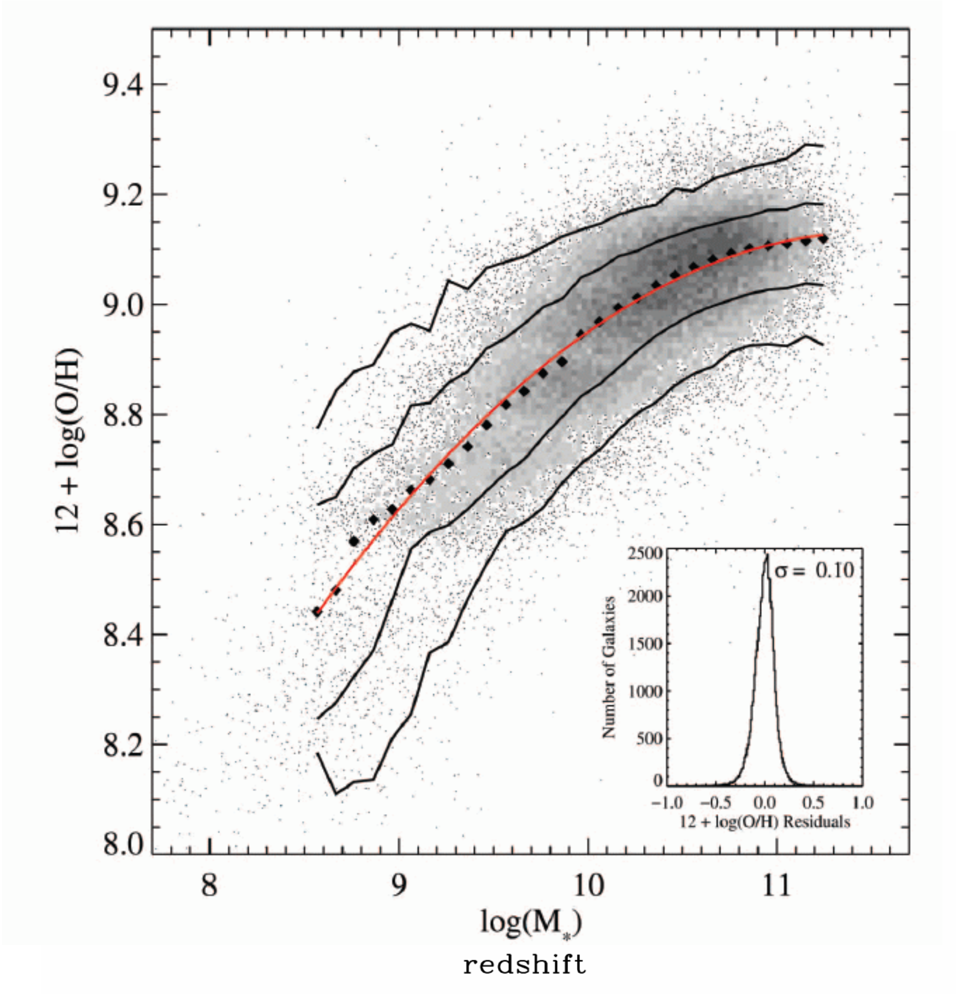
Gruppo Extragalattico
Galassie Lontane e Cosmologia

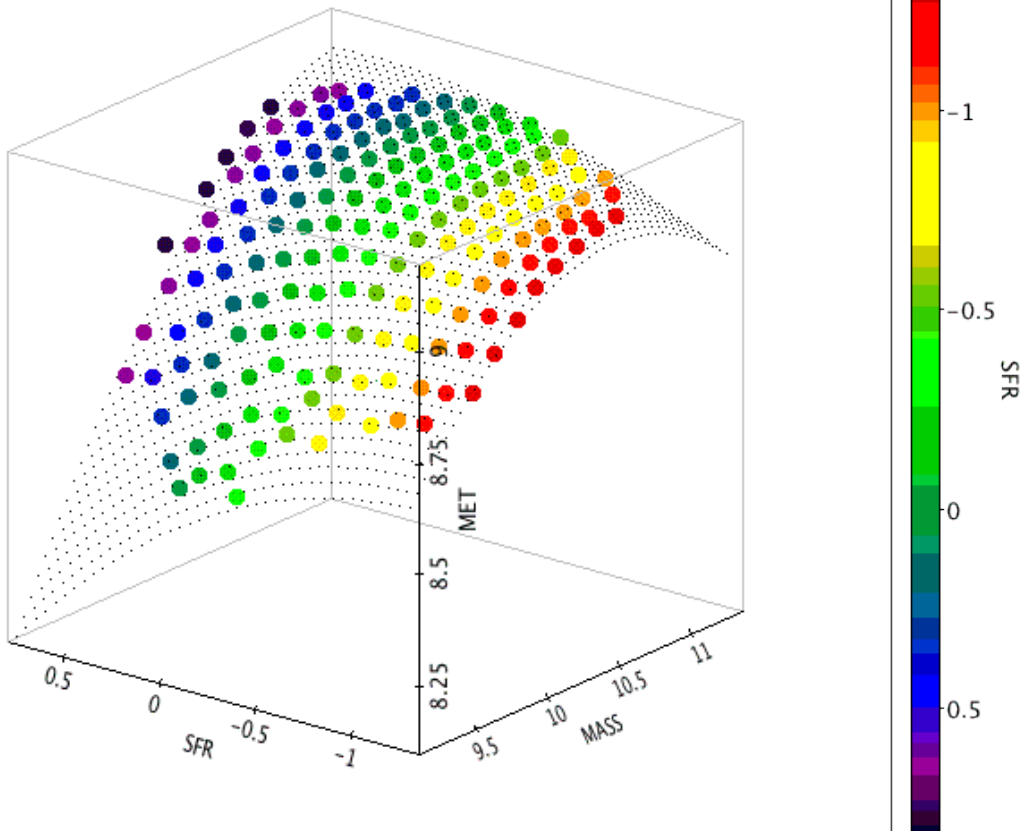
- Giovanni Cresci, Laura Magrini, Filippo Mannucci, Alessandro Marconi, Veronica Sommariva: Evoluzione chimica e dinamica e morfologia di galassie a form. stellare
- Leslie Hunt, Giovanni Cresci: Galassie ospiti di GRB
- Paolo Tozzi: Ammassi lontani di galassie, Indicatori di formazione stellare
- Stefano Zibetti: Assorbitori MgII, Evoluzione della massa stellare e morfologia
- Sperello di Serego Alighieri: Evoluzione degli sferoidi, Birifrangenza cosmologica

