

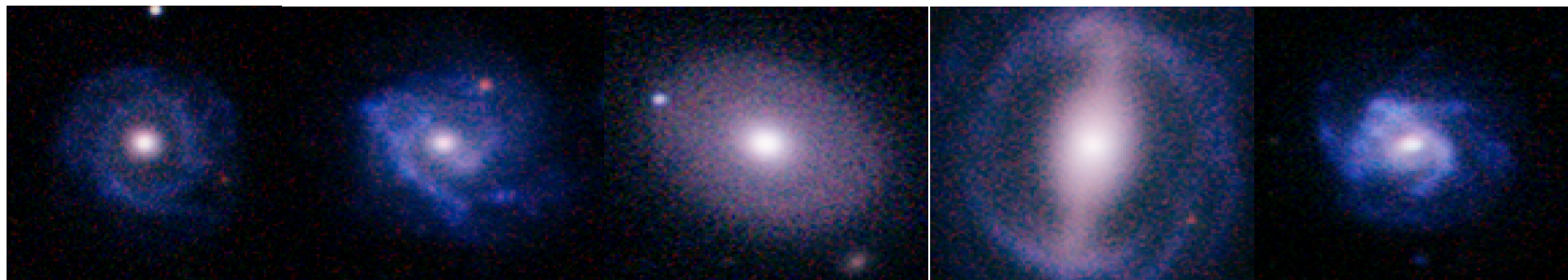


GAMA



Simon Driver
Univ. Western Australia

The GAMA Survey
Current Progress
Future Plans
WAVES





GAMA@ICRAR & GAMA TEAM



Aaron Robotham



Luke Davies



Amanda Moffett



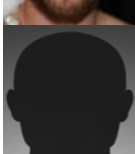
Mehmet Alpaslan



Rebecca Lange



Angus Wright



Stephen Andrews



Joe Liske (Project Manager, ESO)



Lee Kelvin (Innsbruck)



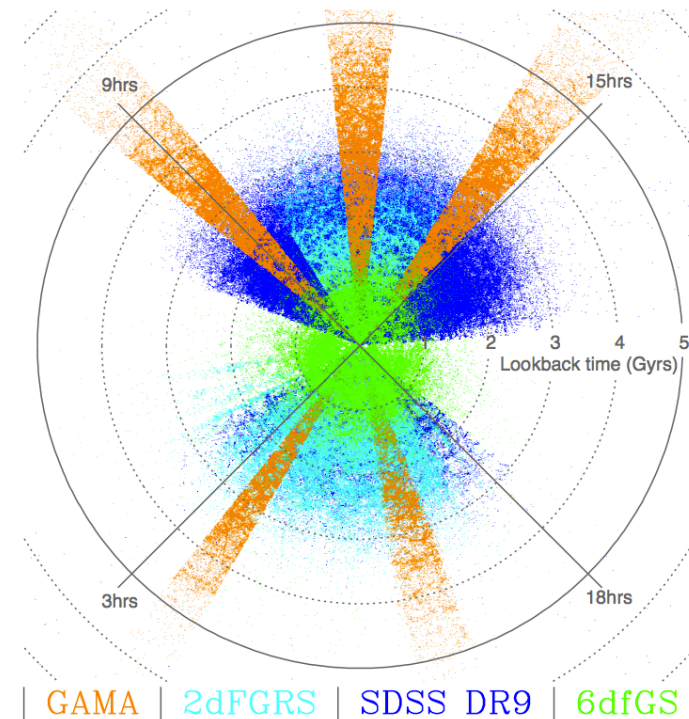
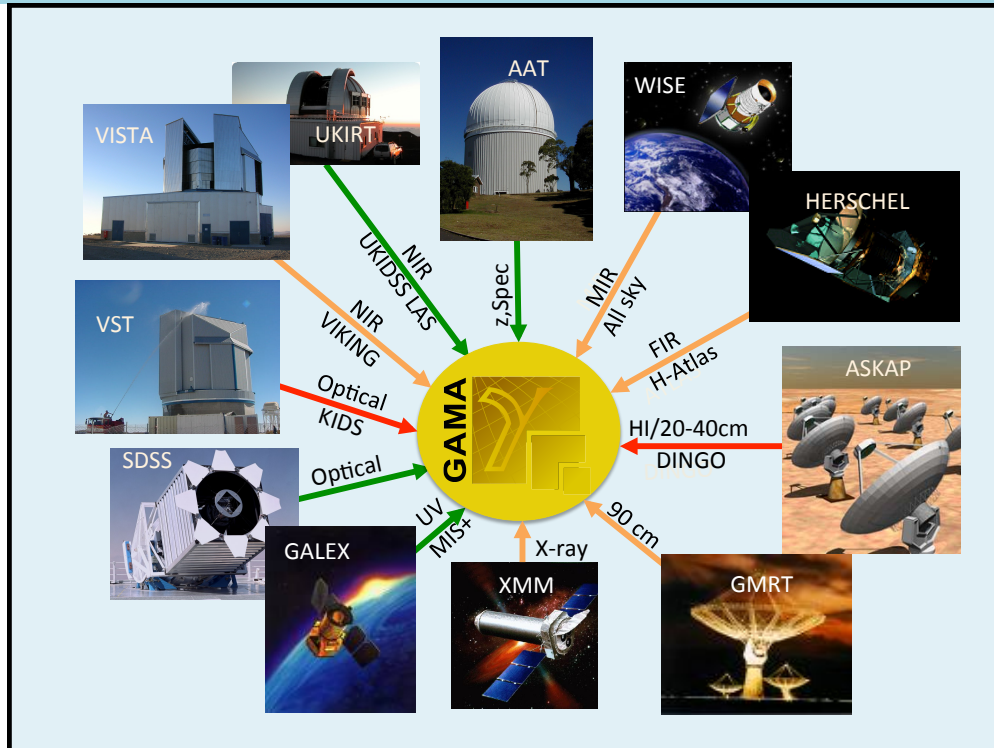
Ivan Baldry (LJMU)

+ 80 collaborators near and far:



International Centre for Radio Astronomy Research (ICRAR)

