the star formation rate in galaxies at high redshift $z \geq 3$? To cast light on these issues (see Fig. 1), we built up the SFR functions in the range $z \approx 0\text{-}10$. For $z \leq 3$ we fitted a Schechter function to the UV data for SFRs $\psi \leq 30\ M_\odot/\mathrm{yr}$ and to the far-IR data for SFRs $\psi \leq 100\ M_\odot/\mathrm{yr}$. We have imposed that at $z \geq 8$ the UV-inferred SFR function is representative of the intrinsic one, since we expect small attenuation by dust due to the short age of the Universe. This allows us to set the redshift evolution of the Schechter parameters to work out predictions for the SFR function over the whole redshift range. We checked the SFR functions obtained against observed number counts and z-distributions at different wavelengths finding good agreement (see Fig. 2 for an example); we furthermore exploited the continuity equation approach and the "main sequence" star formation timescales to reproduce the stellar mass function of active, star-forming galaxies at $z \geq 4$ (see Fig. 3). We also computed average relationships between stellar vs halo mass via the abundance matching technique and worked out two different methods to study such galaxies at high-z .

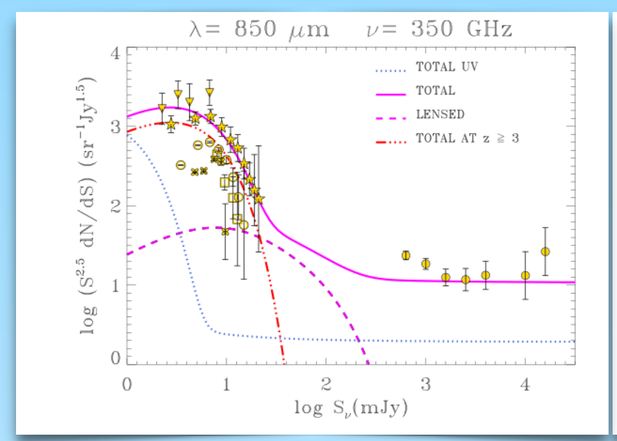

Figure 2: Validation of SFR functions via number counts

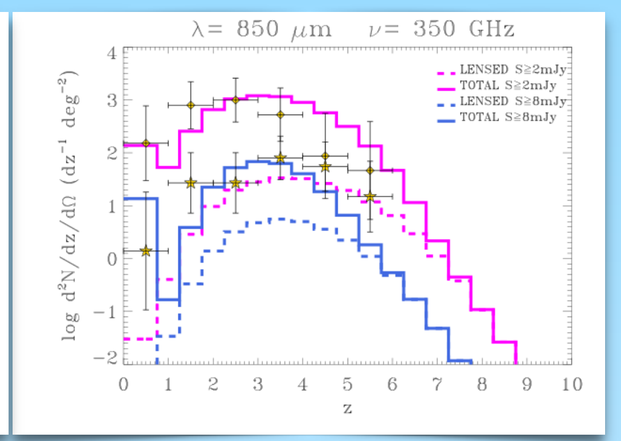

Figure 3: Validation of SFR functions via Continuity Equation

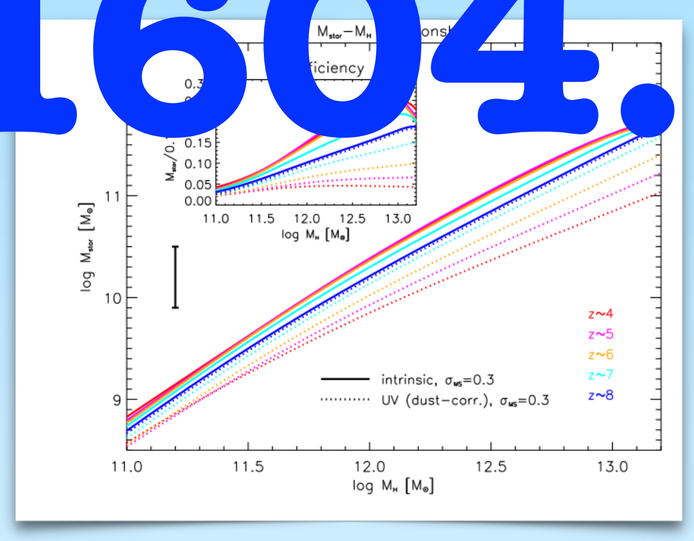

Figure 4: Connection with DM via Abundance Matching

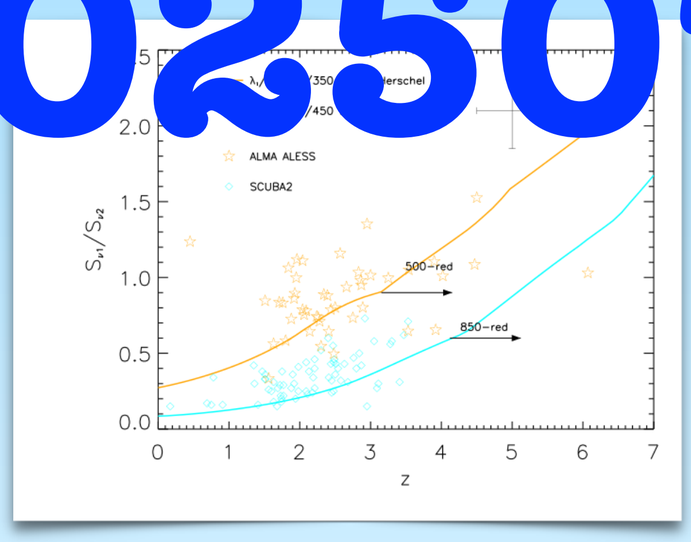

Figure 5: selection of "red sources"

