

# Cosmos Survey PI Scoville HST 590 orbits I-band 2 deg.<sup>2</sup> !

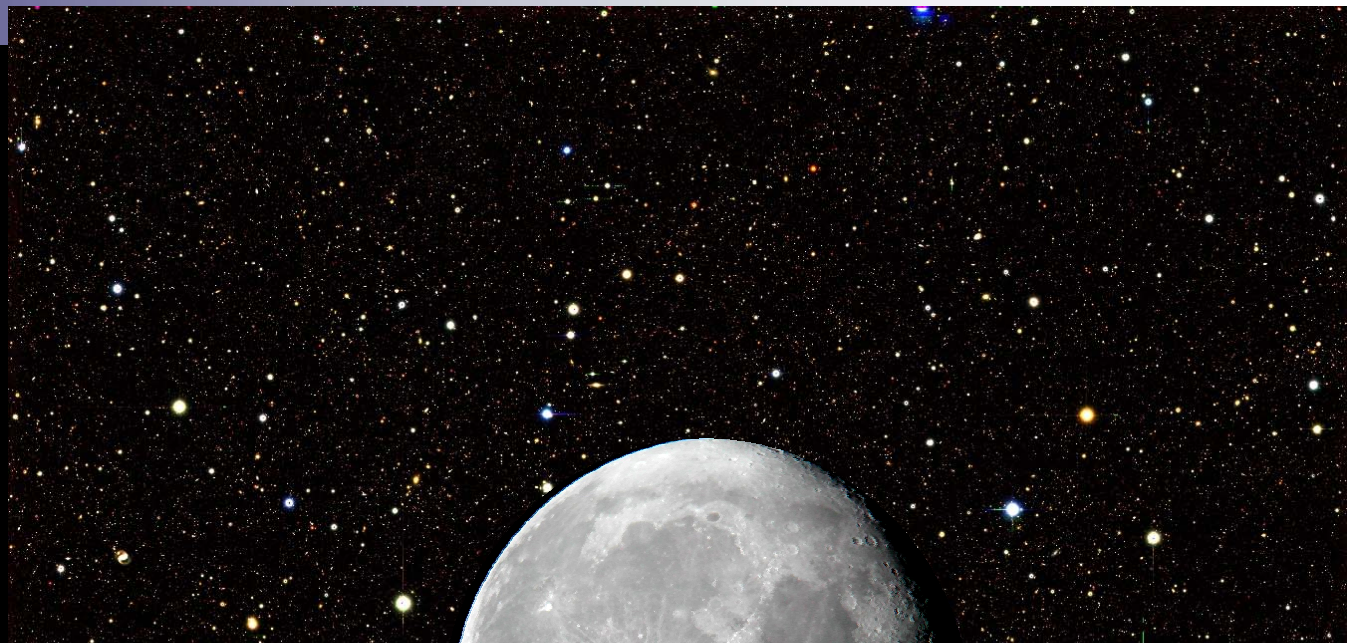


Table 7: Expected Numbers of Objects in COSMOS 2□° Field

Class	Expected #	$I_{AB}$ ( $10\sigma$ )	Reference
All objects	$1.9 \times 10^6$	$< 27$	Metcalfe <i>et al.</i> 2001
XMM-AGN	3400	27	based on Lockman Hole
XMM-clusters	$\sim 100$	$> 5 \times 10^{-17}$ erg/s	
VIMOS Gal.w/ Spectra	$\sim 10^5$	$I \leq 25$	VIMOS-GTO/COSMOS
QSOs	600(100)	24(21)	Croom <i>et al.</i> 2001
ULIRGs	3,000	26	Smail <i>et al.</i> 2002
ExtremelyRedObjects	25,000	25	Daddi <i>et al.</i> 2000, Smith 2002
LymanBreakGalaxies ( $z > 2$ )	10,000	25.5	Shapley <i>et al.</i> 2001
Red high- $z$ Galaxies ( $z > 2$ )	10,000	25.5	Labbé <i>et al.</i> 2002
L,T Dwarfs	2000( $< 700$ pc), 300( $< 200$ pc)	28( $4\sigma$ )	Burgasser <i>et al.</i> 2002
KuiperBeltObjects	100-250	27	

# Major themes:

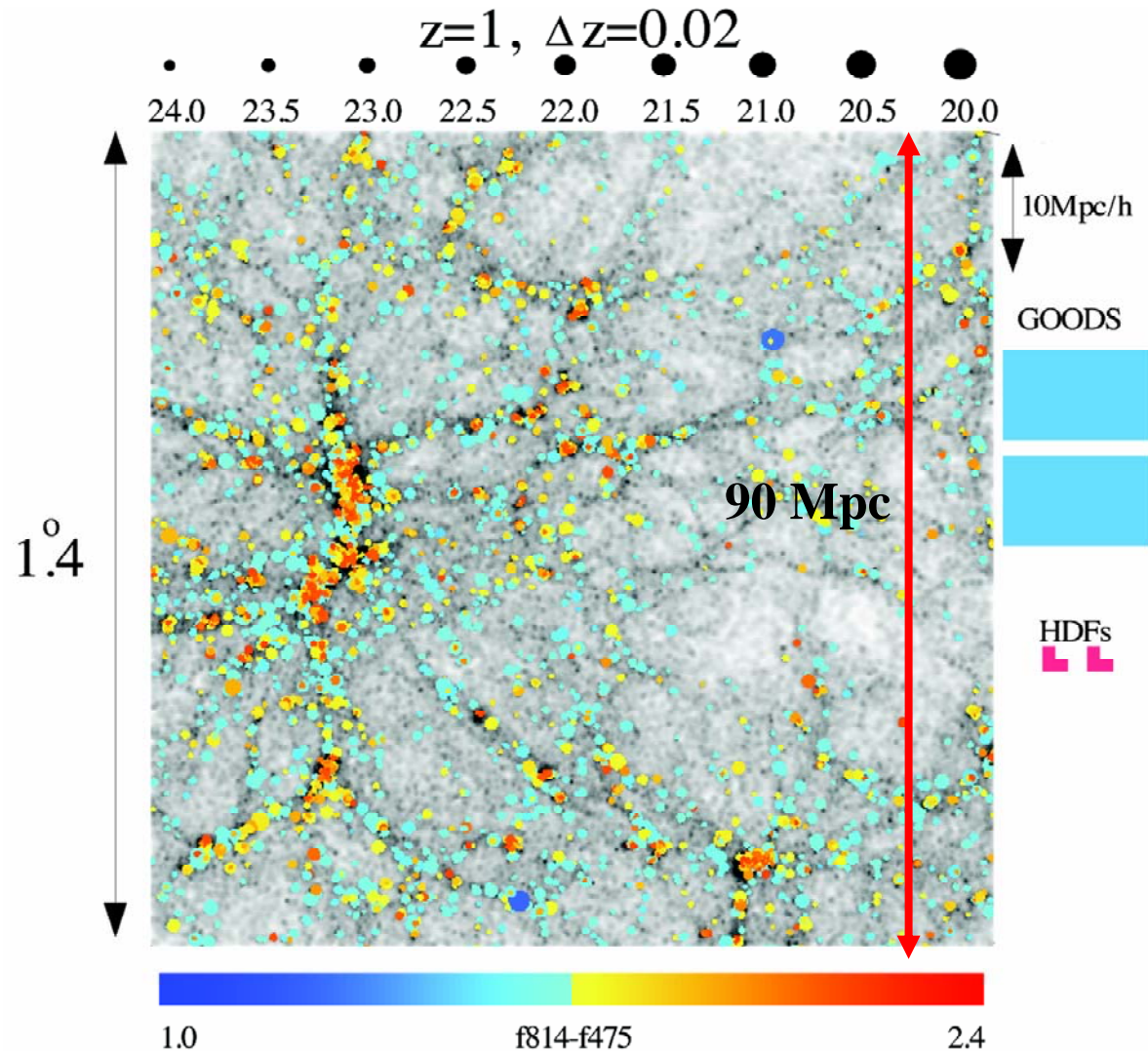
- Panchromatic studies of the coupled evolution of LSS, galaxies, star formation, AGN: environment and redshift