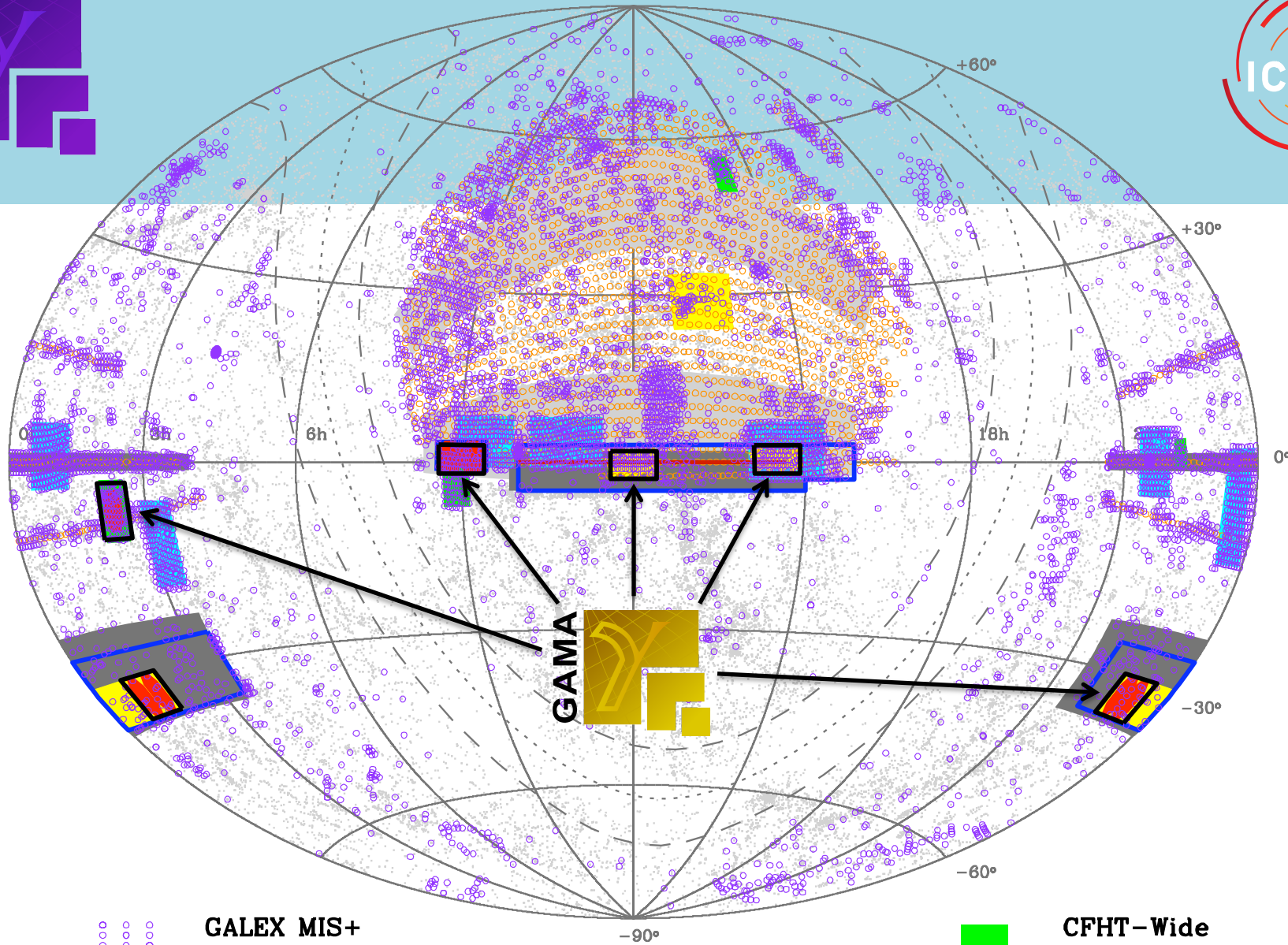















250,000 galaxies to $r < 19.8$ mag over four 60 sq deg (~98% complete, selected from SDSS)

- catalogue of 25,000 groups (halos) to $10^{12} M_{\odot}$
- 20 band photometry + gas (ASKAP) [GALEX+VST+VIKING+WISE+Herschel]
- structure on 1kpc to 100Mpc scales to $z \sim 0.2$
- DR2 available via <http://www.gama-survey.org/dr2/>





- | | | | |
|---|-------------------------------|---|-------------------------------|
|  | GALEX MIS+ |  | CFHT-Wide |
|  | GAMA |  | ASKAP-DINGO |
|  | HERSCHEL-ATLAS |  | SDSS-Main (spec. only) |
|  | Millennium Galaxy Cat. |  | WigggleZ |
| | |  | 2dFGRS |
| | |  | UKIDSS-LAS |
| | |  | VST-KIDS/VISTA VIKING |



AAT 1

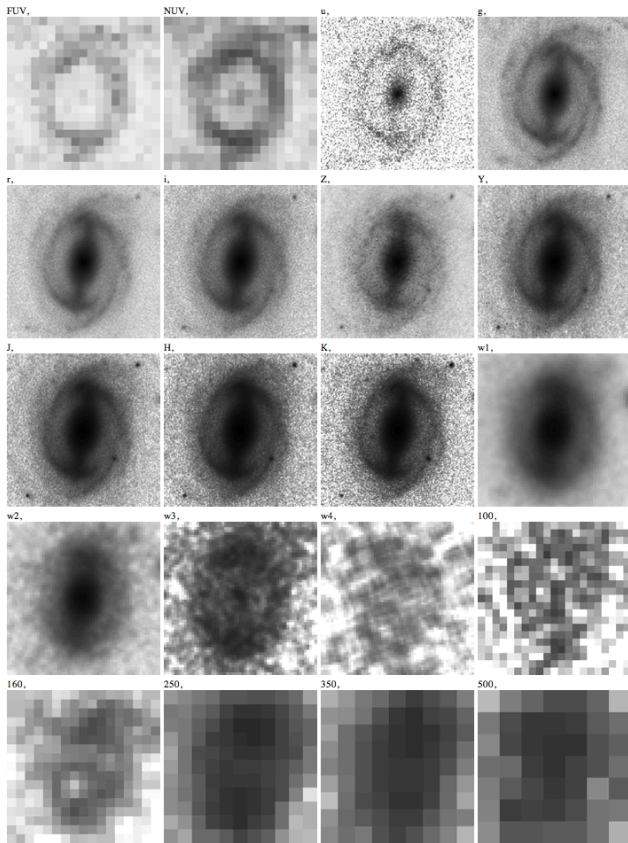


© Anglo-Australian Observatory

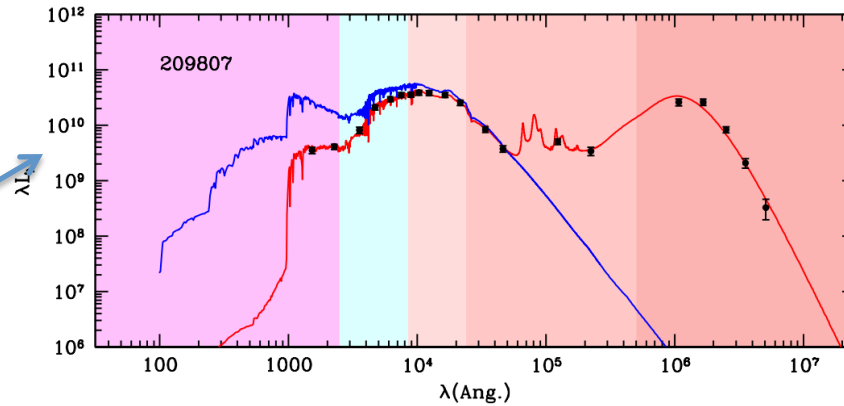
AAT RESPONSIBLE
FOR 35% OF ALL
KNOWN REDSHIFTS



20 band photometry
FUV-Opt-NIR-MIR-FIR

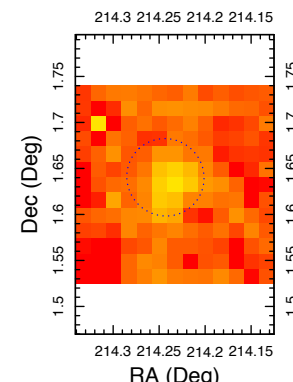
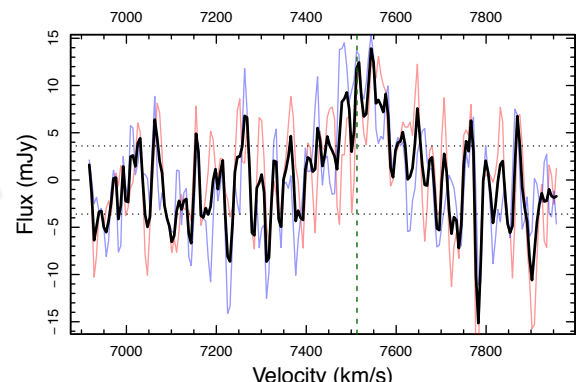


MAGPHYS



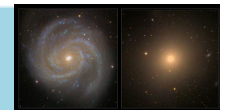
M_*
 M_D

HI

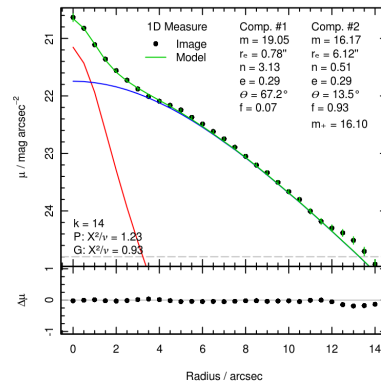
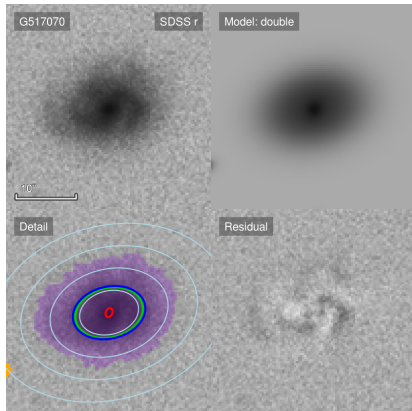


M_{HI}
 M_{dyn}
 M_{Halo}

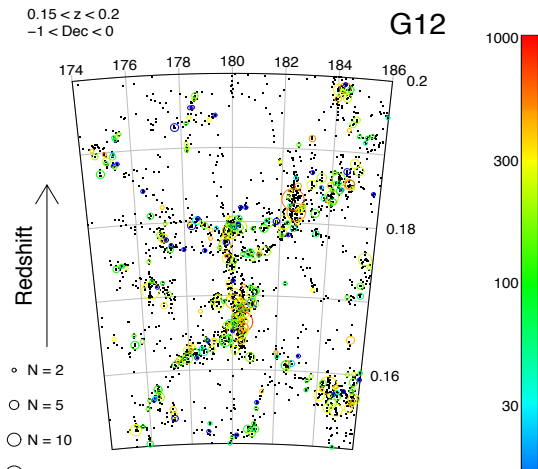
+ spectral line diagnostics + structural decomp + halo properties
+ IFU follow-up (SAMI) + HI (ASKAP)