The Fundamental Metallicity Relation

Mass Metallicity relation



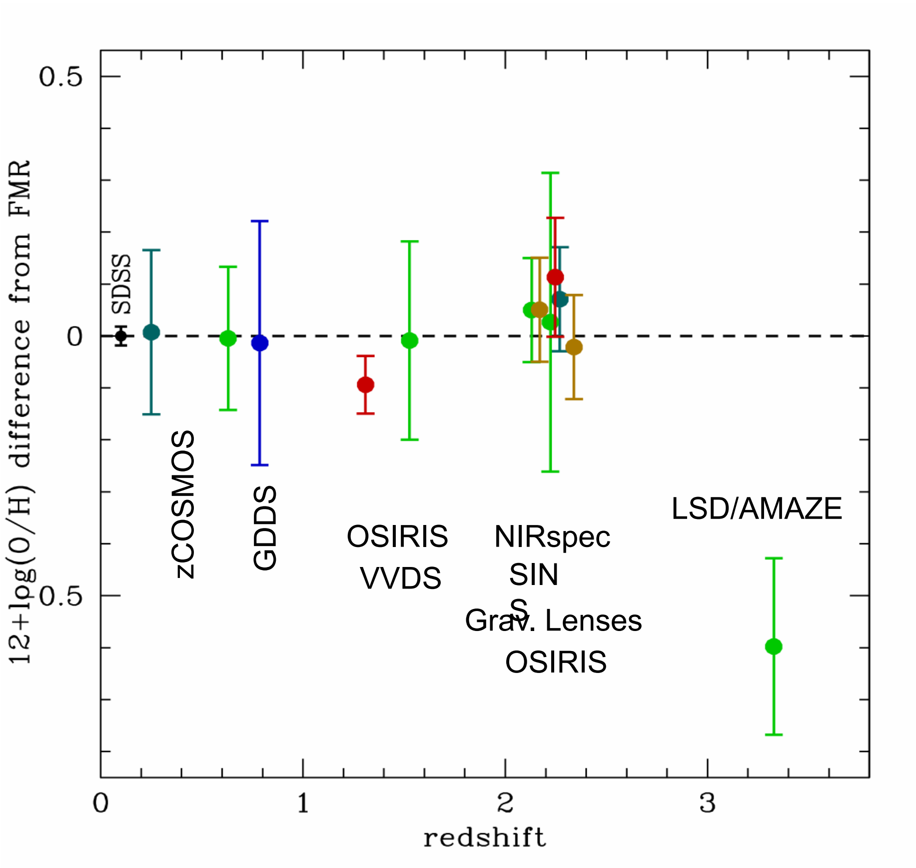
Scatter reduced by introducing the SFR as third parameter => 3D surface



Small scatter => Long lasting equilibrium between gas accretion, star formation and metal ejection

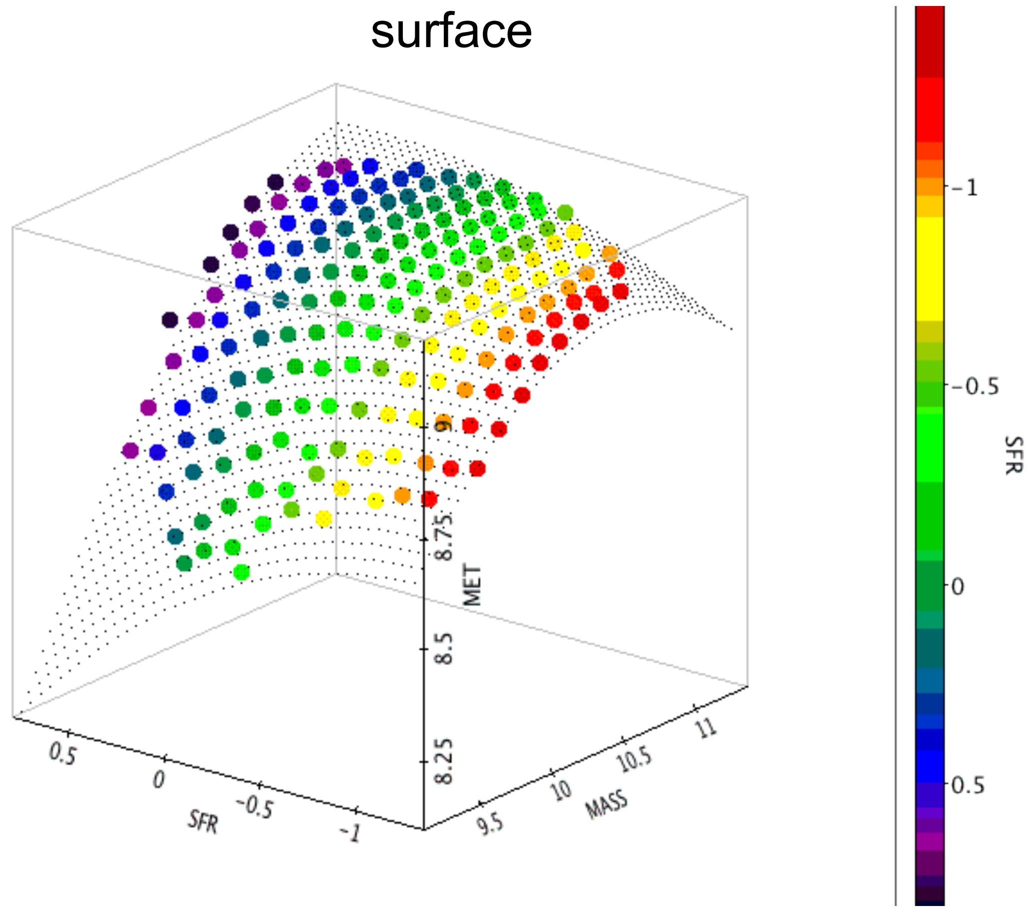
Mannucci et al. 2010; Cresci et al. 2011

The Fundamental Metallicity Relation



No evolution of the FMR up to z~3

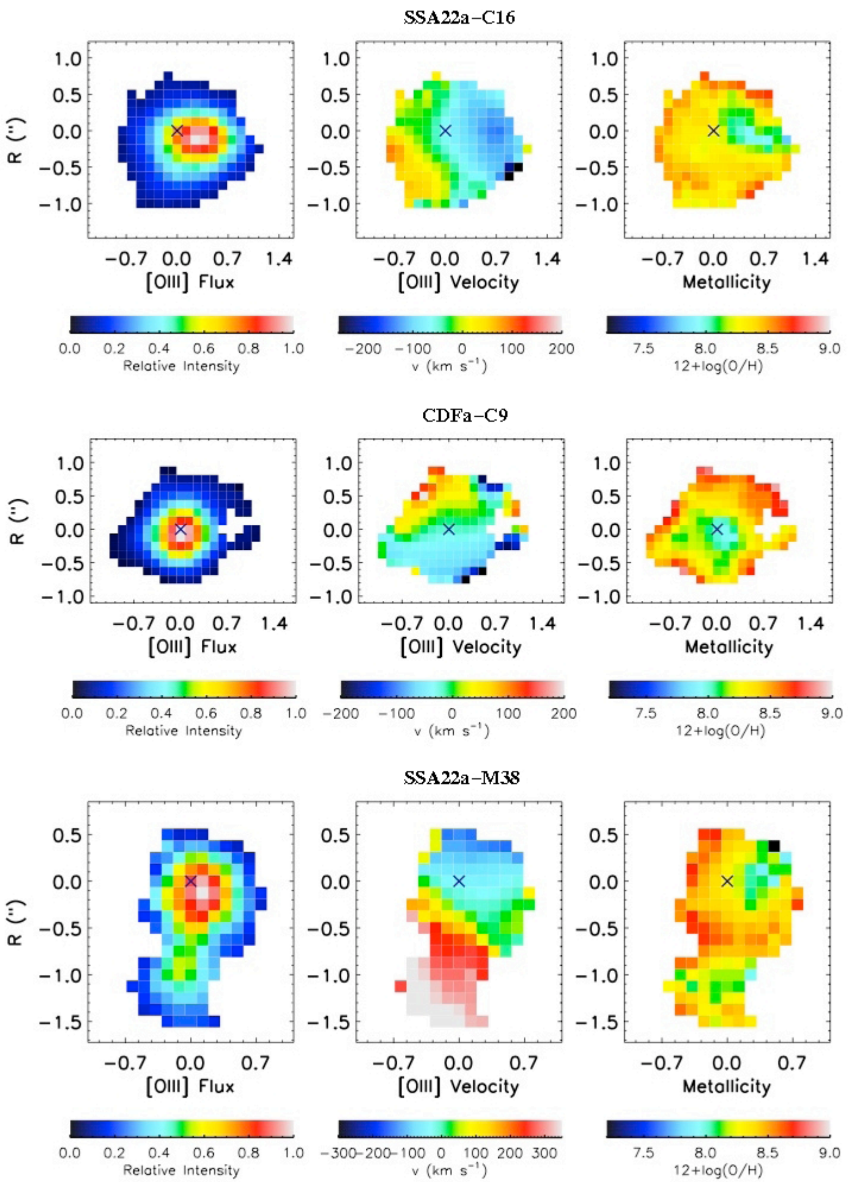
Scatter reduced by introducing the SFR as third parameter => 3D surface