- Assembly of galaxies, clusters & dark matter (Coma supercluster)

- Area: mitigates cosmic variance

- Equatorial field

redshift slice from  $\Lambda$  CDM sim.





**Xray** -  
XMM

**UV** -  
Galex

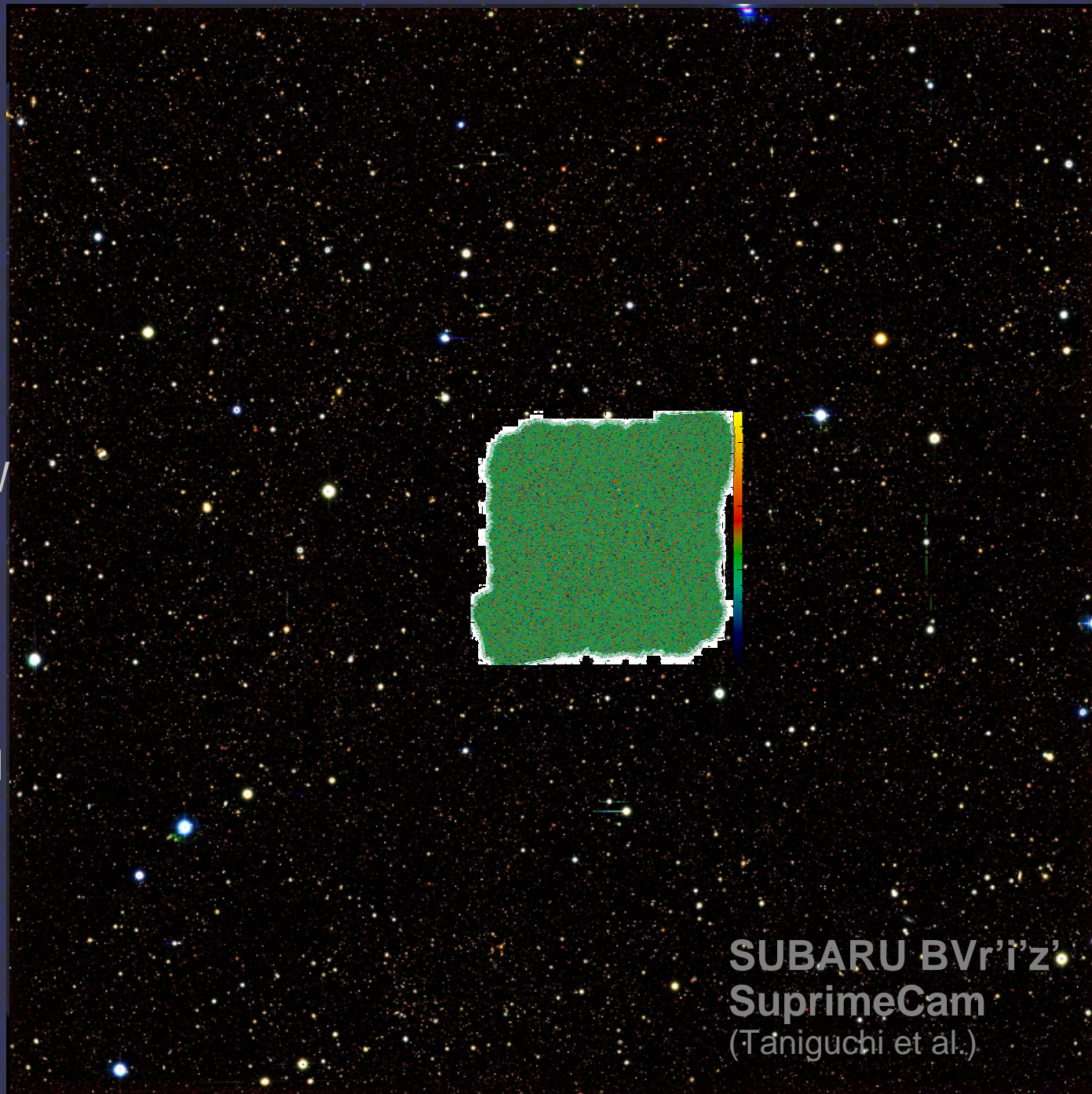
**Optical** -  
UBVr'i'z'K + ...  
HST/ACS F814W

**Spectroscopy** -  
VLT/VIMOS  
Magellan/IMACS

**Infrared** -  
Spitzer scheduled

**mm** -  
MAMBO  
BOLOCAM

**cm** -  
VLA



**SUBARU BVr'i'z'**  
**SuprimeCam**  
(Taniguchi et al.)



# VLA-COSMOS: Schinnerer (PI)

1.4 GHz continuum, 1.5'' res

## Large project (275hr): A+C array

- ~ 3,600 sources
- ~ 2(1) sqrdeg; rms ~ 15(10)  $\mu$ Jy/bm;