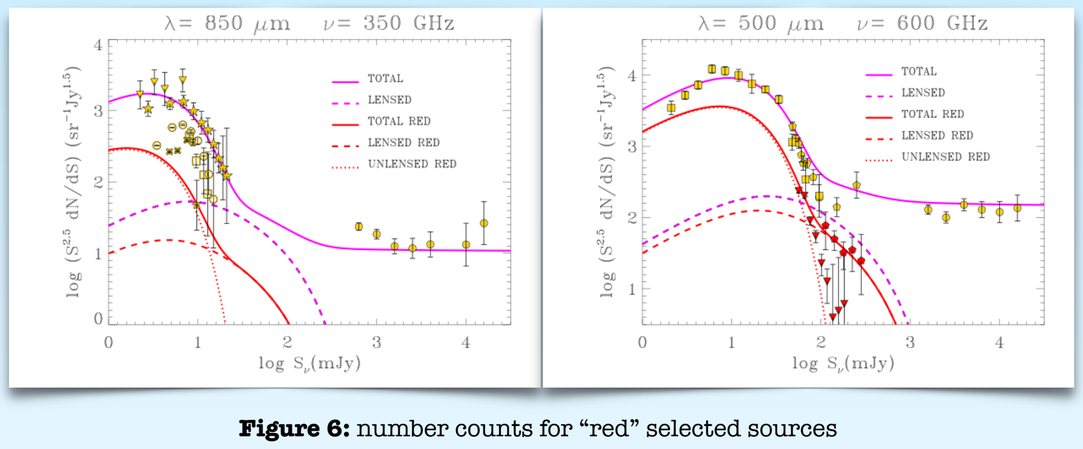

Figure 6: number counts for "red" selected sources

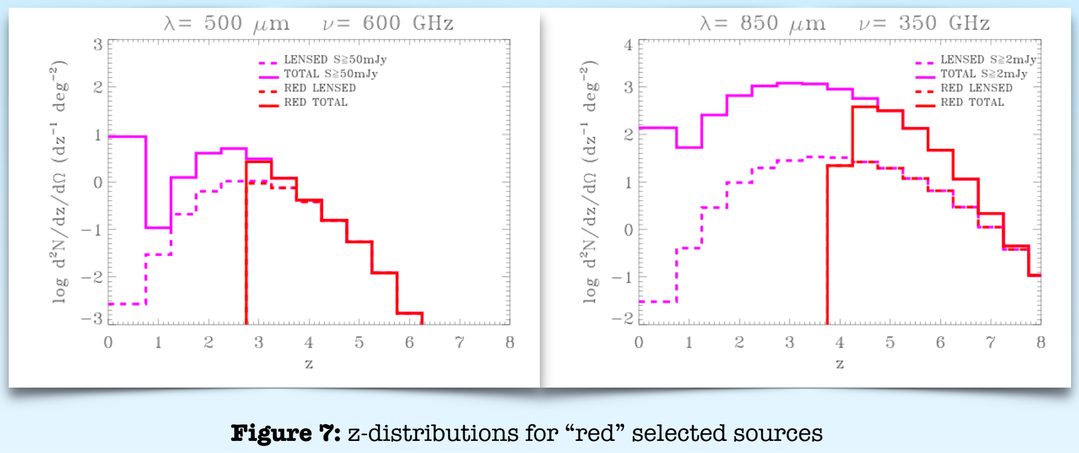

Figure 7: z-distributions for "red" selected sources

Main Results

Our analysis highlights that:

(i) the buildup of stars and black holes in galaxies occurs via **in-situ** processes, with mergers playing a marginal role at least for stellar masses ≤ 3 x 10^(11)M⊙ and BH masses ≤ 10^(9) M⊙ (see Fig. 4).

(ii) we designed an observational strategy to hunt dusty star-forming galaxies at $z \geq 4$ based on a color preselection in the far -IR or (sub)-mm band (see Fig. 5).

(iii) to probe the bright end of the SFR functions we computed the expected number counts and z-distributions of dusty star-forming galaxies (see Figs. 6,7).

(iv) we investigated the nature of UV-selected galaxies at $z \geq 4$ finding their attenuation to be in strong excess with respect to the commonly used one, which is based on the β-IRX relation(see Fig. 8); we propose an attenuation proportional to ψ^(0.25) .

(v) we propose the combination of current UV surveys with (sub)-mm and radio upcoming facilities (ALMA, NIKA2, SKA) to definitely probe the bright end of the SFR functions at $z \geq 4$.

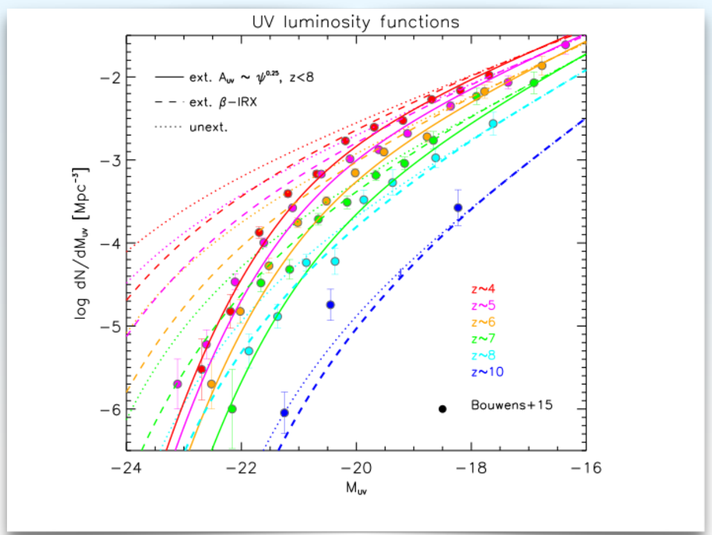

Figure 8: dusty galaxies in the UV