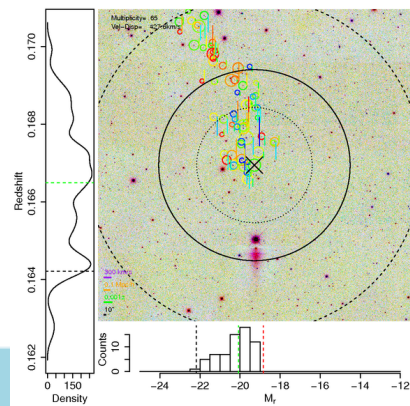
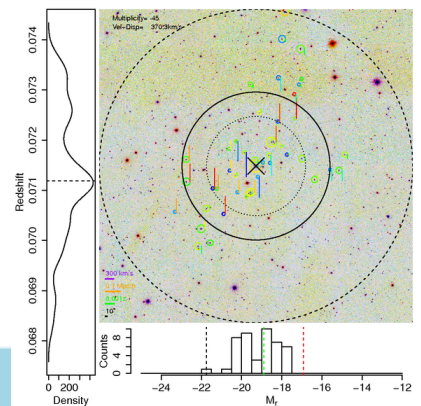
Galaxy Decomposition (1-20kpc)



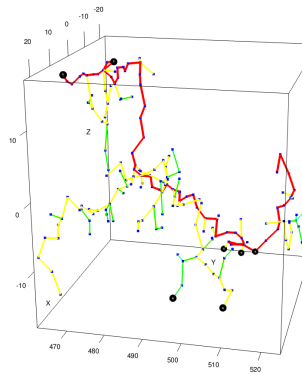
Superclusters (1-10Mpc)

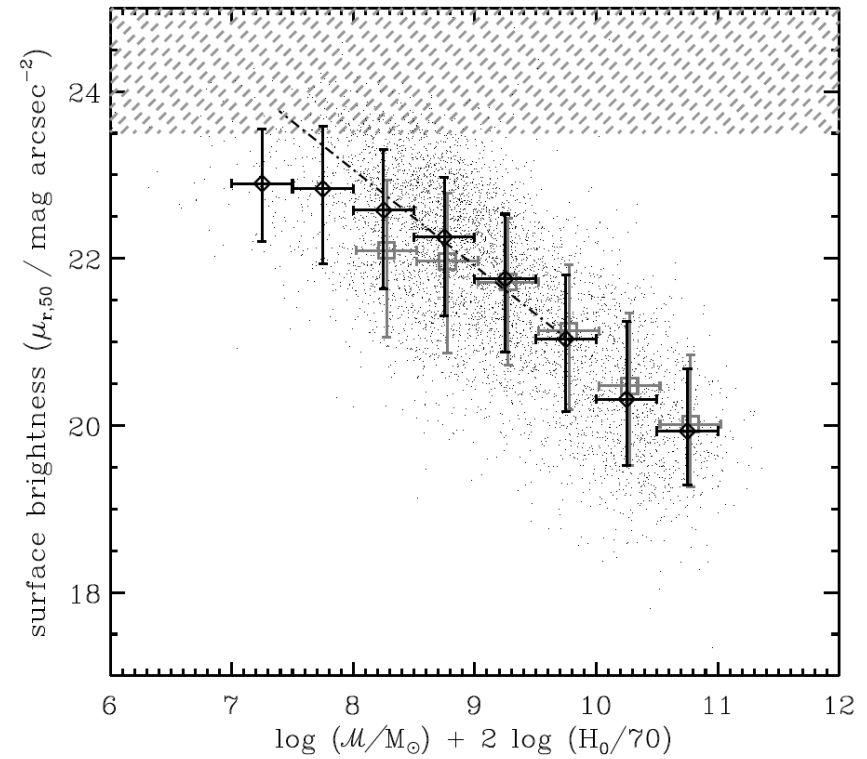
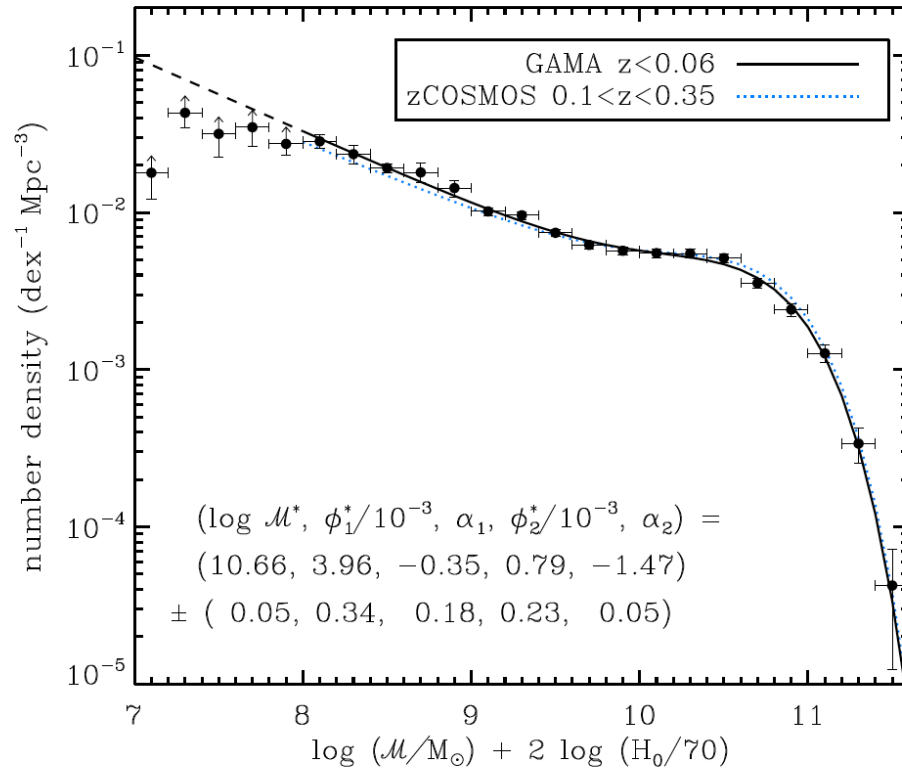


Groups (100kpc-1Mpc)

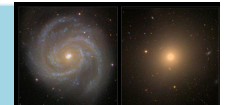


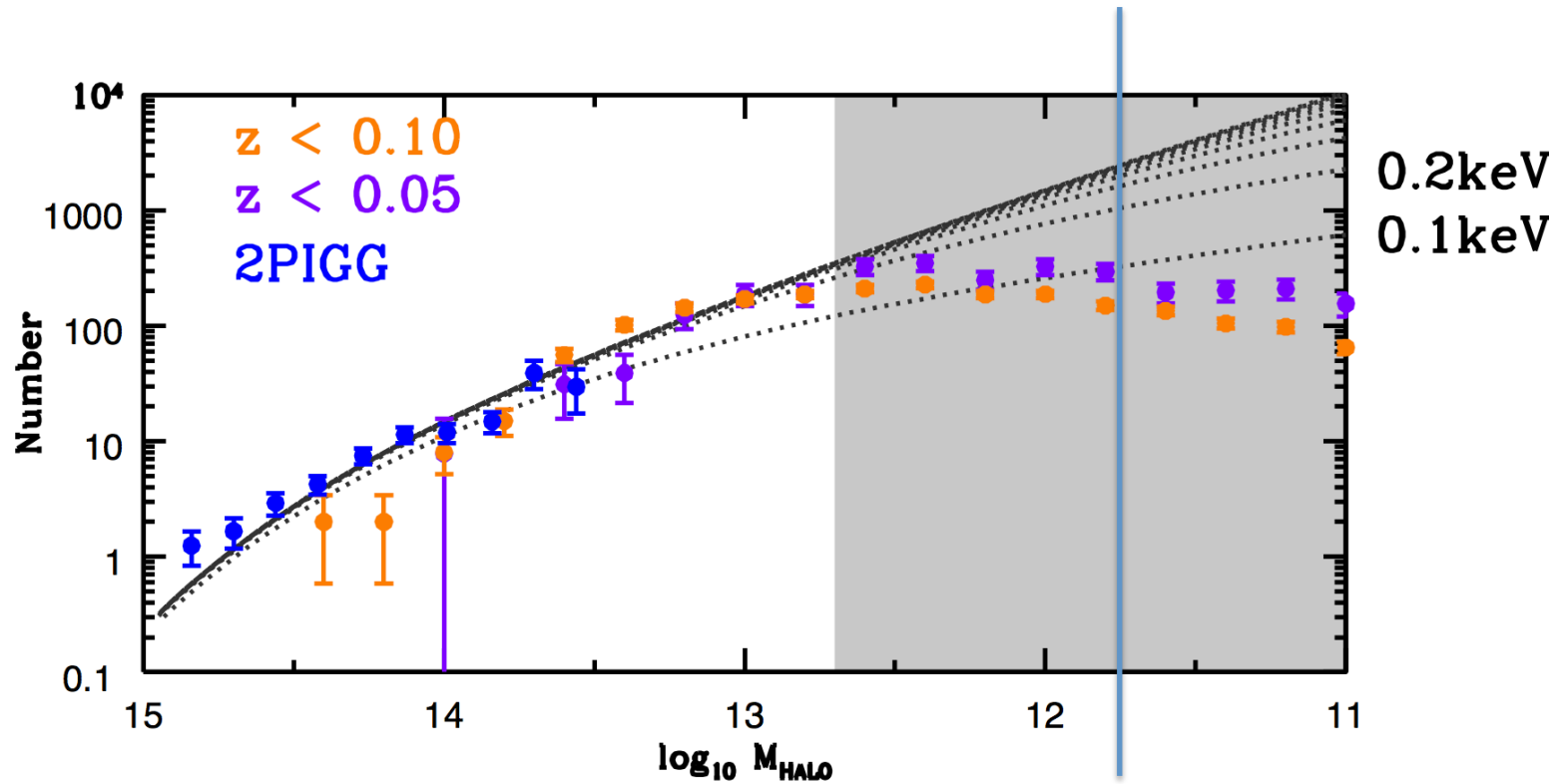
Filaments (10-100Mpc)