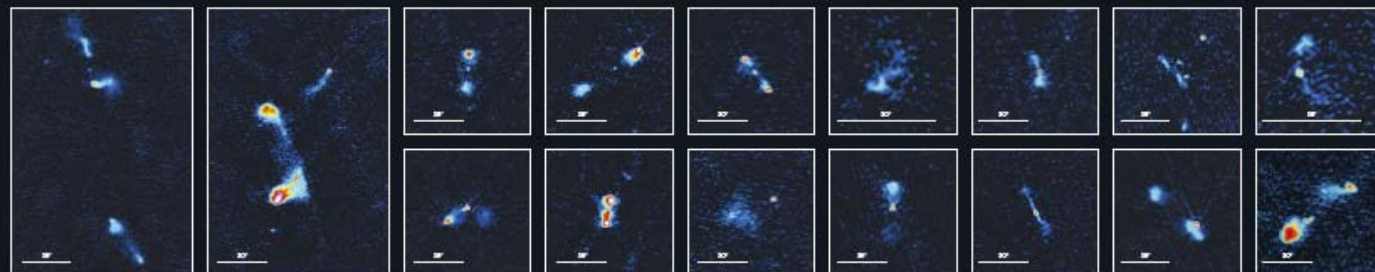
## Deep project (60hr): A array

- ~ 1 sqdeg; rms ~ 7  $\mu$ Jy/bm (central 30')

1.4d

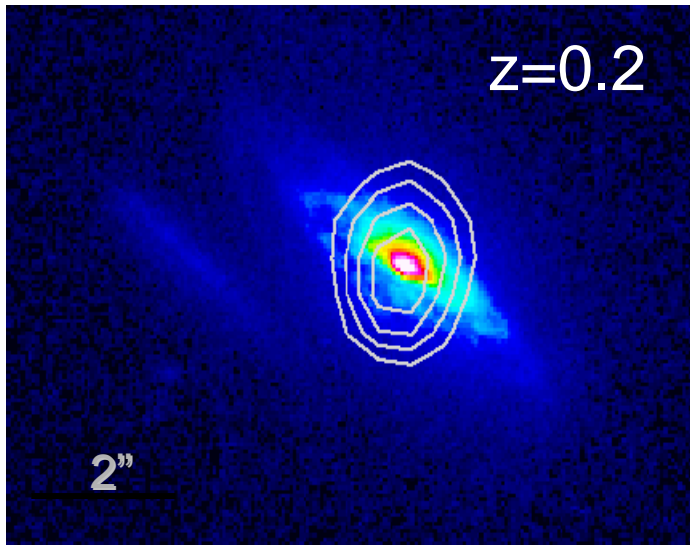
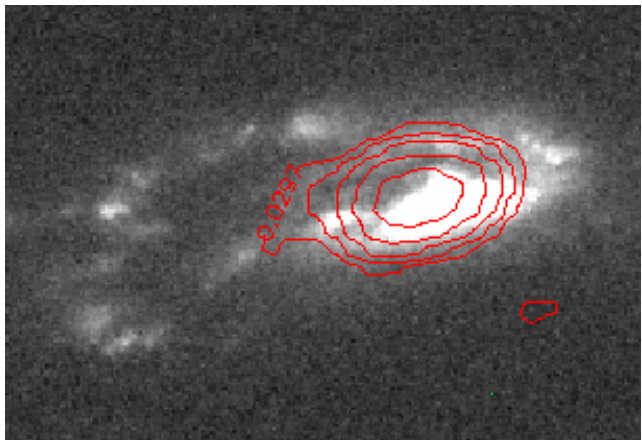
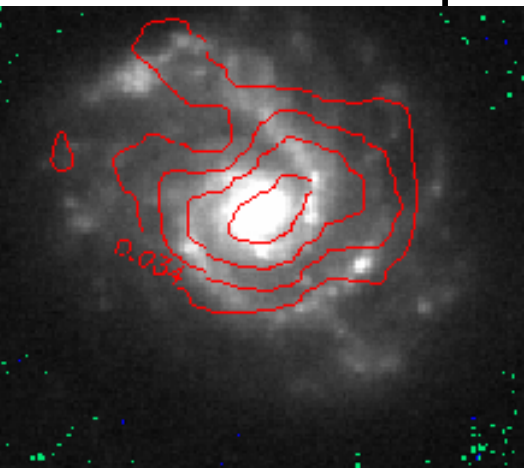
## Major science:

- (dust-)obscured cosmic star formation history (Smolcic)
- evolution of low luminosity radio AGN to high z (Jahnke)
- evolution of the FIR-radio correlation (Schinnerer)
- z=6 galaxies (Carilli)
- absolute astrometry for COSMOS field (Aussel)

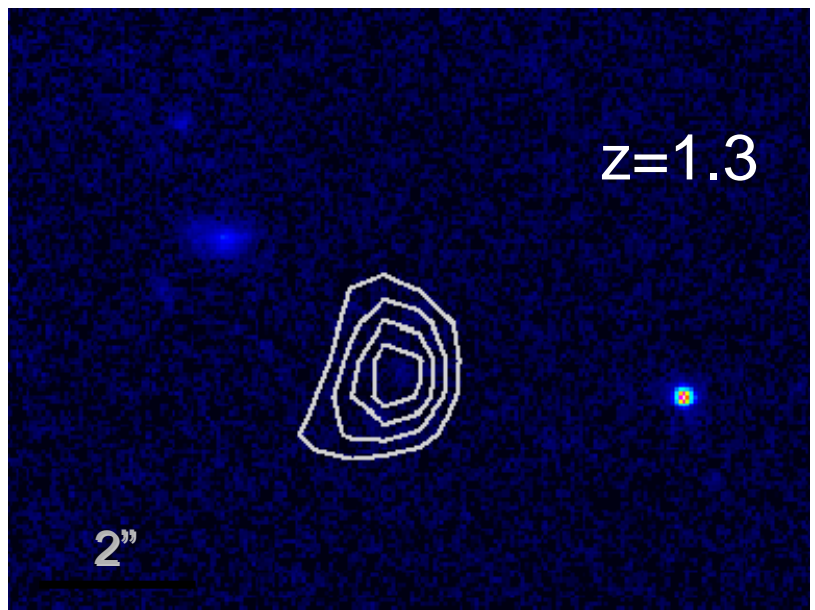
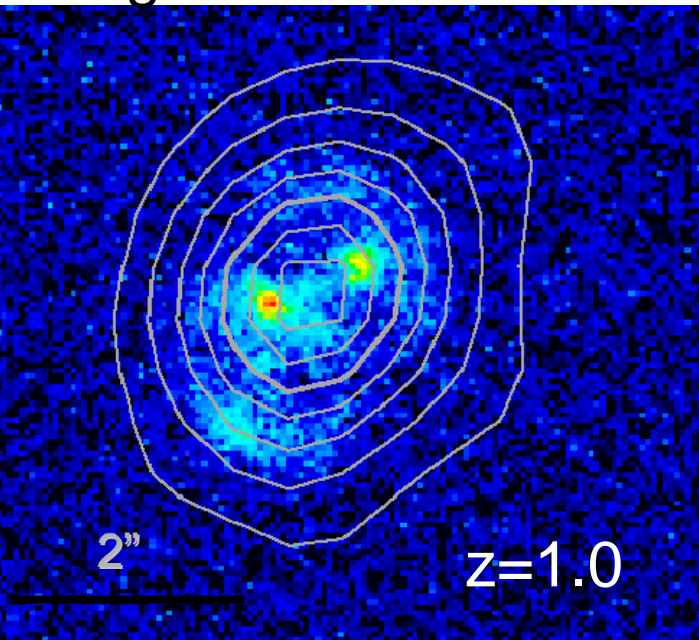