Small scatter => Long lasting equilibrium between gas accretion, star formation and metal ejection

Mannucci et al. 2010; Cresci et al. 2011

Metallicity Gradients at z=3



Cresci et al. Nature, 2010

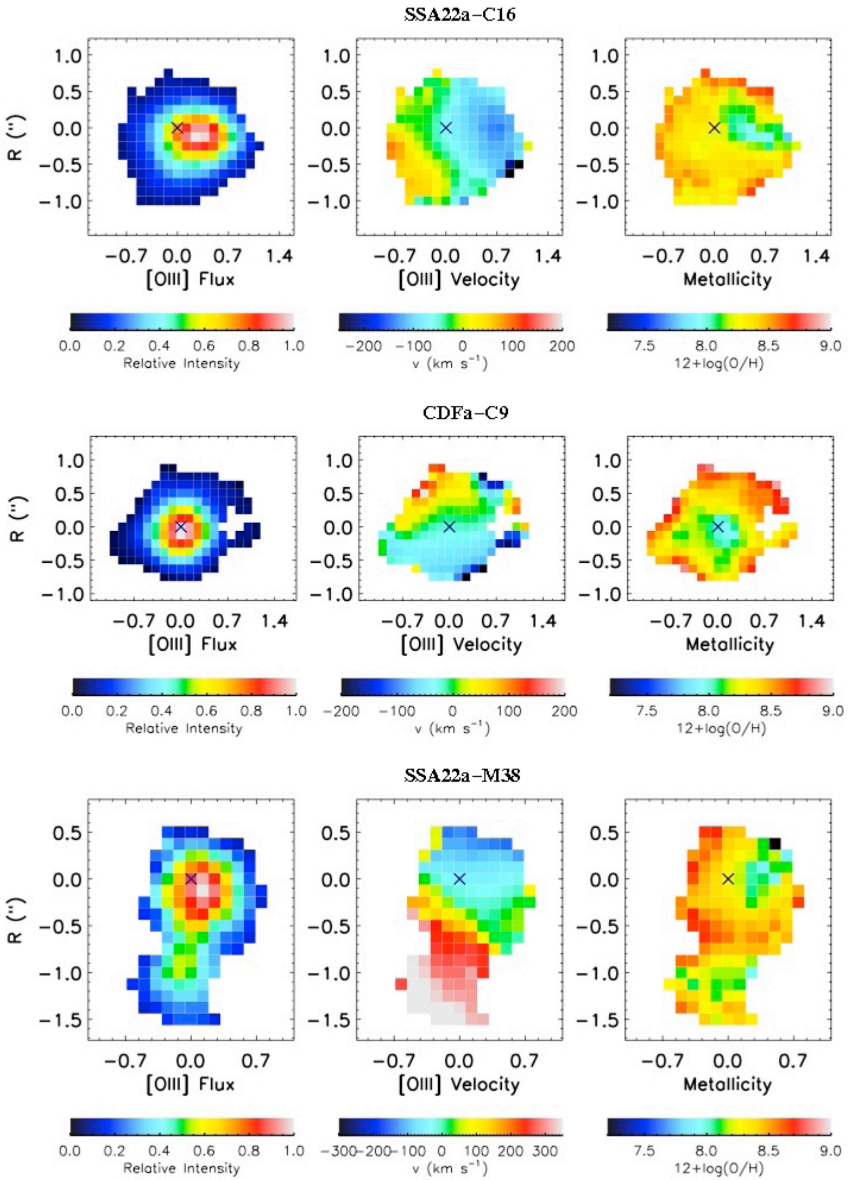
First metallicity maps at z~3:

- Three undisturbed disks
- Well defined regions close to the SF peak are less metal enriched than the disk

Evidence for massive infall of metal poor gas feeding the star formation

Sommariva et al. 2011

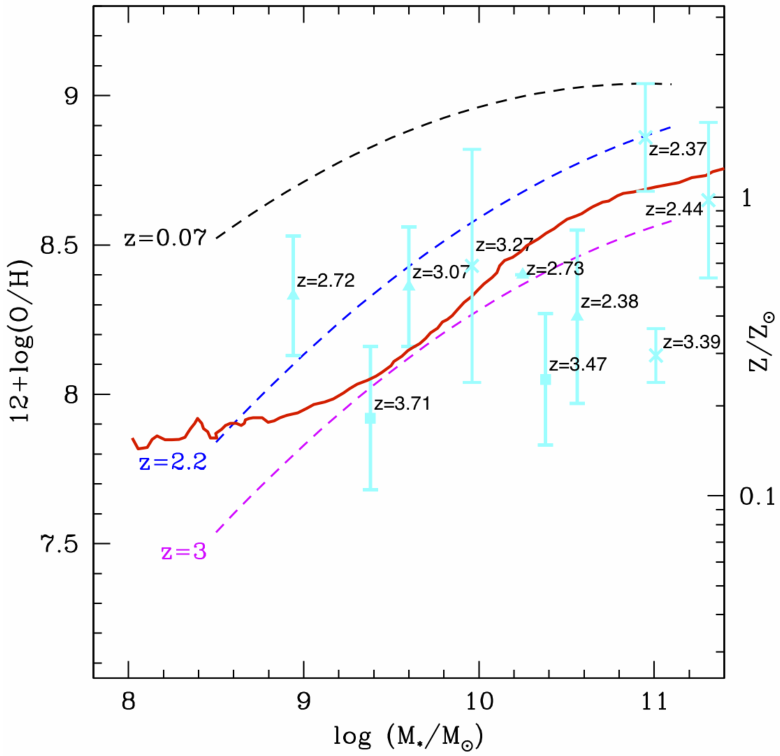
Metallicity Gradients at z=3



Cresci et al. Nature, 2010

Evolution of Stellar Metallicity

New rest frame UV features defined to measure stellar metallicities in high-z galaxies



Gas phase and **stellar metallicities** are comparable in star forming galaxies at high-z

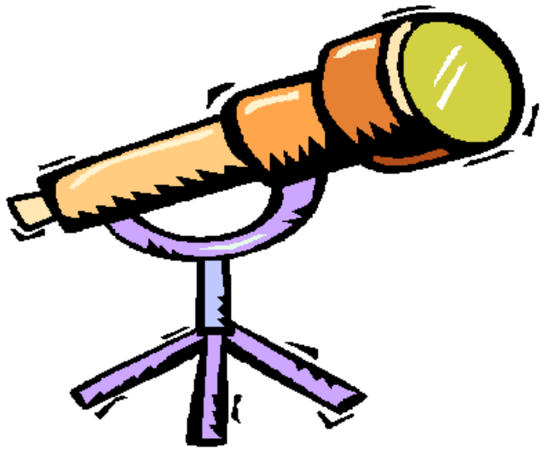
Sommariva et al. 2011

Finanziamenti Ricevuti:

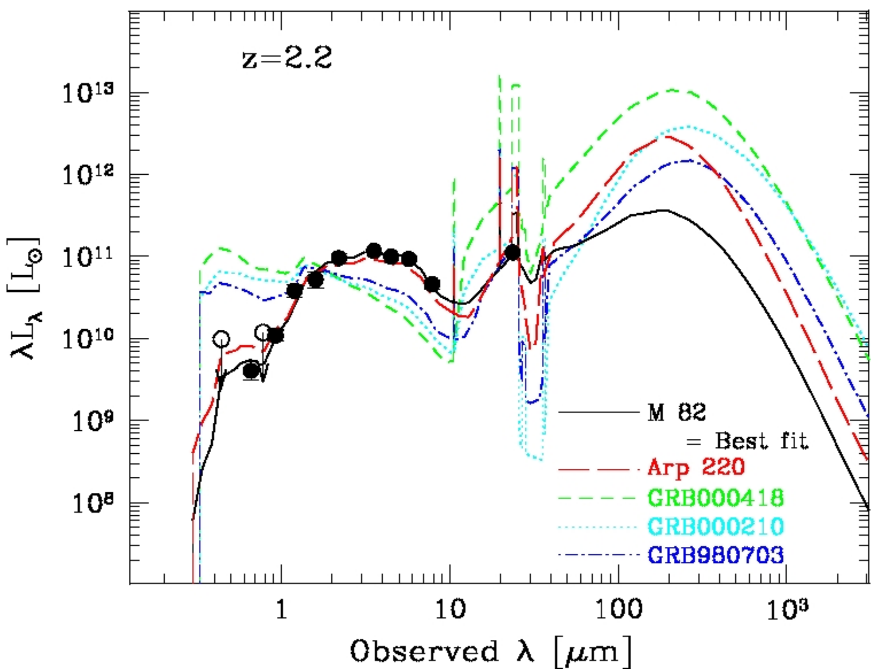
- ASI/INAF 2010   48KE
- PRIN 2008   108KE
- HST   32KE
- SPITZER 26KE

Proposal Approvati:

Telesc.	Cycle	Instr.	h	PI	Title/Subject
Spitzer	5	IRAC	17	Mannucci	Stellar masses of LSD galaxies
HST	17	WFC3/ACS	18	Mannucci	Optical and near-IR morphology of LSD galaxies
ESO	83/84	FORS	40	Maiolino	Stellar metallicity at z=3
ESO	85	SINFONI	23	Vanzi	Dynamics and resolved metallicity gradients at z>3: cold disk or hot merger?
ESO	85/86	ISAAC	28	Mannucci	The mass-metallicity at z=5
TNG	21	NICS	74	Mannucci	Stellar masses of LSD and AMAZE galaxies
LBT	3	LUCIFER/MOS	44	Mannucci/ Cresci	Metallicity and SFR in an unbiased sample of LBG at z>3
LBT	3	LUCIFER	12	Cresci	Spatially resolved chemical properties at z~2
ESO	84	X-shooter	8	Maiolino	High signal-to-noise Optical and near-IR spectrum of a lensed galaxy at z~3
LBT	5	LUCIFER/MOS	7	Magrini	Metallicity of the galaxies in a cluster zt z~1.4
ESO	85/86	SINFONI	22	Vanzi	Metallicity gradients in high redshift galaxies



GRB host galaxies (GRBHs) with *Spitzer* and *Herschel*

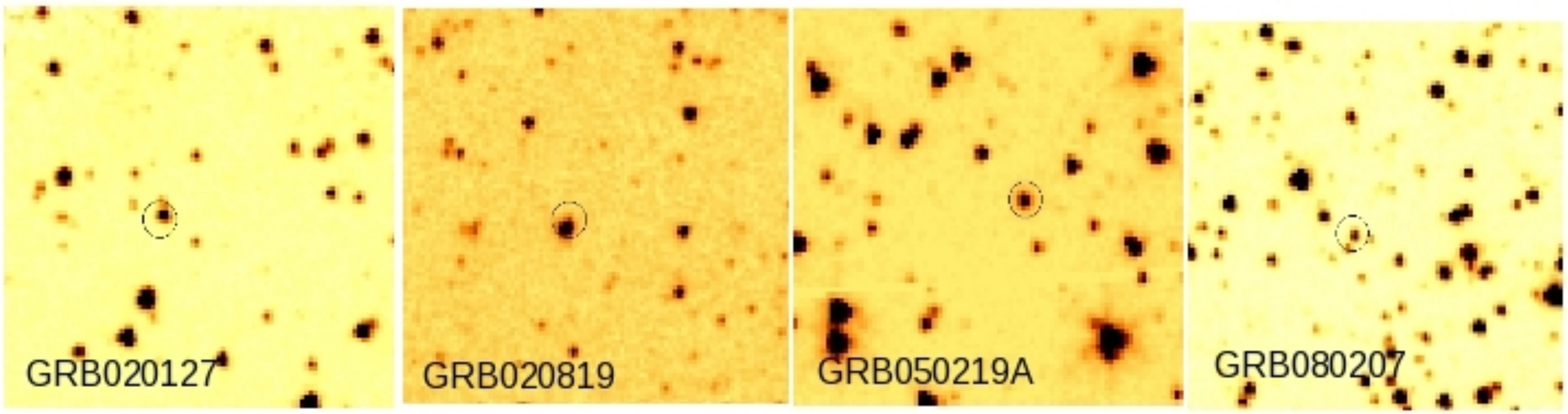


Host galaxy of (dark) GRB 080207
(Hunt, Palazzi, Savaglio, Cresci et al. 2011)

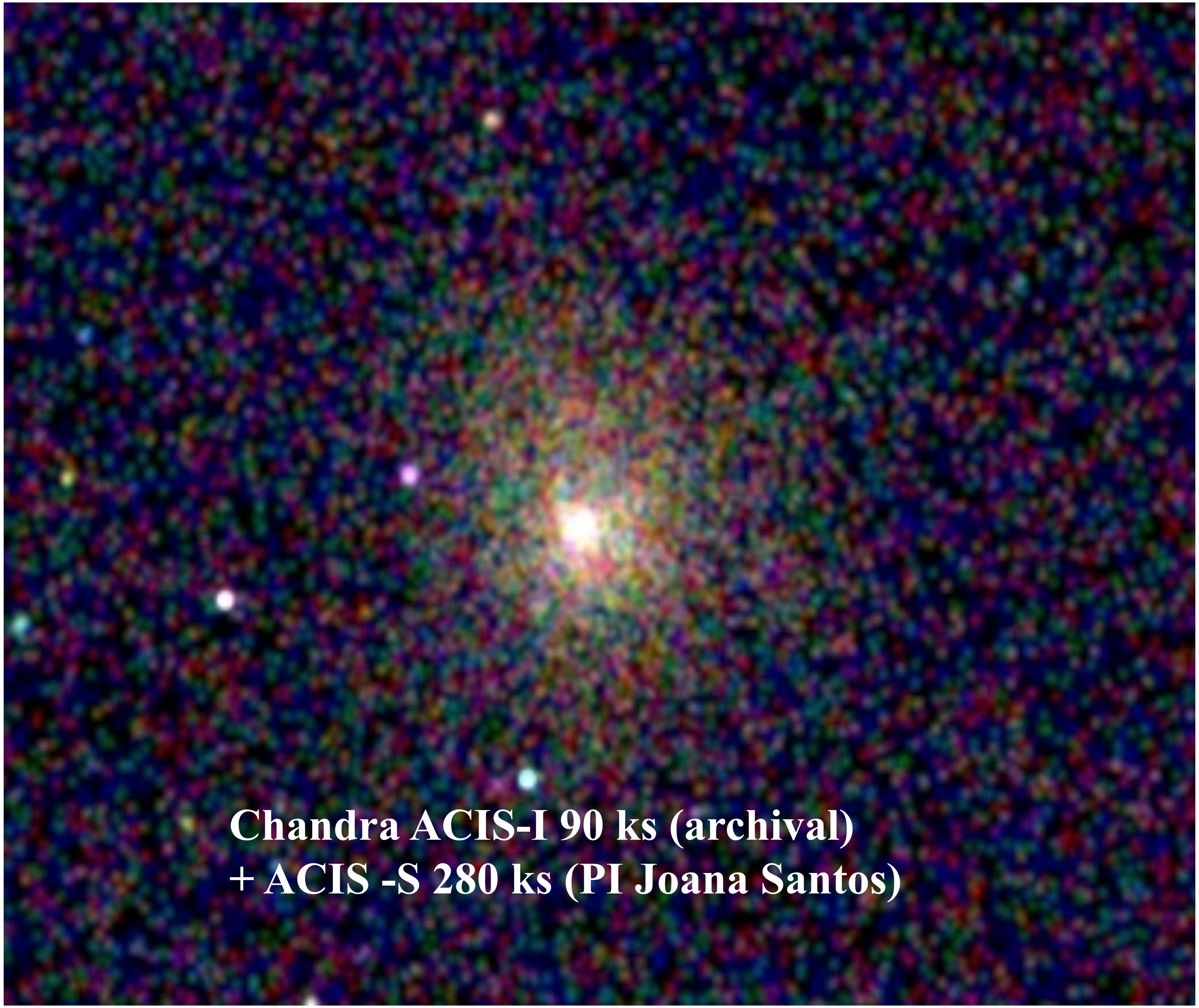
- ✓ ERO and DOG (Extremely Red Object and Dust Obscured Galaxy): first DOG GRBH
- ✓ SED fitting gives phot z = 2.2 (coincides with yet unpublished Xshooter spec z)
- ✓ Stellar mass 3 x 10^{11} $M_\odot$, A_V ~1-2 mag, SFR ~ 120 $M_\odot$ yr $^{-1}$. Emblematic of a distinct class of GRBHs with evolved stellar populations, high extinction and SFR?

