The intriguing life of massive galaxies
Proceedings IAU Symposium No. 295, 2012
D. Thomas, A. Pasquali & I. Ferreras, eds.

doi:10.1017/S1743921313004195

Looking for molecular gas in a massive lyman break galaxy at z = 4.05

Qinghua Tan[1,2], Emanuele Daddi[1], Mark Sargent[1], Jackie Hodge[3], and Yu Gao[2]

[1]CEA, Laboratoire AIM, Irfu/SAp, F-91191 Gif-sur-Yvette, France
email: edaddi@cea.fr

[2]Purple Mountain Observatory, CAS, 2 West Beijing Road, 210008 Nanjing, China

[3]Max-Planck Institute for Astronomy, Königstuhl 17, 69117 Heidelberg, Germany

Abstract. We present a search for CO emission in a massive lyman break galaxy at z ∼ 4.05.

Keywords. galaxies: high-redshift, galaxies: star formation, radio lines: galaxies

---

We have observed the CO(4-3) and CO (6-5) lines with the Plateau de Bure Interferometer. The observations of each individual configuration show a tentative detection at the $\sim 3\sigma$ level of CO emission at the position of the ACS/HST source. The signal is improved to S/N $\sim$ 5 when combining CO (4-3) and CO (6-5) observations (Fig. 1). We have run extensive simulations to estimate that the chance probability of such a signal in our combined datacubes is $\sim 2\times10^{-4}$. Assuming that both detections are real, we infer a molecular gas mass of $\sim 1.4\times10^{11}$ M$\odot$ by adopting a conversion factor of $\alpha_{\rm CO} \sim$ 7.0, which is based on the $\alpha_{\rm CO}$ - metallicity relation (Magdis *et al.* 2011; Sargent *et al.* 2012b). The location of this galaxy in the $L_{\rm IR}$ - $L'_{\rm CO}$ plane suggests little variation from the trend defined by normal star-forming galaxies over $0< z < 2.2$, possible evidence against a too strong evolution of the conversion factor to higher redshifts. The molecular gas ratio ($\sim$68%) is found to be comparable to the ratios observed at $z = 2$ (Magdis *et al.* 2012a), providing additional support for the existence of a plateau in the redshift evolution of the specific SFR of normal galaxies at $z > 3$. However, we need more CO observations to make a definitive detection and thus further confirm these conclusions.

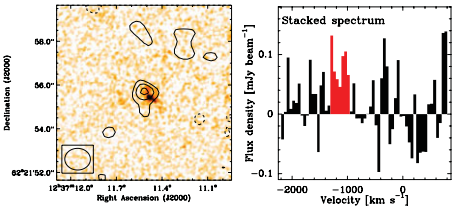

Figure 1. Left: Countours of stacked CO (4-3) and CO (6-5) overlaid on HST+WFC3 F140W image. Countour levels start at $\pm2\sigma$ and are in steps of 1σ, with positive(negative) countours shown as solid (dashed) lines. **Right**: Combined CO spectrum adopting average line ratio from GN20 and M82 total SLED models. The red color indicates the maximum emission region.

References

Magdis, G., Daddi, E., Elbaz, D., *et al.* 2011, *ApJ*, 740, 15
Magdis, G., Daddi, E., Sargent, M., *et al.* 2012a, *ApJ*, 758, 9
Sargent, M., *et al.* 2012b, in preparation