# Low z examples

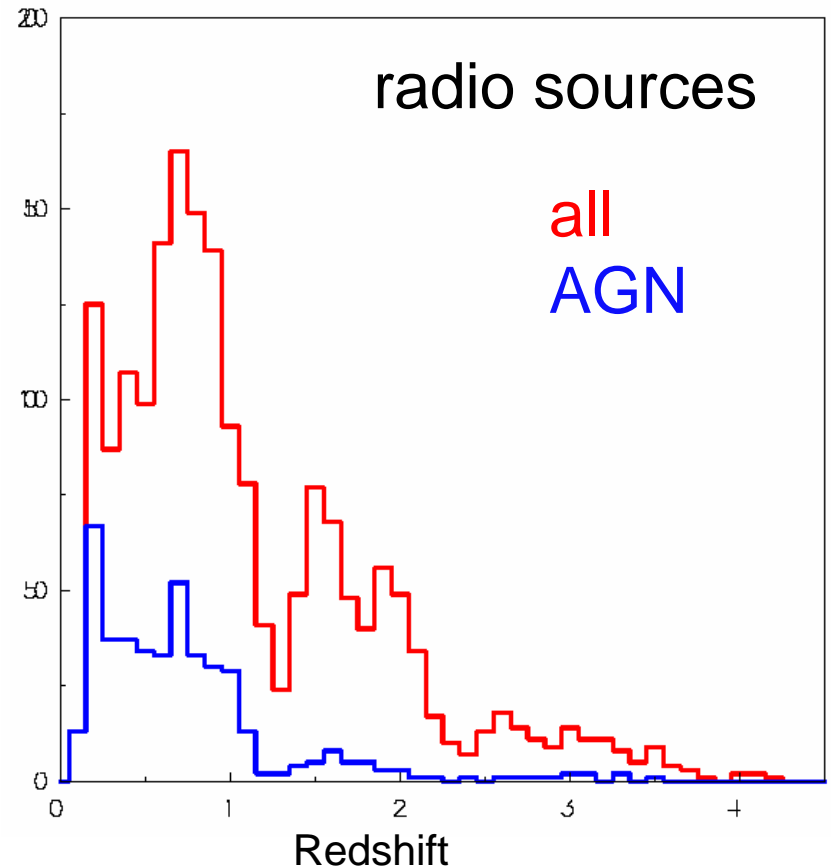
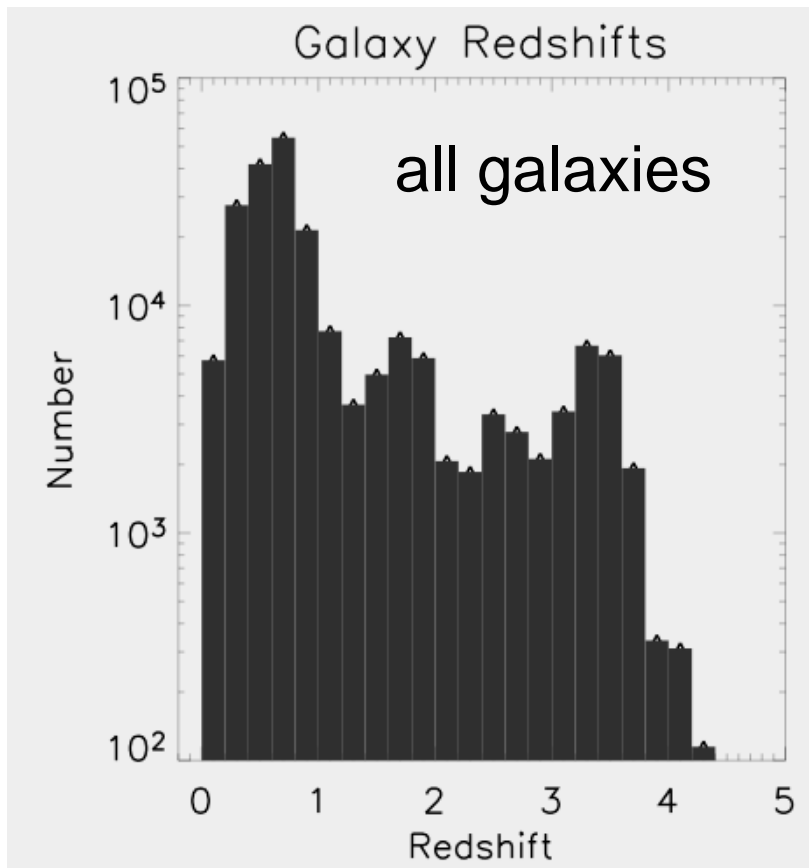