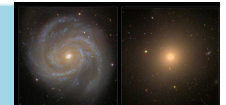


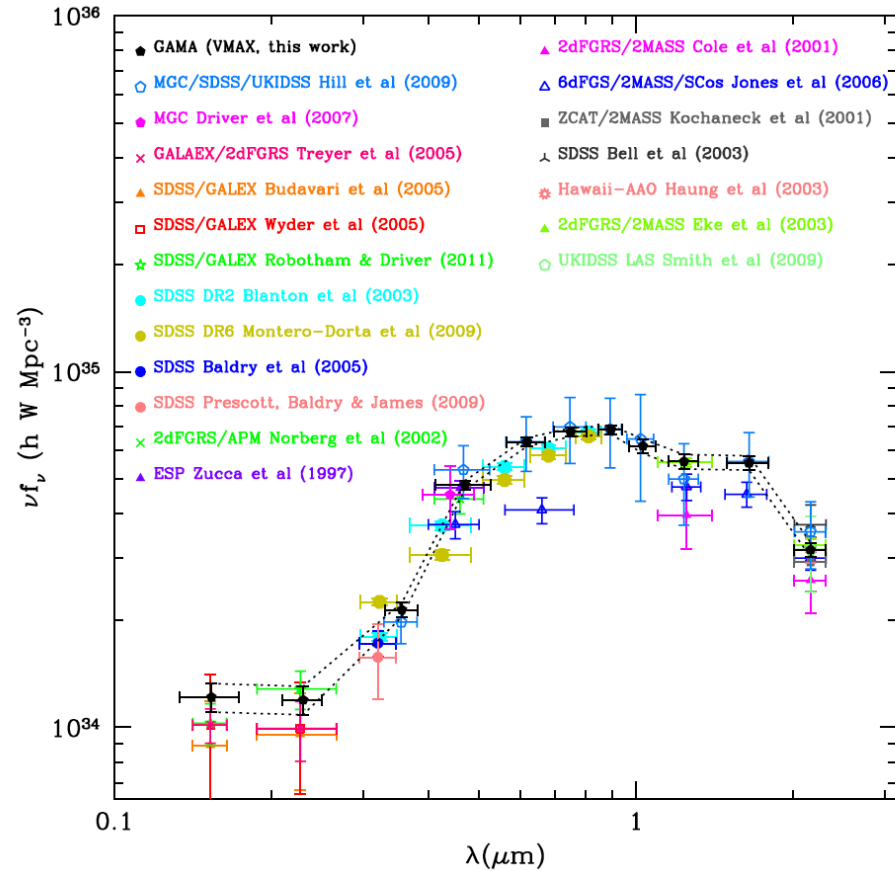
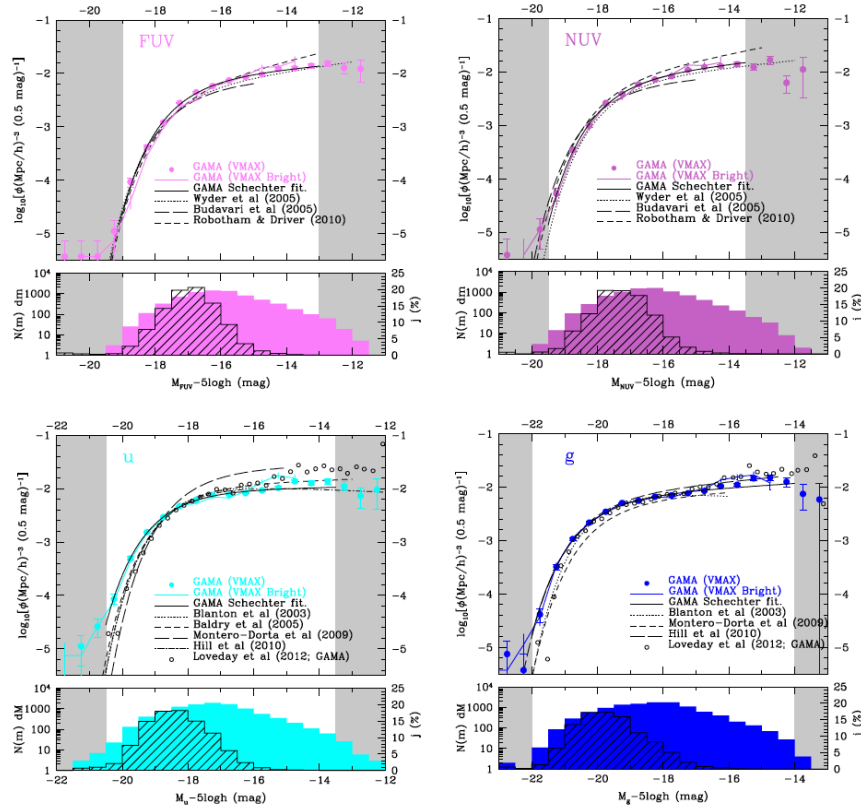
Baldry et al (2013)



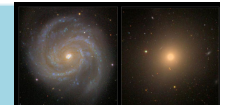


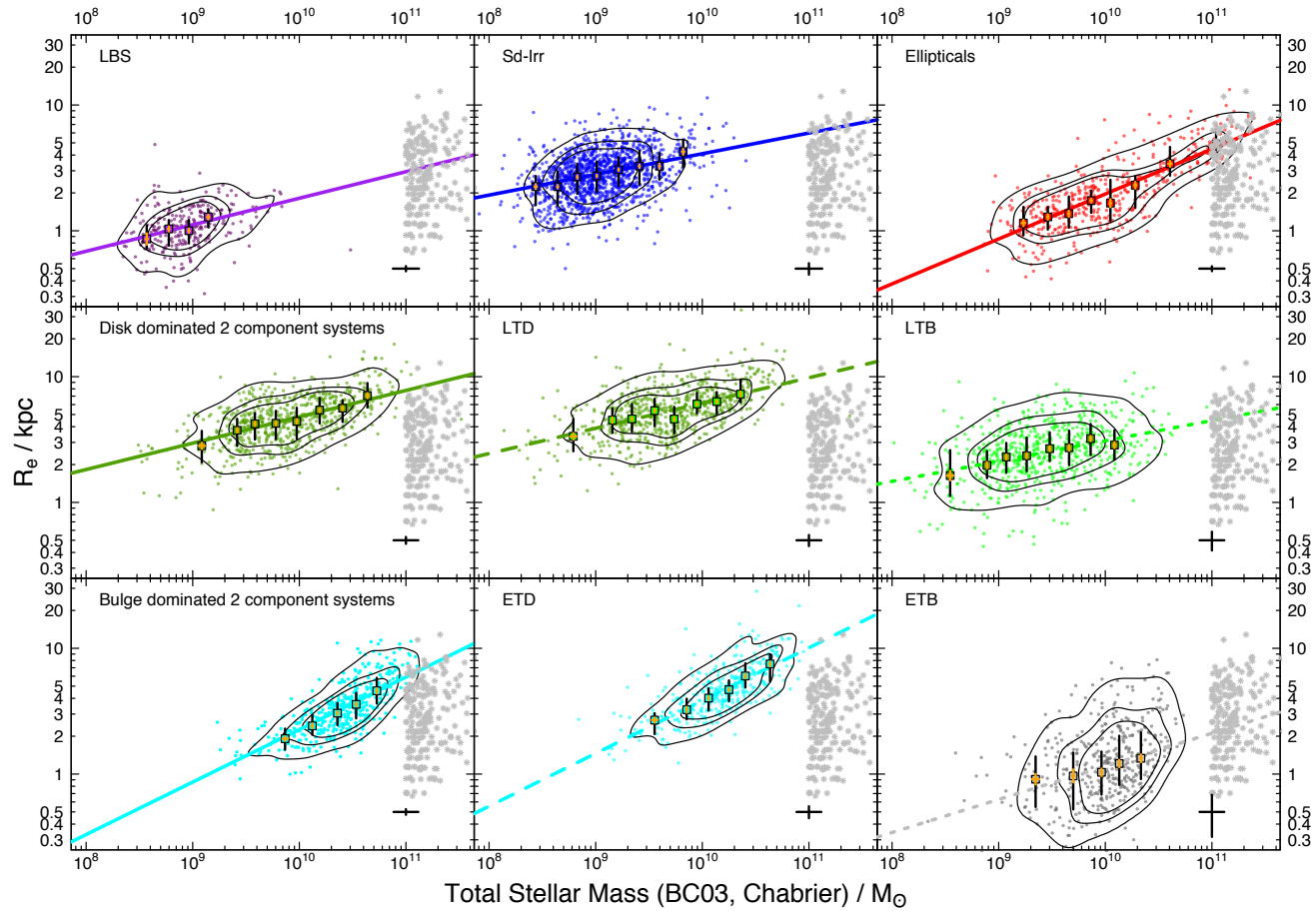
Final limit around here.