Work in progress: ~70% detection for 118 GRBHs with IRAC 3.6 µm (archive data)

Herschel OT2 proposal approved in Priority 1 for 15 dark GRB hosts



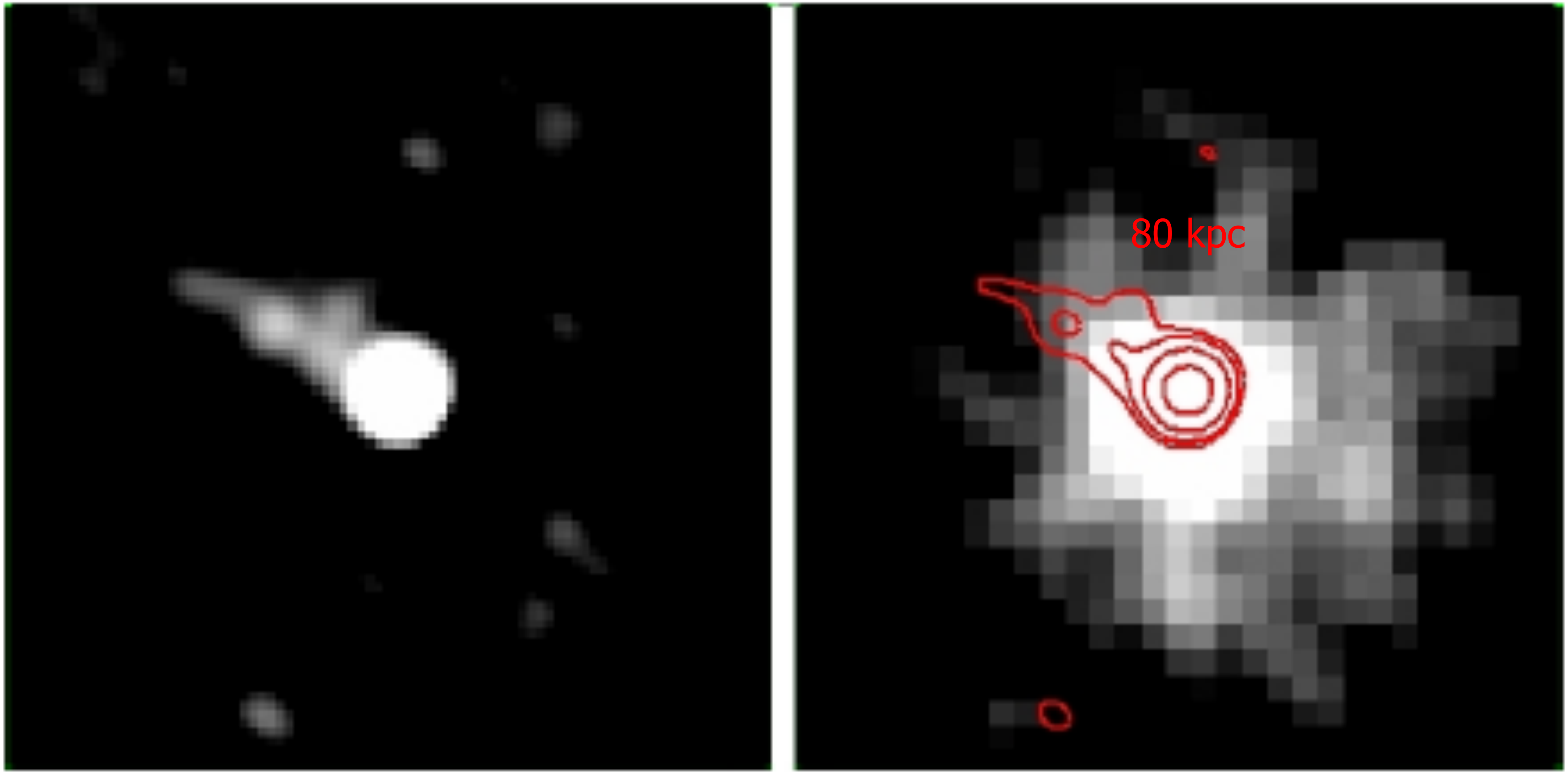
Paolo Tozzi
Investigation of cool core evolution in distant X-ray clusters
CL1415 @ z=1, a CC in the distant Universe



Santos et al. 2012

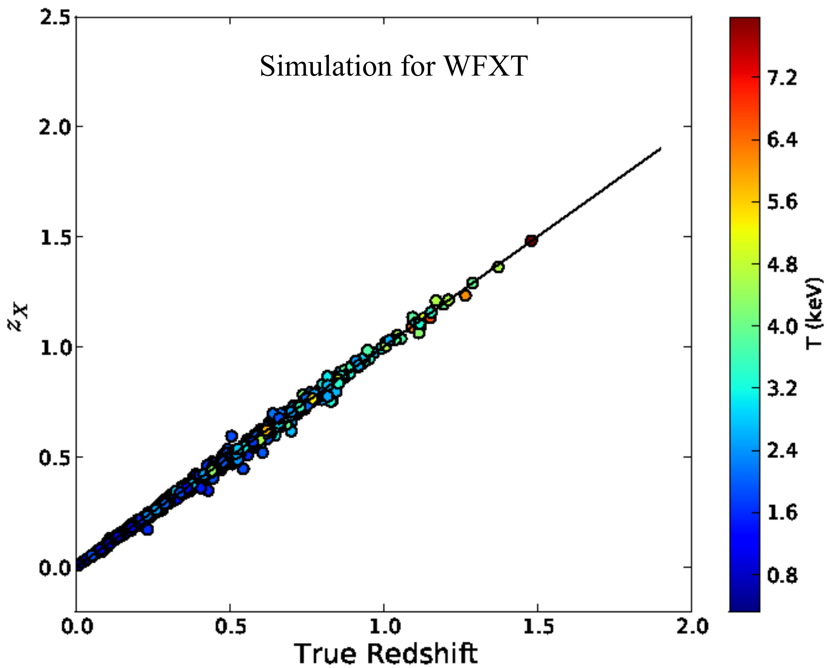
Radio feedback processes in the cores of distant clusters