# Higher z



# VLA-COSMOS – Optical IDs and redshifts

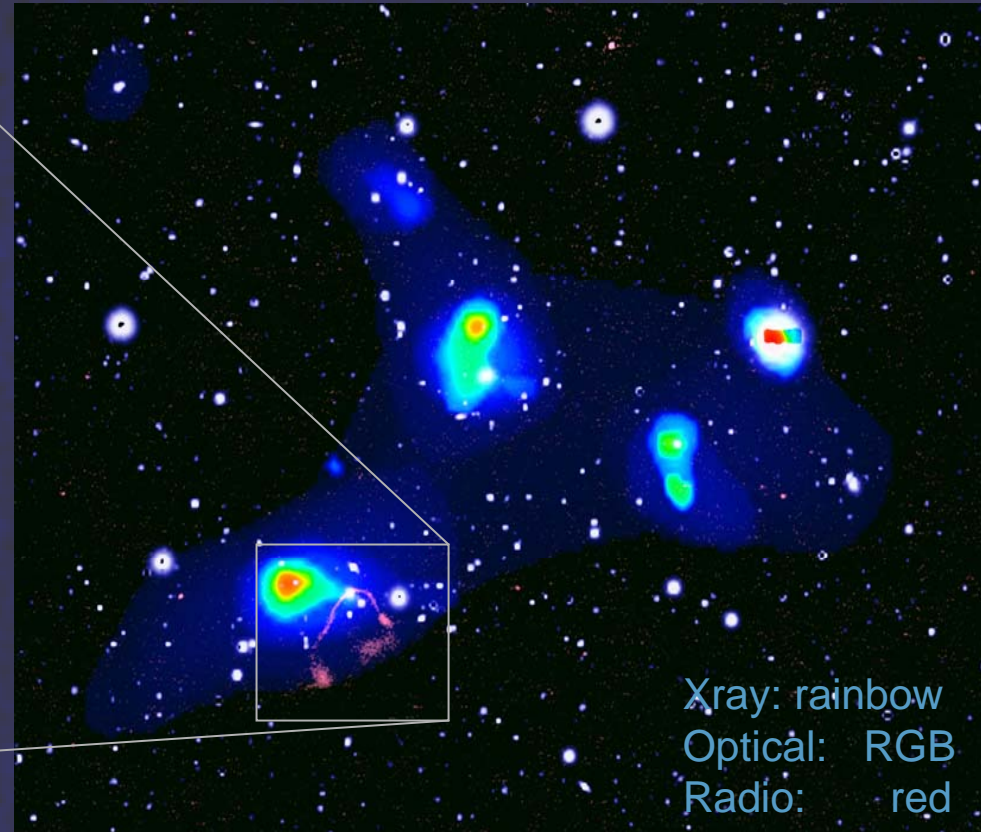
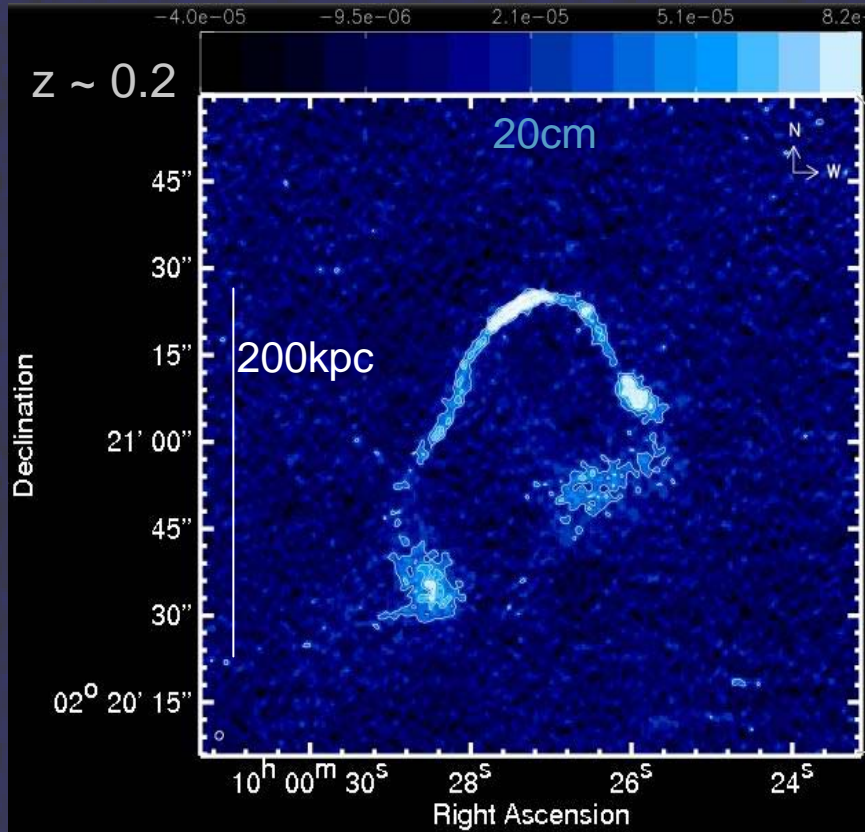
- within 1.0'' – 2886 radio-optical associations (79%) for  $I < 23.5$
- Photo-z ~ 75%
- Spectroscopic z's ~ 50% (so far ~ 300 observed)





# Wide Angle Tail Radio Galaxy

(Smolcic et al. 2006)



CWAT-01 at  $z \sim 0.2$ :

Merging of 4+ sub-clusters of galaxies

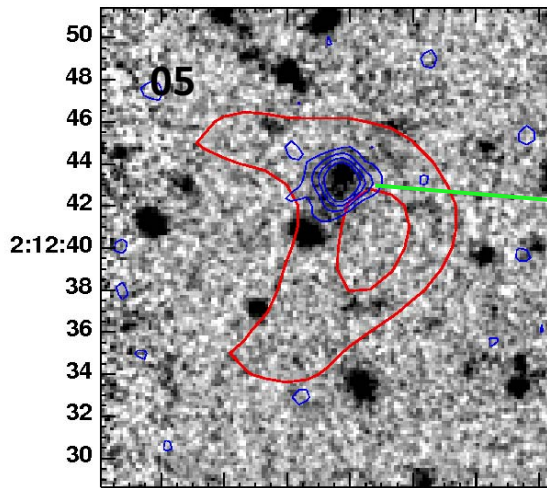
Individual sub-clusters =  $5e^{13} M_{\text{sun}}$