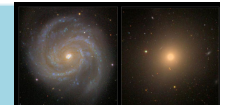


Driver et al (2013)

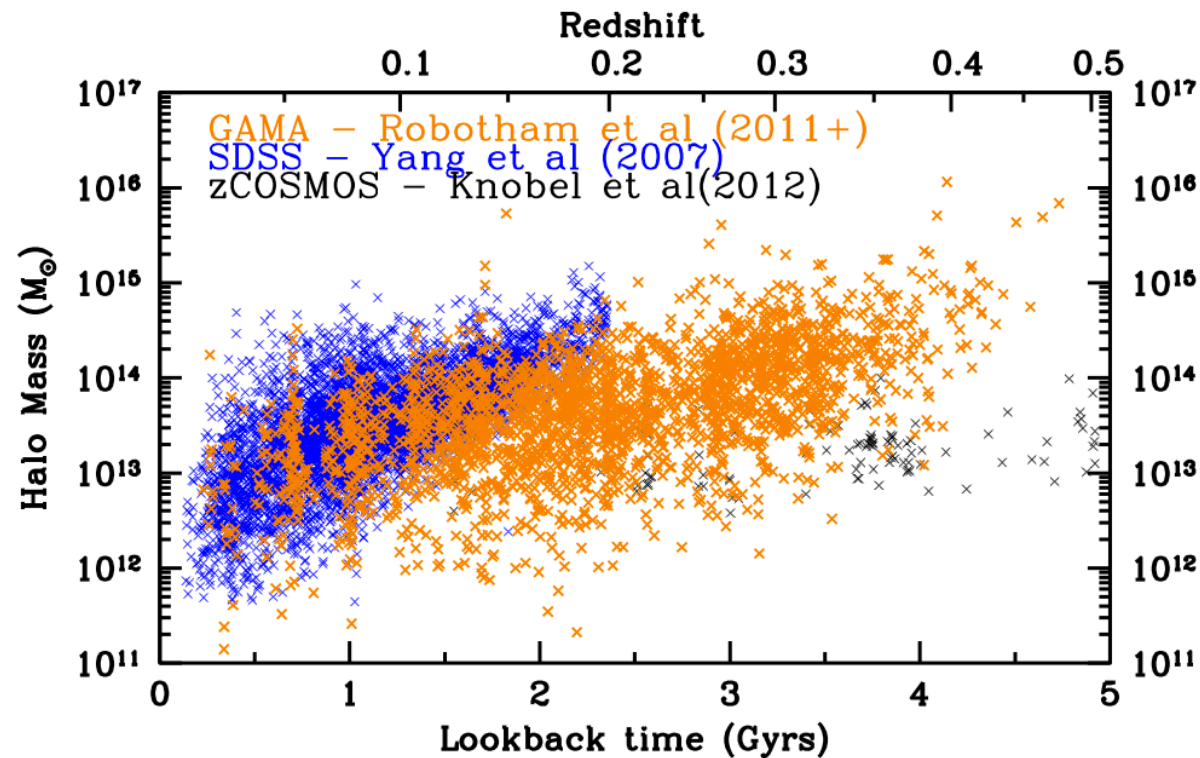


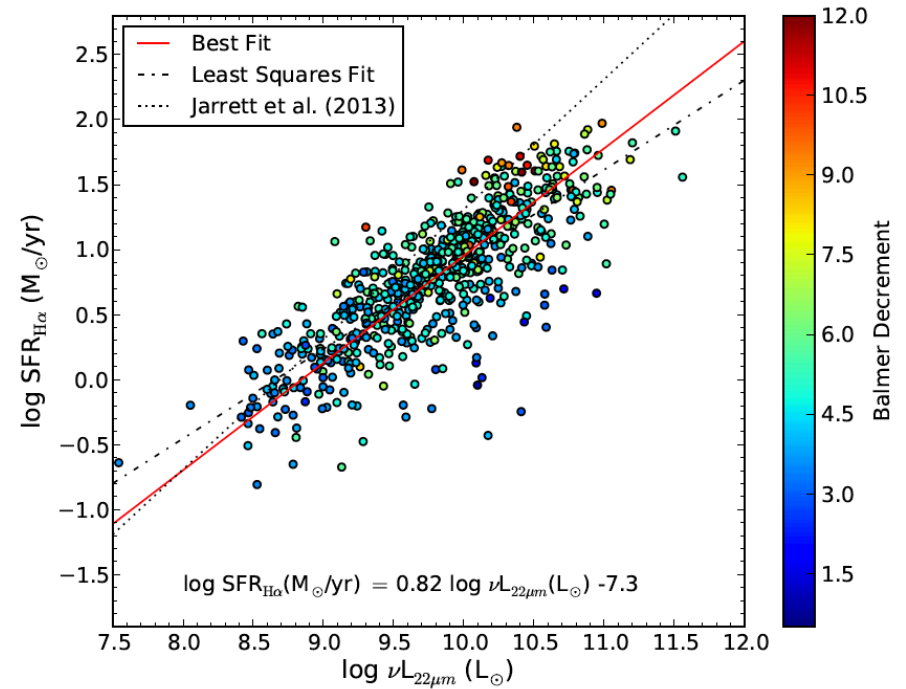
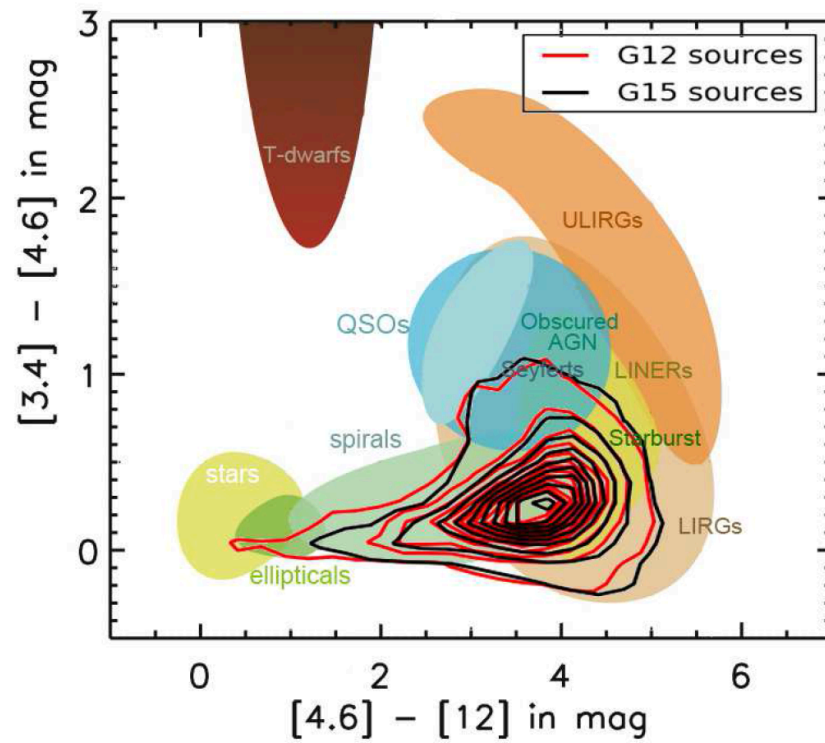


