COSMOS
Cosmic Evolution Survey

1/5

z-COSMOS
40'000 VLT redshifts for COSMOS

Daniela Vergani
(INAF-OABO)
zCOSMOS team

"First mass-selected k+a galaxies at z=0.48-1.2 in a wide range of environments"

- Strong Balmer abs lines (intense burst ~1Gyr ago) and absence of emission lines (no ongoing SF)
- Interpreted to be the link between SF/blue and quiescent/red galaxies
- Discrepant results in the literature and misleading comparisons: 1) Different definitions of the sample (Hδ only or combinations of Balmer lines, A/K, PCA, Ha or [OII]) ; 2) likely strong environmental effects; 3) survey selection effects (flux- vrs mass- vs colour selection); 4) spectral S/N; ...

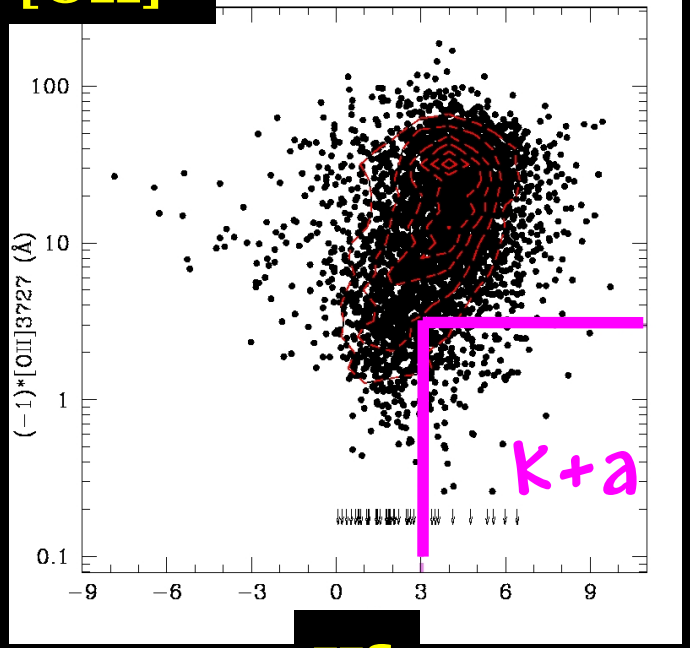
=> Internal comparison with parent samples & Mass selection

- Parent sample: confident z + spectral range (0.48<z<1.2)
- K+As: Hδ>3Å + 2.5σ confidence + [OII]3727>-3Å
- QUIESCENT gal.s: large 4000 Balmer break & no [OII]
- STAR-F.ING gal.s:small 4000 Balmer break,strong [OII]

Outline:

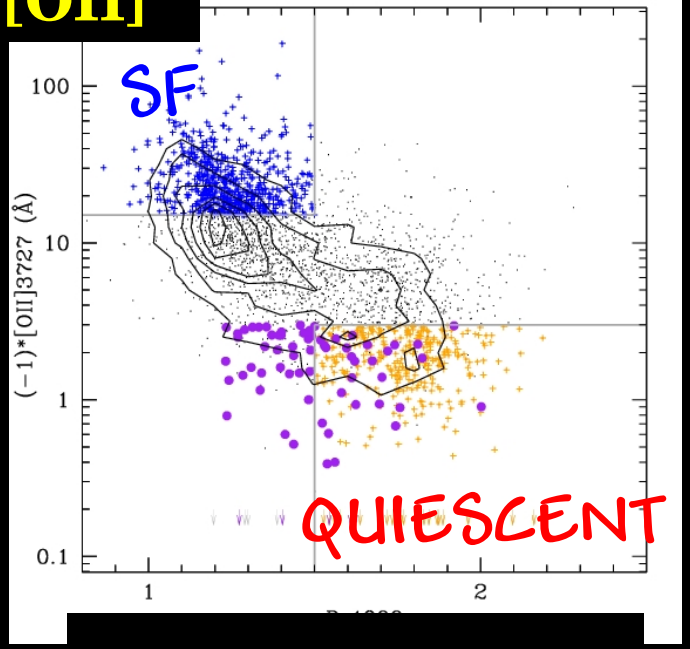
1. Our sample
2. Mass, Lum, Colour, & Morphologies
3. Environment
4. Mass flow
5. Conclusion & prospectives

[OII]



Hδ

[OII]