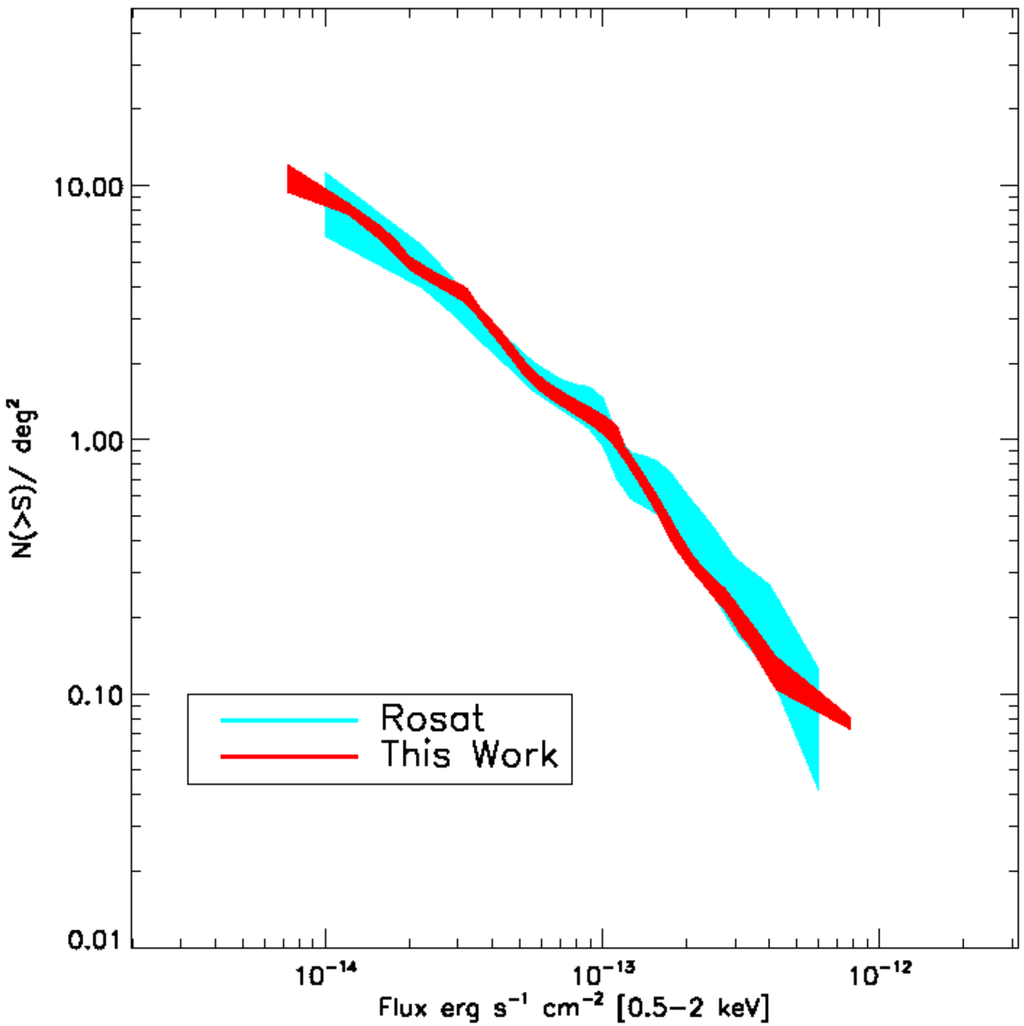
A cool core cluster at z=1



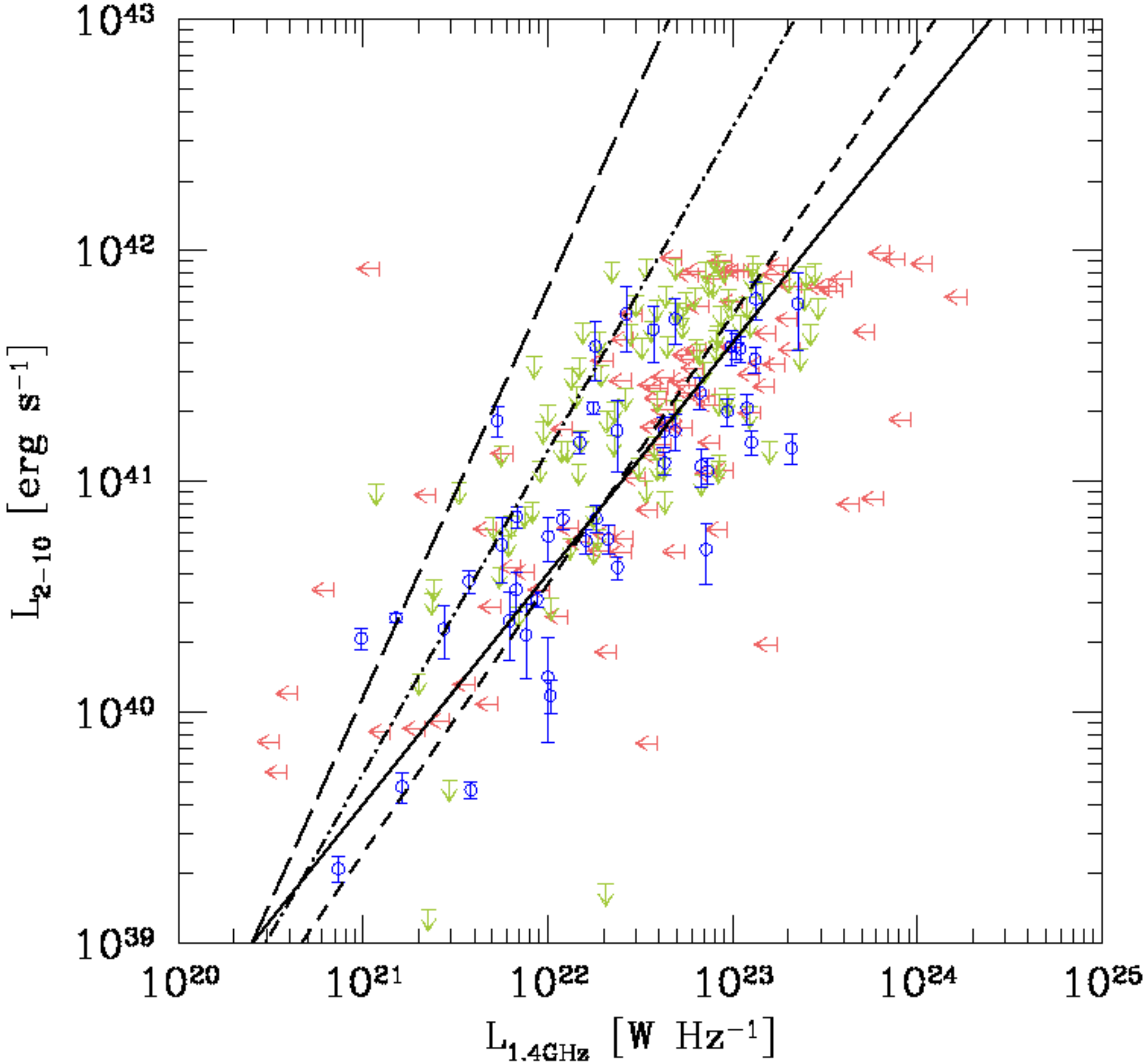
Swift X-ray Cluster Survey

Swift X-ray Cluster Survey:
A new X-ray cluster survey based on the archival data of the X-ray Telescope on board of the Swift Satellite. A complete, well defined, entirely X-ray selected sample of ~ 300 groups and clusters of galaxies to study the evolution of the Intra Cluster Medium and perform cosmological test.
A test bed for future X-ray survey mission (like the Wide Field X-ray Telescope).