Lange et al (2014)

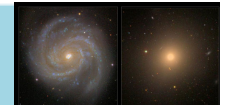


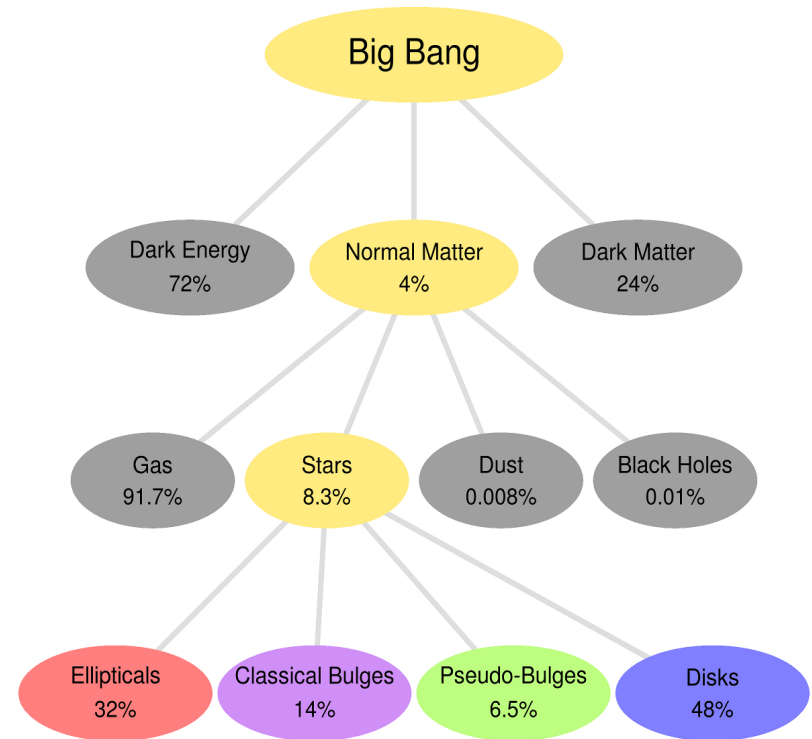
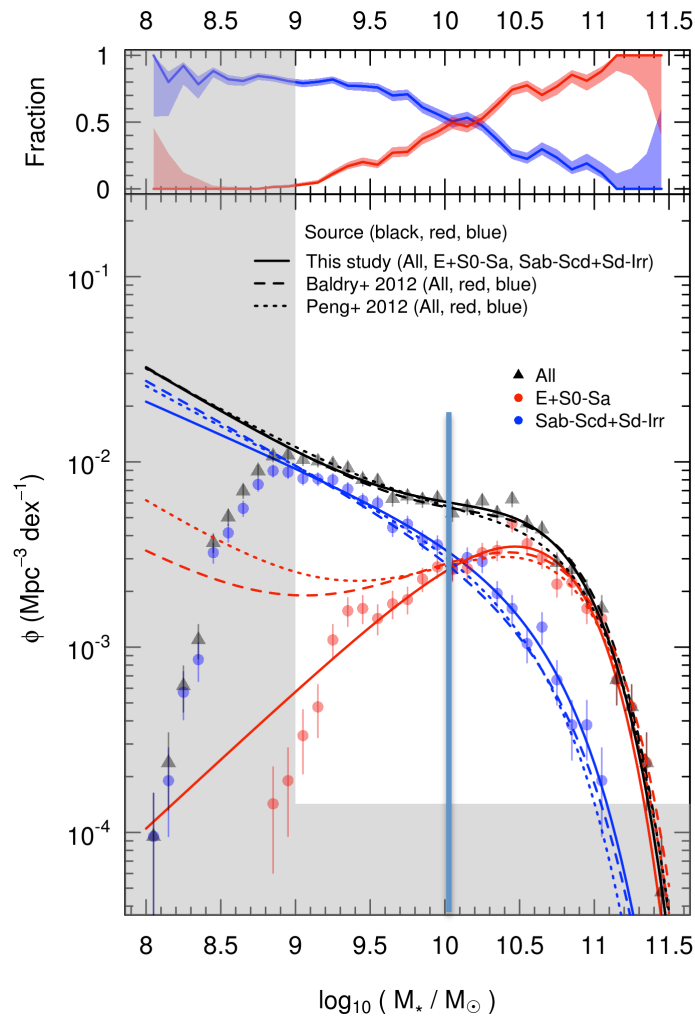
Over 25k pairs/halos identified, 5k with $N > 4$ members





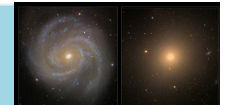
Cluver et al (2014)

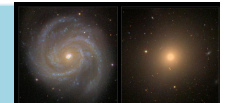
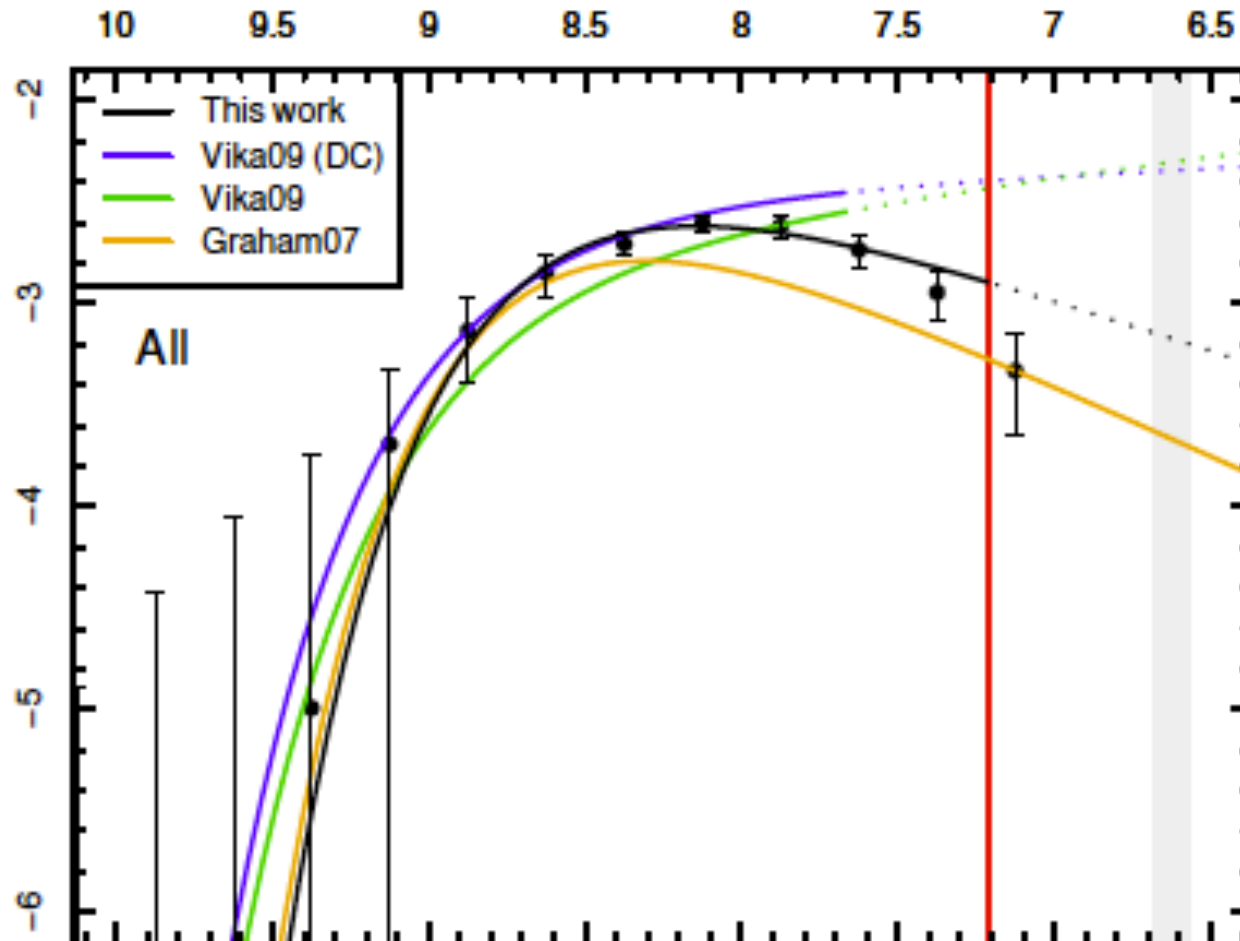




45% Spheroid & 55% Disc

Kelvin et al (2014, PhD thesis)



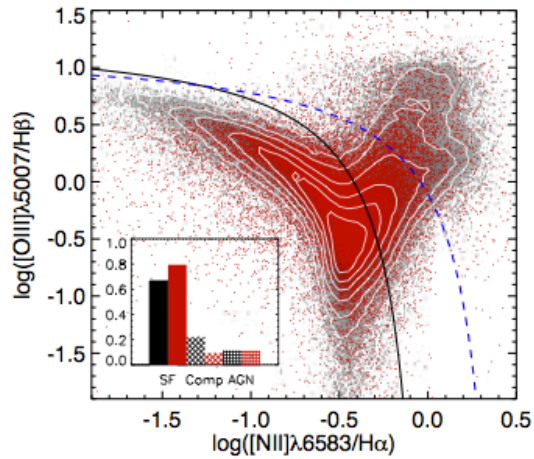


More results...