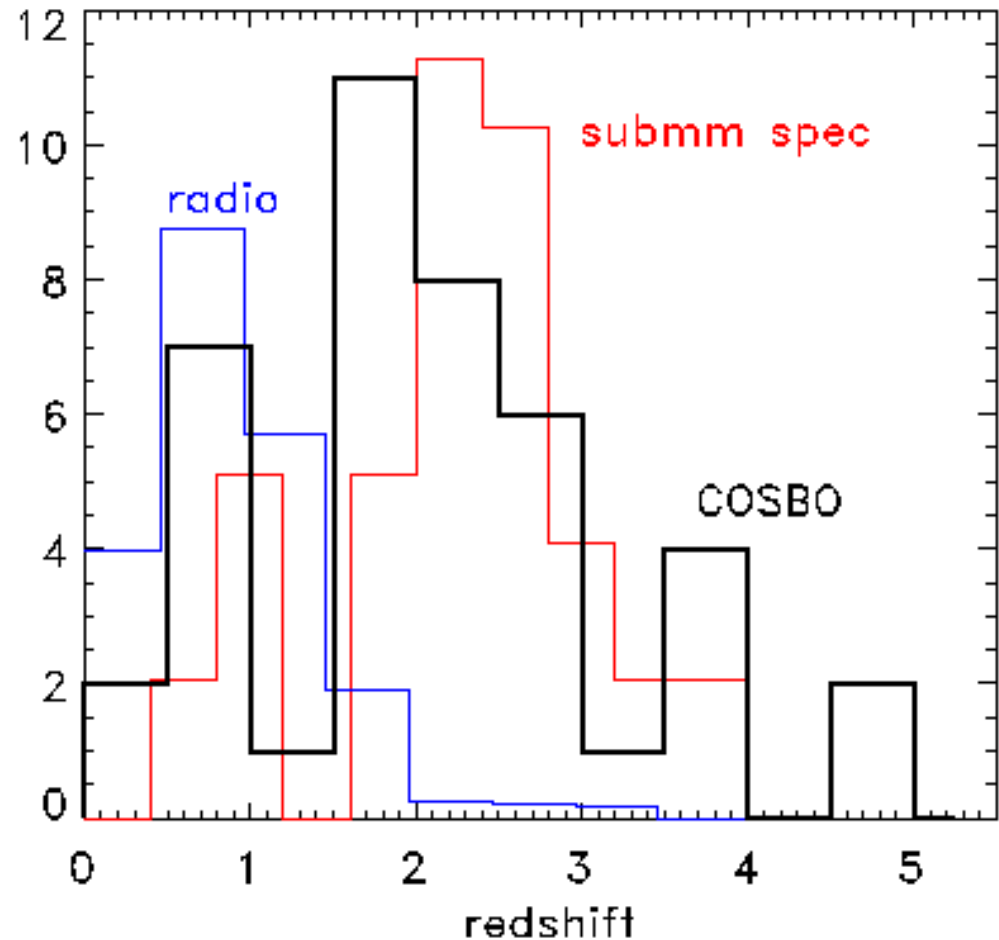
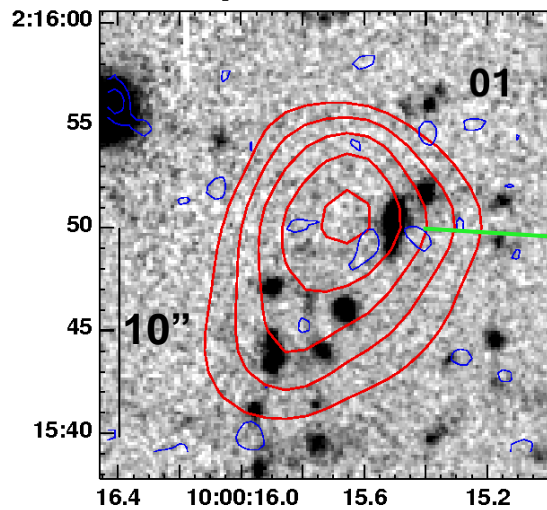
# (Sub)mm Galaxies: formation of large elliptical galaxies

(Bertoldi et al. 2006)

- 23 MAMBO (250 GHz) sources ( $3.5 < \sigma < 7$ ;  $\sigma = 0.9$  mJy)
- 50% radio counterparts  $> 30$   $\mu$ Jy
- $> 50\%$  (?) IRAC and/or 24 $\mu$ m counterparts