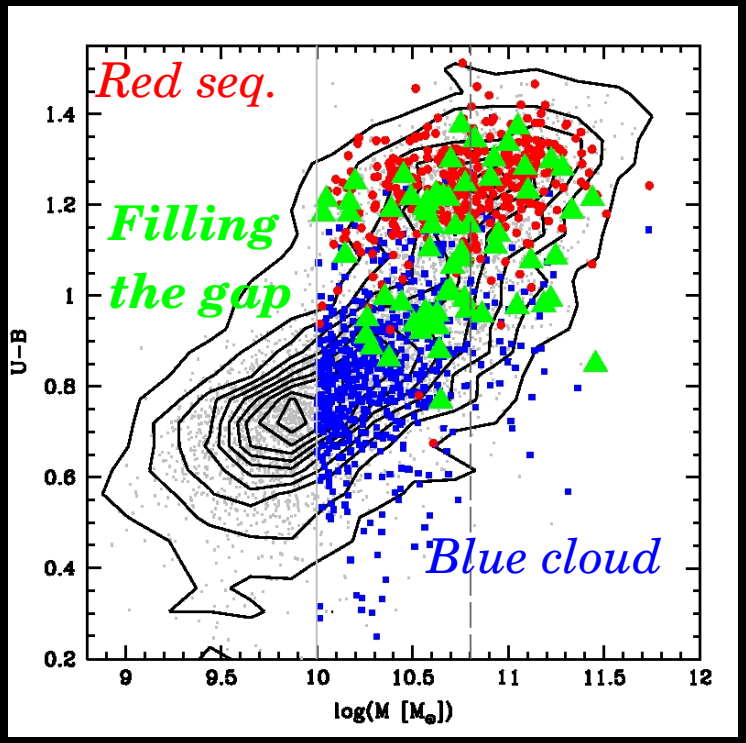


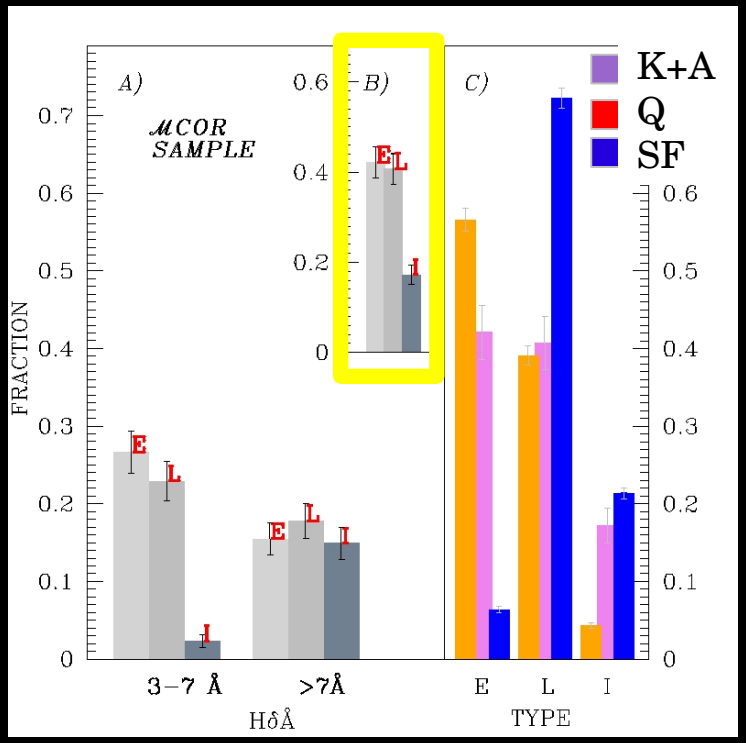
4000 Balmer break

Physical properties of k+a sources: Colours, Morphologies, Luminosities and Stellar Masses

More luminous, with intermediate colours, as massive as quiescent galaxies (and more massive than SF)

Morphologically a heterogeneous population, with no trend with Hδ, but more massive systems prefer an early-type aspect (mass-morphology relation)