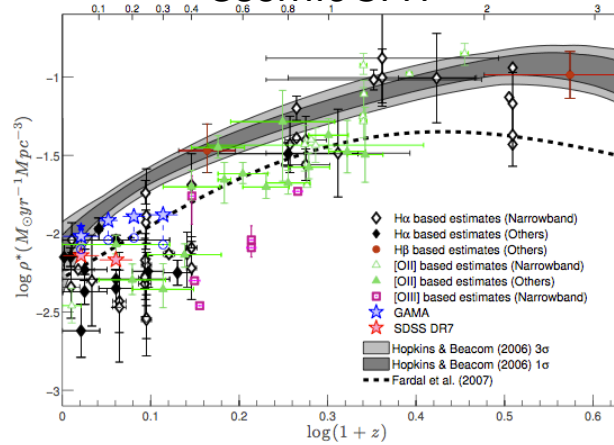
60 papers in print, 180 declared
but best is yet to come...VST & ASKAP

SMBHs

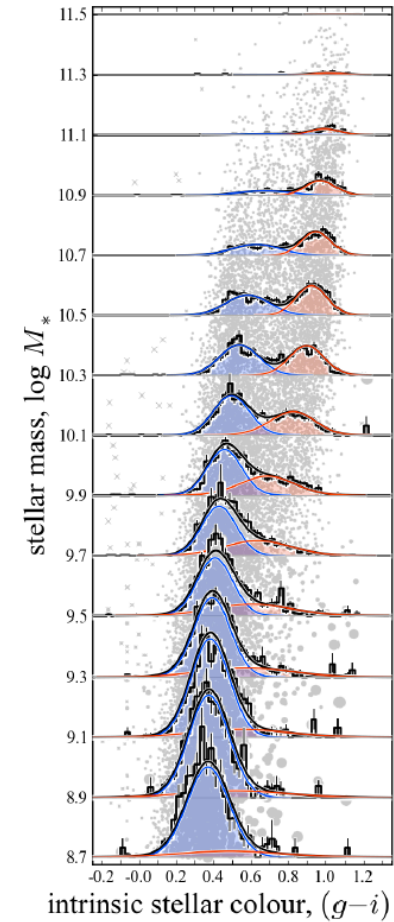
AGN



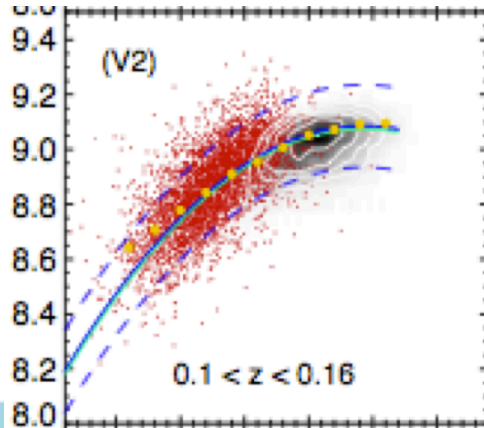
Cosmic SFH



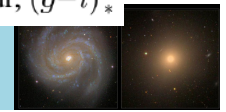
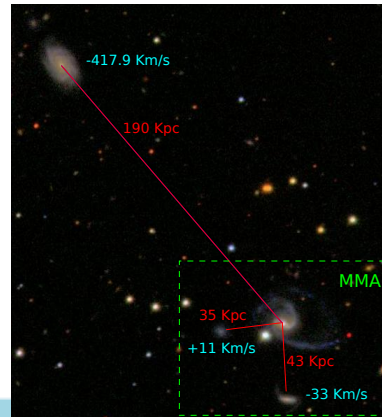
Bimodality



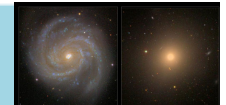
MASS-METALICITY



Local Group Analogs

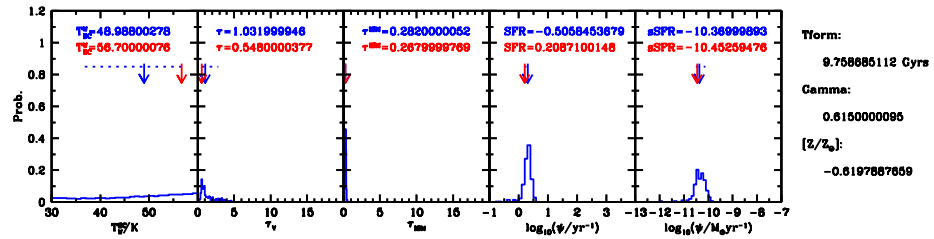
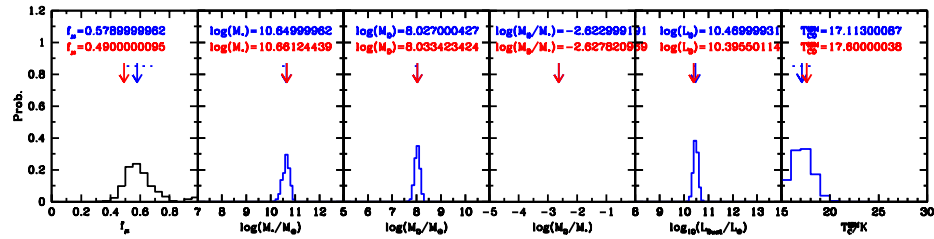
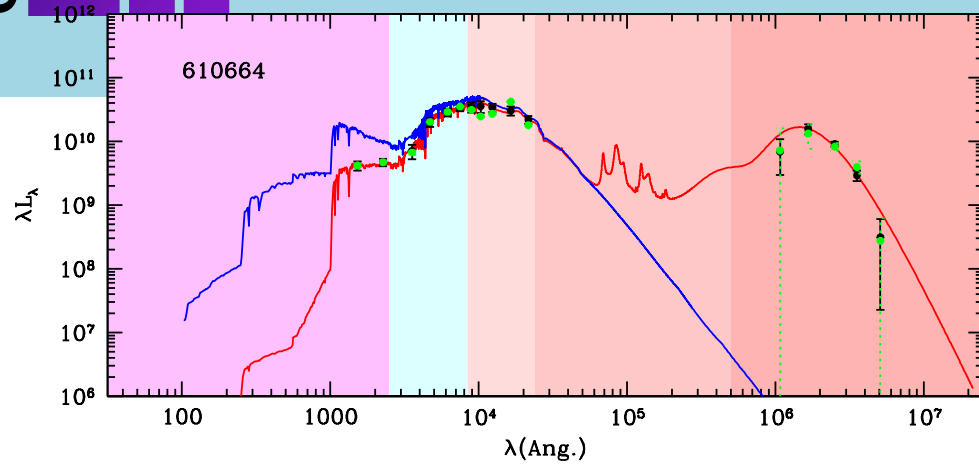


- MAGPHYS analysis of all 250k galaxies
- Into the LSBG Universe with VST
- Structural decomp on VST with SIGMA(GALFIT-M)
- HST GAMA
- Integration of zCOSMOS/COSMOS
- SAMI and GAMA
- Group refined photo-z's
- ASKAP/DINGO
- Alfafa
- JWST