Study of the X-ray-Radio luminosity correlation in distant Star forming Galaxies using the Chandra Deep Field South data

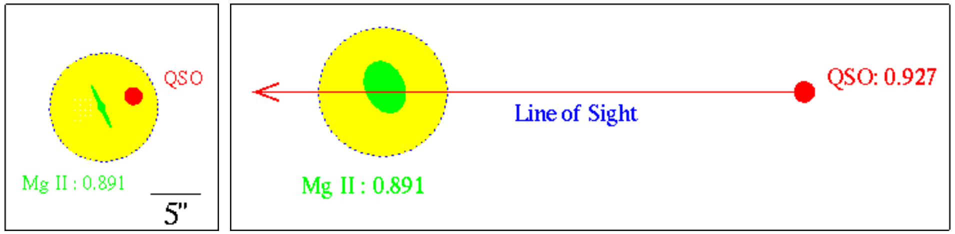


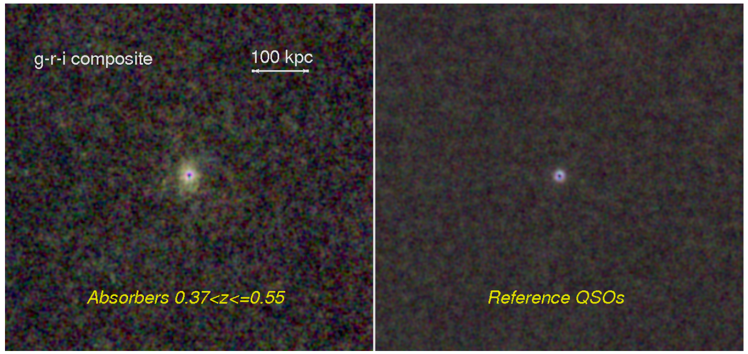
Vattakunnel et al. 2012

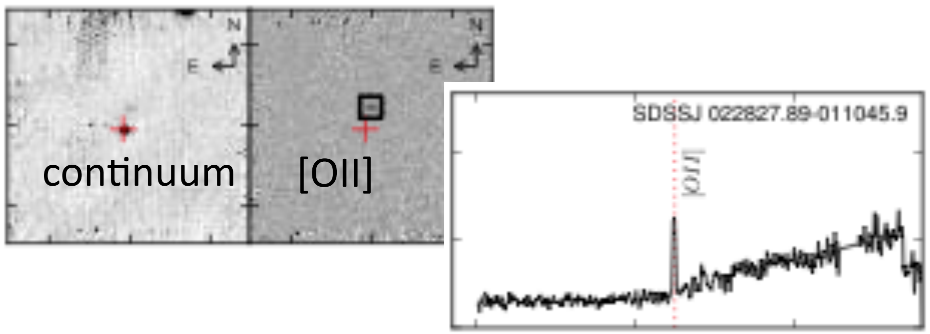
Stefano Zibetti

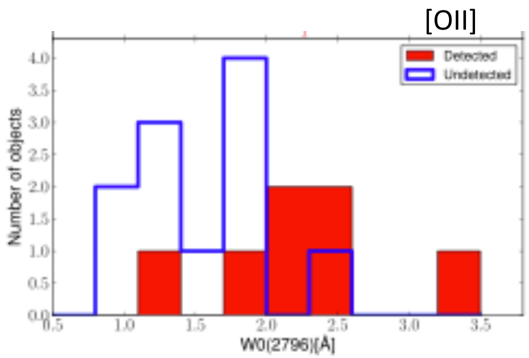
MgII absorbers: linking the IGM to galaxies

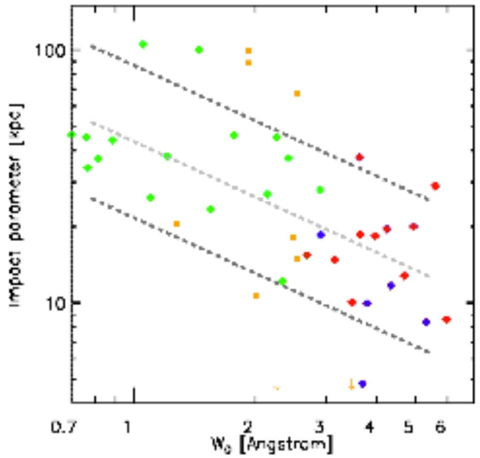
- SDSS stacking studies (imaging of 2800 absorbed QSO: Zibetti +2005,2007; spec:Ménard+2011)
  - Strong MgII absorbers have been shown to correlate with galaxies on scales >100kpc
  - Anti-correlation between strength and impact parameter
  - Correlation between strength and SFR (from colors or [OII] emission)
  - ⇒ MgII absorbing clouds are possibly related to outflows
- Follow-up 18 absorbed QSO with VIMOS-IFU (Khramtsova, SZ & Ménard in prep.) to confirm stacking results with a sample of individual objects
  - identification of [OII] emitters (SFing galaxies) related to MgII absorbers
    - [OII] emitters are more frequent around stronger absorbers
    - MgII strength anticorrelates with impact parameter up to 100 kpc, although with a large dispersion.



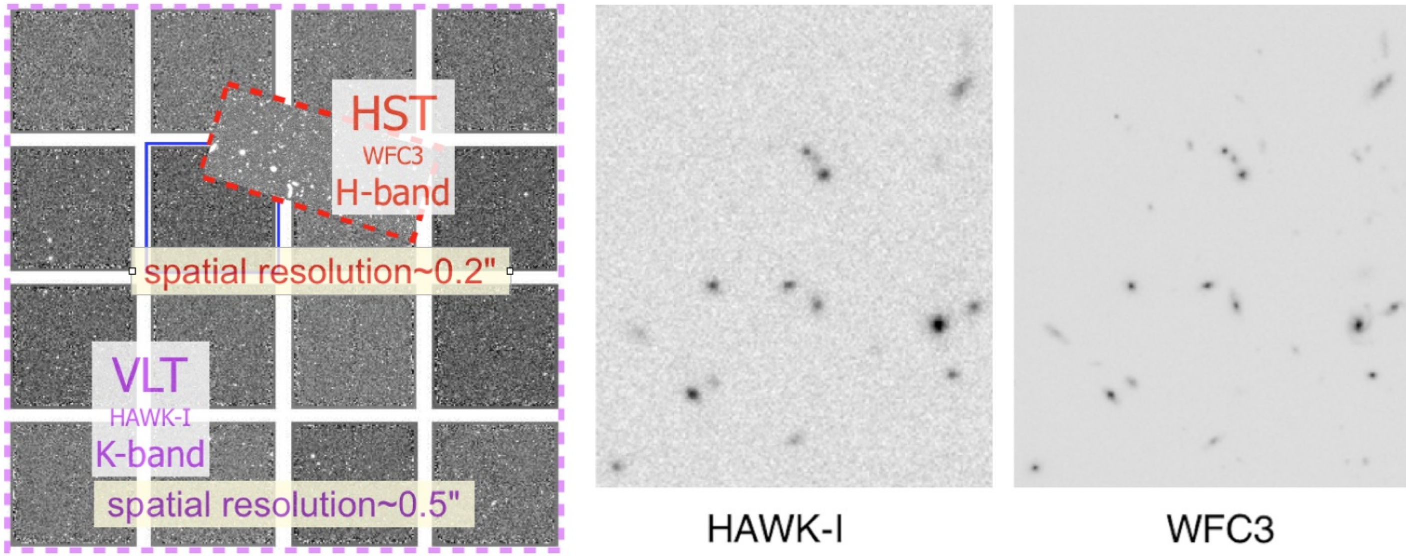








Evolution of stellar mass and morphology at z~2



Chang et al. (in prep.)