Colour-Stellar Masses **Hδ strength** **Morph. Type**

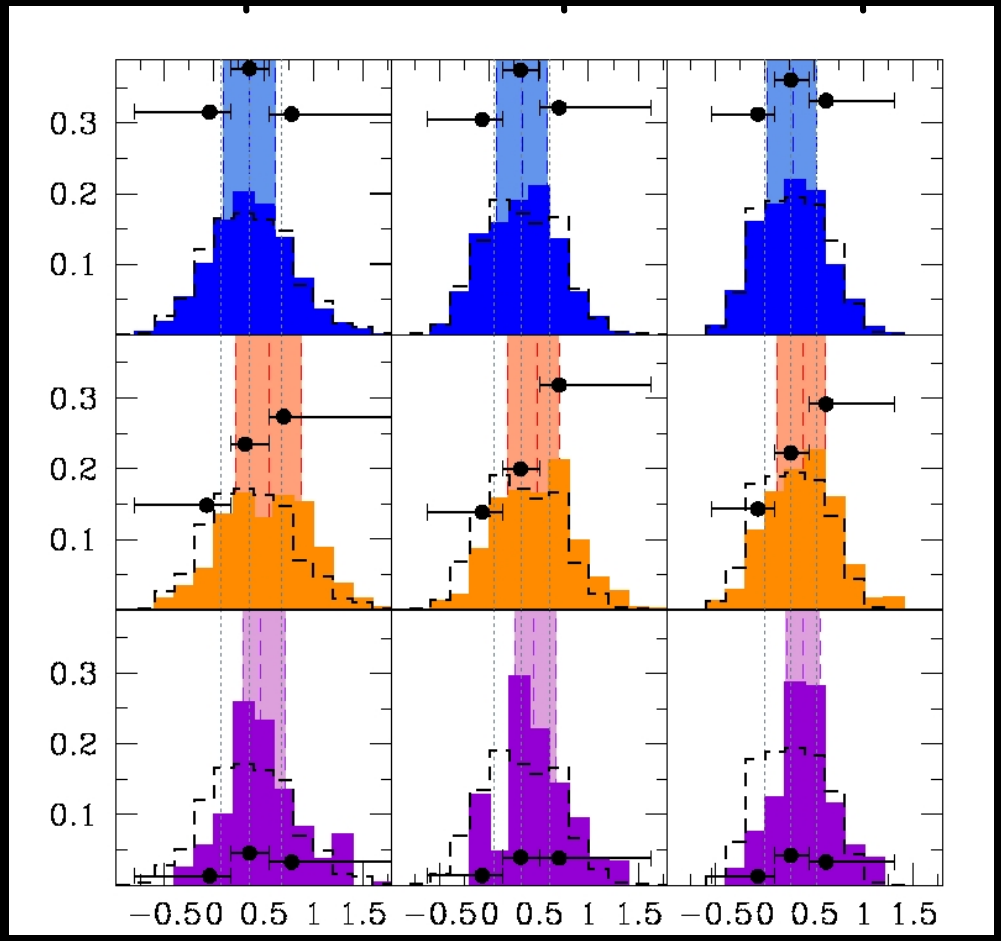
Type by ZEST, Scarlata et al. 2007

Outline:

1. Our sample
2. Mass, Lum, Colour, & Morphologies
3. Environment
4. Mass flow
5. Conclusion & prospectives

K+a galaxy environment using nearest neighbours

Environmental dependence on 2-8Mpc physical scales, but K+as also in under-dense regions: multiple mechanisms acting



$\log(1+\delta_{5NN})$ $\log(1+\delta_{10NN})$ $\log(1+\delta_{20NN})$

Under -> Over dense region

Density estimator $1+\delta=\rho/\langle\rho(z)\rangle$ by ZADE (Kovac & zCOSMOS'09, arXiv0903.340)

Outline:

1. Our sample
2. Mass, Lum, Colour, & Morphologies
3. Environment
4. Mass flow
5. Conclusion & prospectives

The mass flow

The contribution from galaxies having abruptly quenched their SF (K+a Gs) to the growth rate in stellar mass density of the red sequence is up to 10%

3.6. The stellar mass density and mass flux

We estimate the total mass flux that enter the red sequence after a starburst and subsequent fast quenching of the star formation as following:

$$\dot{\rho}_{k+a\rightarrow Q} = \frac{1}{t_{k+a}} \sum_{i=1}^{N_{k+a}} \frac{M_i^*}{w_i . V_{max,i}} \quad (1)$$

where M^* is the stellar mass of the galaxy in solar masses, w is the selection function (w_{SSR}, w_{TSR}), and V_{max} is the correction for the volume in which each galaxy can be seen. With the value t_{k+a} we assume that the $k+a$ spectroscopic features are detectable for 0.35, or 1 Gyr. Our $k+a$ galaxies correspond to a mass flux entering the red-sequence of:

$\dot{\rho}_{k+a\rightarrow Q} = 7.8 \times 10^{-4+1.8\times10^{-5}}_{-1.2\times10^{-5}}$ $M_\odot/Mpc^3/yr$ with $t_{k+a} = 0.35$ Gyr (or 8% contribution to the growth rate estimated in $dM/dt \sim 10^7 M_\odot/Mpc^3/Gyr$);

$\dot{\rho}_{k+a\rightarrow Q} = 2.7 \times 10^{-4+1.3\times10^{-5}}_{-1.7\times10^{-5}}$ $M_\odot/Mpc^3/yr$ with $t_{k+a} = 1$ Gyr (or 3% contribution to the growth rate)

With the assumption that the $k+a$ spectroscopic features are detectable for 0.35 Gyr, or 1Gyr, and galaxies subsequently remain on the red sequence.

Outline:

1. Our sample
2. Mass, Lum, Colour, & Morphologies
3. Environment
4. Mass flow
5. Conclusion & prospectives

Conclusion & prospectives

- K+a Gs: rare, special class where SF ceased abruptly <1Gyr

- The largest mass-selected K+a galaxy sample at intermediate z in no cluster-related environment with multi-λ coverage on COSMOS field using zCOSMOS

- Heterogeneous in many properties: bright, massive, "green" colours, all morphologies

- Multiple mechanisms acting in suddenly quenching SF activity (they reside in all environments)

- Feeding the red-sequence up to 3-10% at z<1 (but lower limit as K+a + AGN galaxies are not in our sample)

- Next steps: Principal component analysis on SFR indicators with different time-scale (or SF mode), their impact on galaxy assembly, and characterisation of exotic sources;
K+a galaxies in X-ray selected clusters (radial dependences and merger hypothesis, + A. Finoguenov et al.); bars fraction in low-z K+a galaxies (as possible AGN feedback quenching, + Kartik Shet et al.)