We performed a study of the baryonic matter (stars and hot gas) budget inside X-ray detected groups at z<1 using the COSMOS survey, and compared it to that of local massive clusters. We constrain the stellar and total baryon mass fractions in groups: our results suggest that groups are not simple scaled down versions of clusters and that they are likely not closed systems having relatively smaller gas fraction than clusters. They are more strongly affected by non-gravitational processes (such as AGN activity). To have a better understanding of the importance of non-gravitational processes in groups we study the energetics of radio galaxy feedback in X--ray detected galaxy groups and estimated the effect of the energy injection. We find that radio-AGN activity is capable of outweighing the capacity of a group to hold its gas. Furthermore, taking this energy injection into account we predict the deviation of the S-T relation from self similarity at the groups regime.

Data:
- 91 COSMOS X-ray detected groups (10^{13}-10^{14} M_{\odot}) at 0.1<z<1.0
- Stellar masses bound to galaxies (K band - COSMOS)
- Total cluster masses from scaling relations (Weak Lensing - COSMOS; Leauthaud et al. 2010)
- Clusters (10^{14}-10^{15} M_{\odot}; Lin et al. 2003)
- Gas masses (Pratt et al. 2009)
- Diffuse star component (Zibetti et al. 2005; Krick et al. 2007)

The Baryonic Budget of Groups and Clusters:
We compute the baryonic budget in groups and clusters as:

\[ f_b = f_{\text{stars}} + f_{\text{gas}} = \frac{M_{\text{gas}}}{M_{\text{tot}}} + \frac{M_{\text{stars}}}{M_{\text{tot}}} \]

We find that:
1. \( f_{\text{stars}} = (M_{500})^{0.37\pm0.04} \) ➔ more efficient star formation in groups (Fig. 2 upper panel)
2. No significant evolution with redshift of the relation between \( f_{\text{stars}} \) and \( M_{500} \) is observed. ➔ groups have already assembled their stellar content at z=1
3. Adding \( f_{\text{gas}} \) by Pratt et al. 2009: \( f_b \) for groups is lower than WMAP5 at > 3\( \sigma \) (Fig. 1 lower panel)
   ➔ ~30% of the expected hot gas is missing in groups!

Can Radio Galaxy Feedback explain the shortage of Baryons in Groups?
Searching for a cause of the baryon deficit in groups, we quantify the importance of the mechanical energy released by radio–galaxies in the groups. 16 groups in our sample have a radio galaxy within R200. For those we compute the mechanical energy from a scaling relation with the monochromatic 1.4 GHz luminosity (as in Birzan et al. 2008) and compare it to the binding energy from the total mass, assuming NFW profile.

We find that:
1. Radio-galaxy activity is capable of outweighing the capacity of a group to hold its gas. The effect is negligible for clusters (Fig.3).
2. Taking this energy injection into account we predict the deviation of the S-T relation from self similarity at the groups regime (Fig. 4).