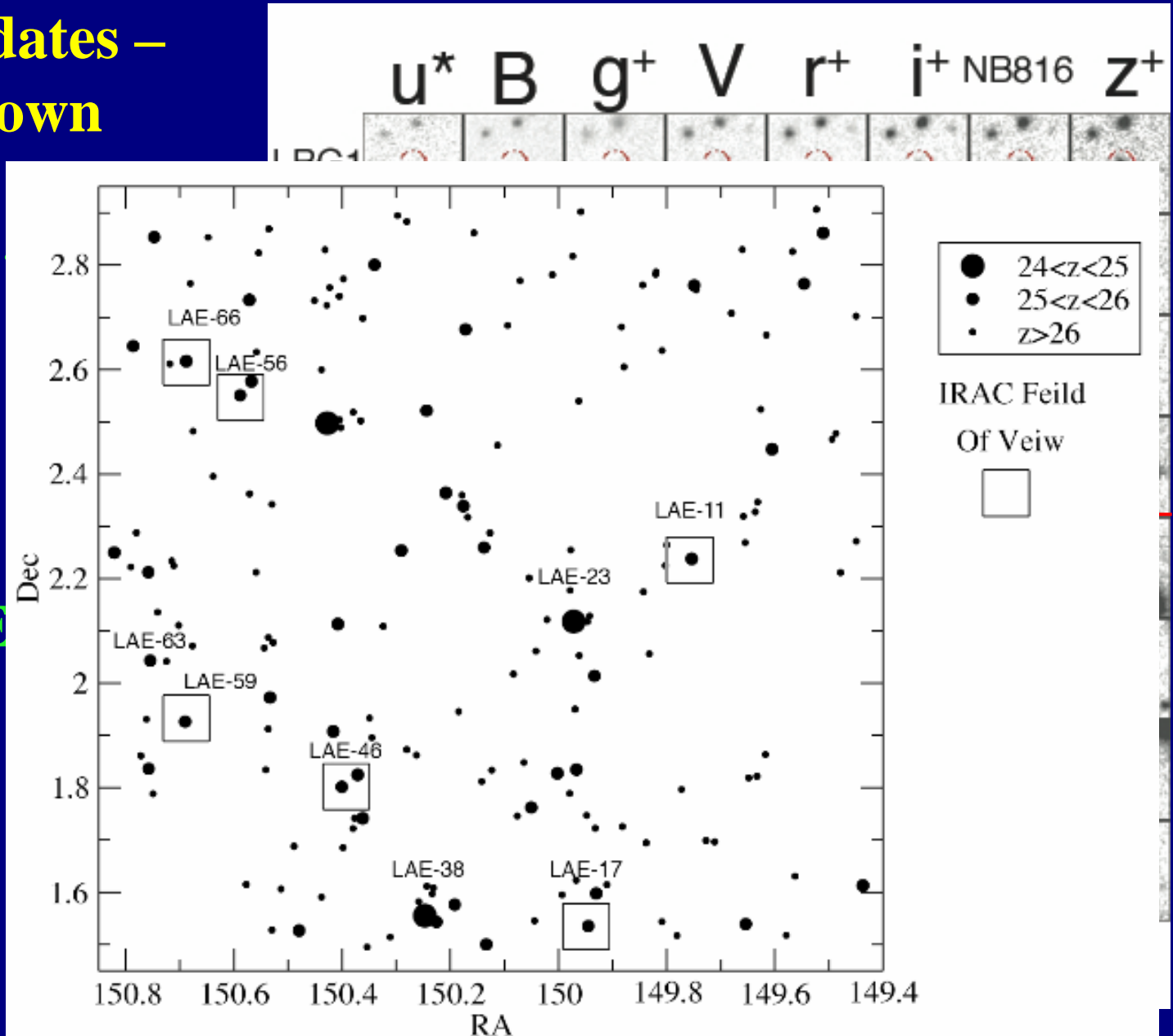
Opt/rad/mambo



100 candidates –  
double known  
samples

LBG

LAE





# Radio Properties of LAEs

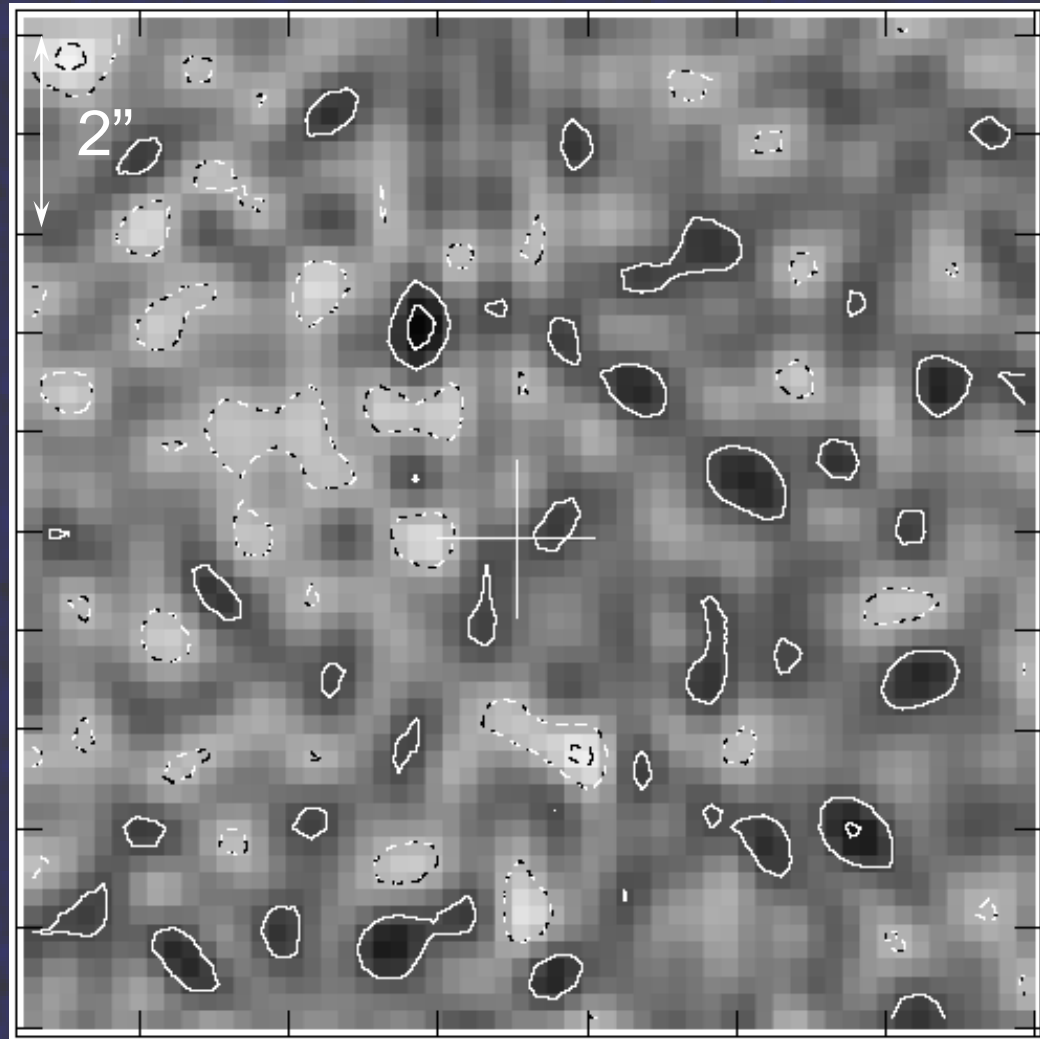
(Carilli et al. 2006)

$\text{Ly}\alpha$  emitters ( $z \sim 5.7$ ):  
(Ajiki et al. 2006)

No radio counterparts  $< 30 \mu\text{Jy}$   
 $\Rightarrow$  No AGN (FRI  $\sim$  M87)  
 $\Rightarrow$  no (sub)mm galaxy w/  
SFR  $> 1500 M_{\text{sun}}$

Stacked limit ( $2\sigma$ ):  $4.4 \mu\text{Jy}$   
 $\Rightarrow$  mean SFR  $< 250 M_{\text{sun}}$

$\Rightarrow$  consistent w/ LAEs being  
moderate luminosity star  
forming galaxies  
(no beastly outliers)



# VLA-COSMOS -

## - Status

- 3,644 sources ( $> 4.5\sigma$ ) in 2 sqrdeg (rms  $\sim 10 \mu\text{Jy}$ )
- central 30' down to rms  $\sim 7 \mu\text{Jy}$  (underway)
- $\sim 80\%$  optical counterparts ( $\rightarrow$  spectroscopy)


## - Science

- 20cm emission: SF/AGN contribution
- single targets: e.g. WAT radio galaxy
- identification: (sub)mm sources
- stacking analysis: LAE, ...

## - Products

- 1.4 GHz image
- source catalog
- public release @ IRSA archive:  $\sim$  June '06





**END**

# 20cm continuum surveys:

Field	Area [deg <sup>2</sup> ]	rms [ $\mu$ Jy/beam]	resolution [" $\times$ "]	# of objects	Reference
COSMOS (large)	2	10	1.5 $\times$ 1.4	$\sim$ 3400 <sup>a</sup>	this paper
COSMOS (pilot)	0.837	25	1.9 $\times$ 1.6	246	Schinnerer et al. 2004
HDFN	0.35	7.5	2.0 $\times$ 1.8	314	Richards 2000
FIRST	1e4	150	5	1e6	Becker et al. 1995
FLS	5	23	5	3565	Condon et al. 2003
VIRMOS	2	17	6	1054	Bondi et al. 2003
ATHDFS	0.35	11	7.1 $\times$ 6.2	466	Norris et al. 2005, Huynh et al. 2005
ATESP	26	79	14 $\times$ 8	2960	Prandoni et al. 2001
PDS	4.56	12	12 $\times$ 6	2090	Hopkins et al. 2003
ELIAS <sup>b</sup>	4.22	27	15	867	Ciliegi et al. 1999
Lockman	0.35	120	15	149	de Ruiter et al. 1997
NVSS	3.4e4	350	45	1.7e6	Condon et al. 1998