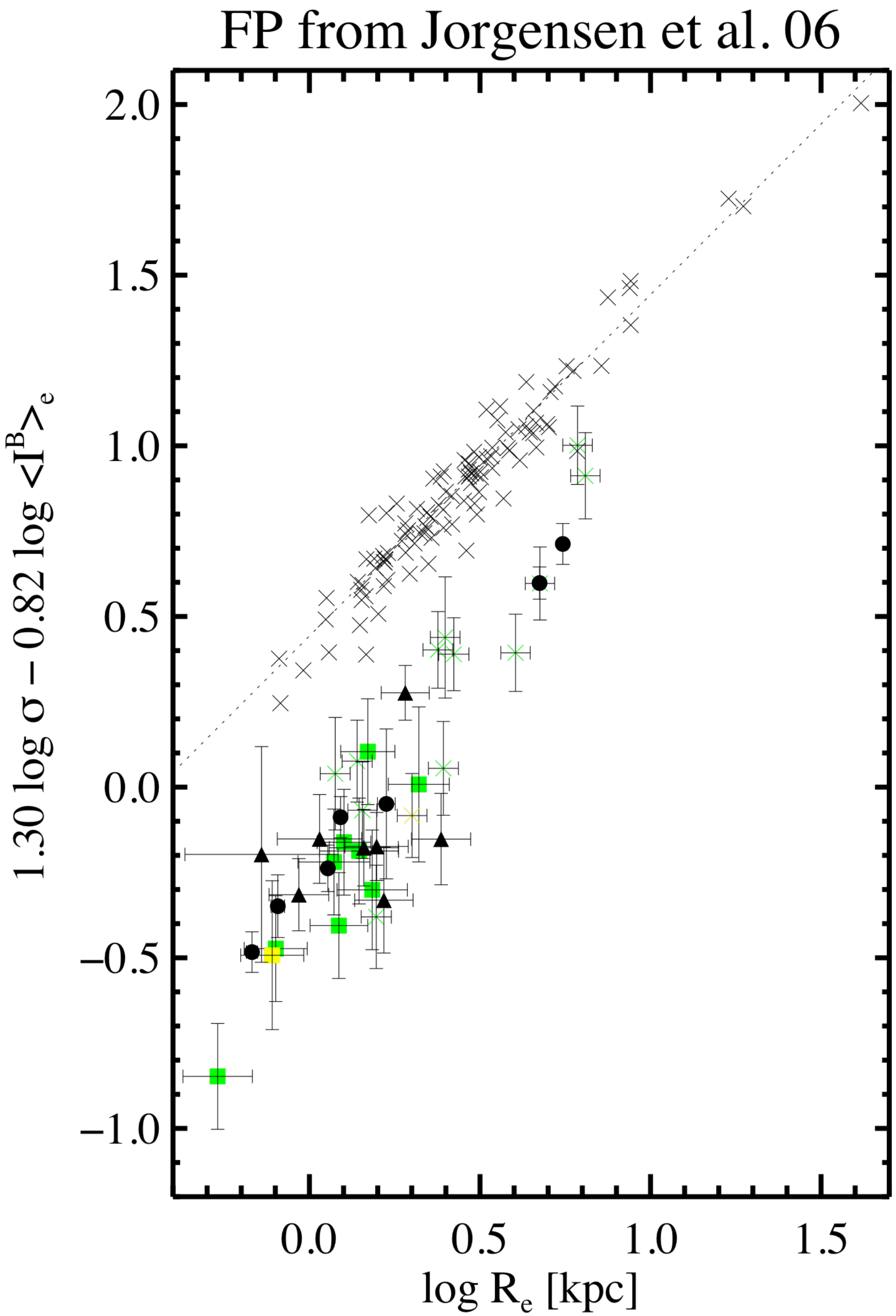
- Ultradeep NIR (J+K) VLT/HAWK-I imaging of the E-CDFS in collaboration with MPIA
- Compact red galaxies (Xshooter, w/Toft, Zirm, Gallazzi et al. @ DARK)

Sperello di Serego Alighieri

Evoluzione delle galassie “Early Type” attraverso lo studio delle relazioni di scala a alto z, in particolare con la misura della dispersione di velocità a z~1-2.

Evoluzione delle dimensioni? Se ci fosse, per mantenere lo equilibrio dinamico si dovrebbe vedere un effetto sulla dispersione di velocità.

La dispersione di velocità sembra essere il parametro fondamentale delle ETG.



The relevance of cosmological birefringence

Cosmological birefringence (CB) or, better, optical activity, is a frequency independent rotation of the plane of linear polarization for light traveling long distance trough the universe.

It would arise in the context of violation of a number of fundamental physical principles:

1. **Lorentz invariance and CPT violation**: "The absence of cosmological birefringence sets the most stringent constraint on the 10 out of the 19 dimensionless parameters of the CPT-even part of the SME (the most general Extension of the Standard Model of elementary particles which provides a framework to search for Lorentz invariance violation)" (Kostelecky & Mewes 2001);
2. **EEP violation**;
3. **Pseudoscalar-photon interaction and axion theory** (dark matter candidates);
4. **Neutrino number asymmetry**;
5. Non-standard theories, e.g. NLED (non-linear electrodynamics)

See Ni 2008, 2010 for a review.

I have been involved in CB tests based on the optical (rest-frame UV) polarization of distant radio galaxies, where, because of the scattering origin of the polarization, its direction can be accurately foreseen.

Table 1 Comparison of CB test methods.

Method	CB rotation	Distance	Direction	Ref.
RG radio pol.	$\lvert\theta\rvert < 6^o$	$0.4 < z < 1.5$	all-sky (uniformity ass.)	[6]
RG radio pol.	$\theta = -0.6^o \pm 1.5^o$	$\langle z\rangle = 0.78$	all-sky (uniformity ass.)	[8, 29]
RG UV pol.	$\theta = -1.4^o \pm 1.1^o$	$\mathrm{z} = 0.811$	$RA : 176.37^o, Dec : 31.56^o$	[44]
RG UV pol.	$\theta = -0.8^o \pm 2.2^o$	$\langle z\rangle = 2.80$	all-sky (uniformity ass.)	[16]
RG UV pol.	$\langle\theta^2\rangle \leq (3.7^o)^2$	$\langle z\rangle = 2.80$	all-sky (stoch. var.)	[23, 16]
CMB pol. BOOMERanG	$\theta = -4.3^o \pm 4.1^o$	$z \sim 1100$	all-sky (uniformity ass.)	[39]
CMB pol. QUAD	$\theta = 0.64^o \pm 0.71^o$	$z \sim 1100$	all-sky (uniformity ass.)	[5]
CMB pol. BICEP	$\theta = -2.6^o \pm 1.2^o$	$z \sim 1100$	all-sky (uniformity ass.)	[9, 45, 41]
CMB pol. WMAP7	$\theta = -1.1^o \pm 2.0^o$	$z \sim 1100$	all-sky (uniformity ass.)	[24]

In general, all the results of CB tests are consistent with a null rotation, within a few degrees, although there is a small tendency to negative values.
Also the BICEP result is not confirmed by other more accurate measurements.
The different methods are complementary, since they cover different wavelengths and distances.
Methods at shorter wavelengths have an advantage, if CB effects grow with photon energy.
Methods using more distant sources have an advantage and the CMB is unbeatable here.
However the relative difference in light travel time between z=3 and z=1100 is only 16%.
The integrated radio polarization method on RG has the disadvantage of not relying on a firm prediction of the polarization orientation at the source and of requiring Faraday correction.
The UV polarization method on RG is the only one which has so far been successfully used to test for a rotation which is not uniform in all directions.