## VLA-COSMOS survey:

unique phase space

X-ray - mm complementary data

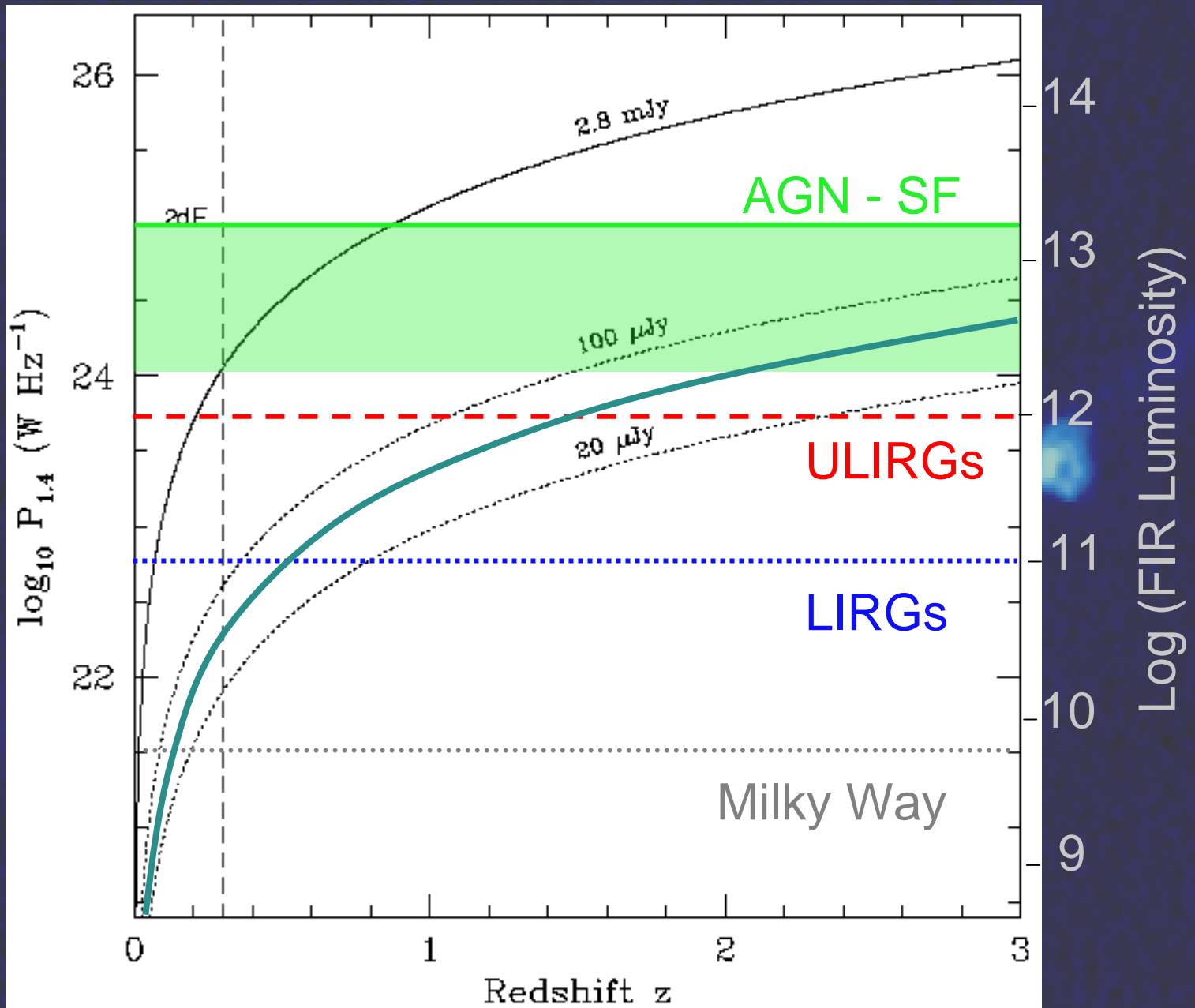
$\sim$  70% optical counterparts

photometric redshifts ( $\sim$  900,000)

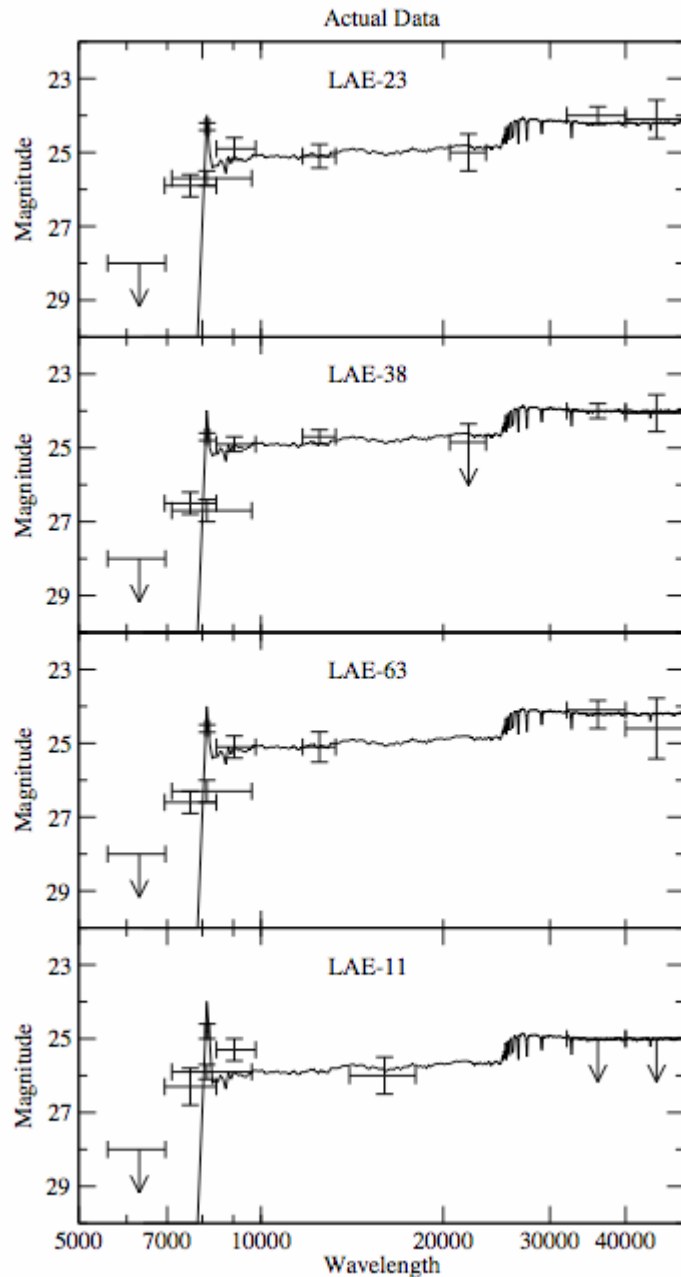
spectroscopy (> 210 available; expected: 50%)



# Radio Surveys - Limits



## Example LAE SEDs



- Ages around 0.1 Gyr

- Masses around  $10^{10} M_{\odot}$

- Ages and Masses consistent with  $z \sim 6$  LBG galaxies (Yan et. al. 2005)

- All LBGS known at  $z \sim 6$  have strong Lyman Alpha Emission

- Very compact morphology in ACS and NICMOS. No clear mergers