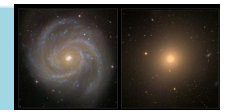
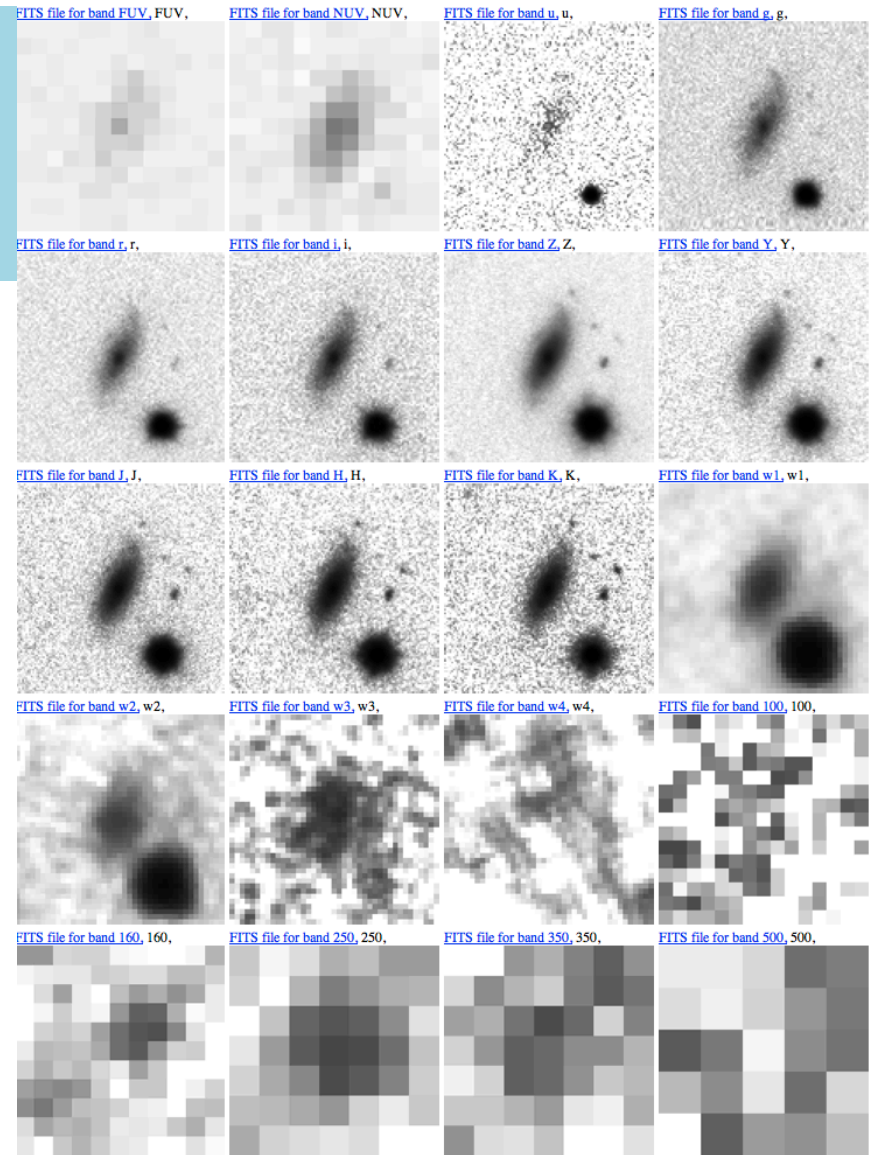


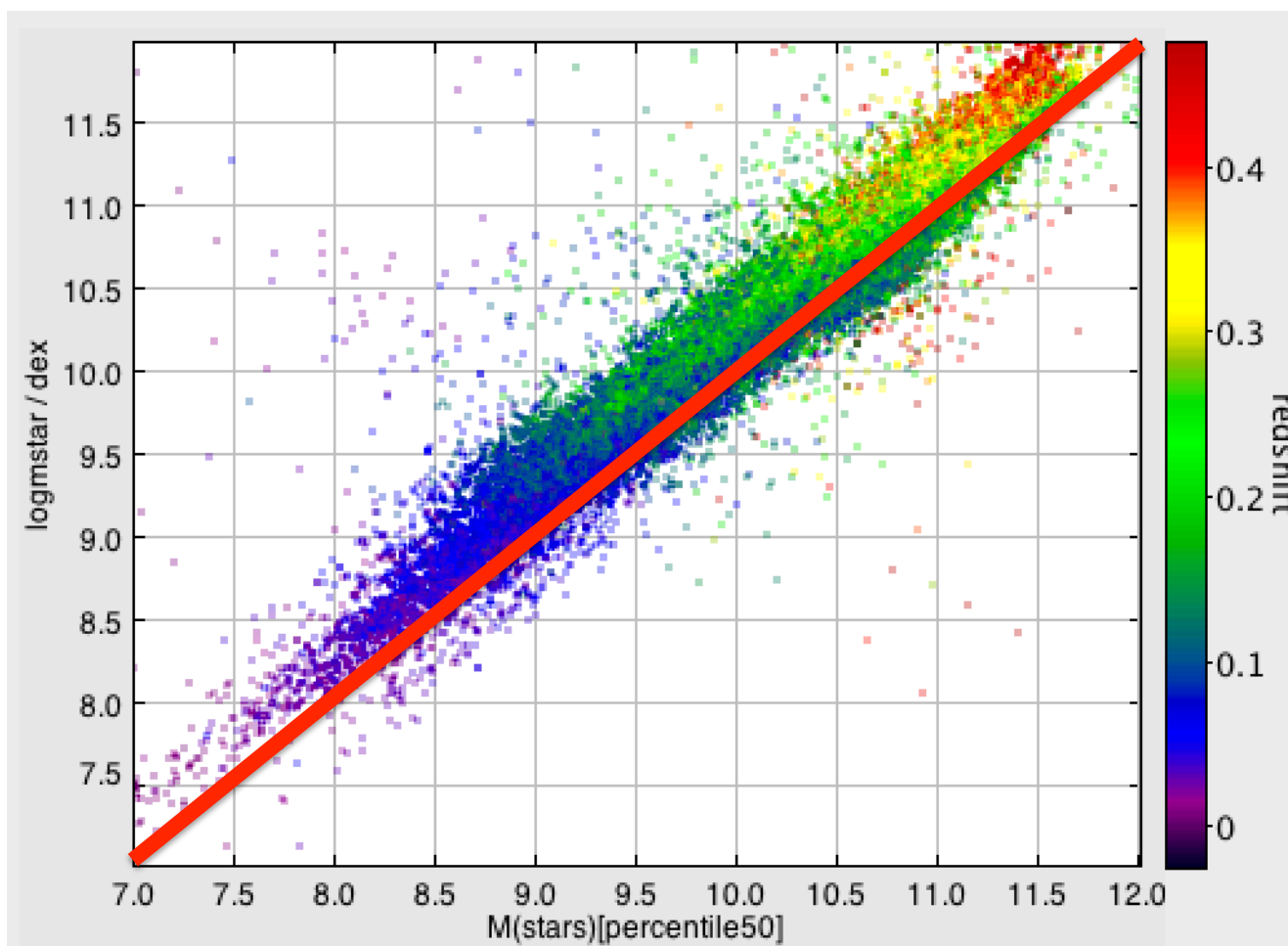
GAMMA

Comparison to Herschel Atlas data

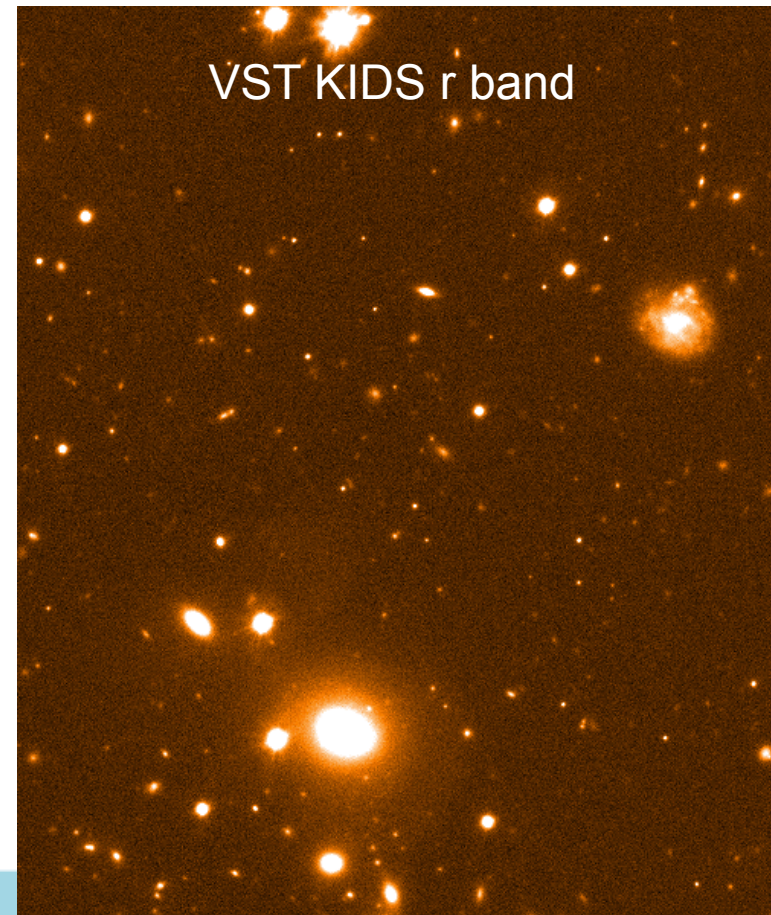
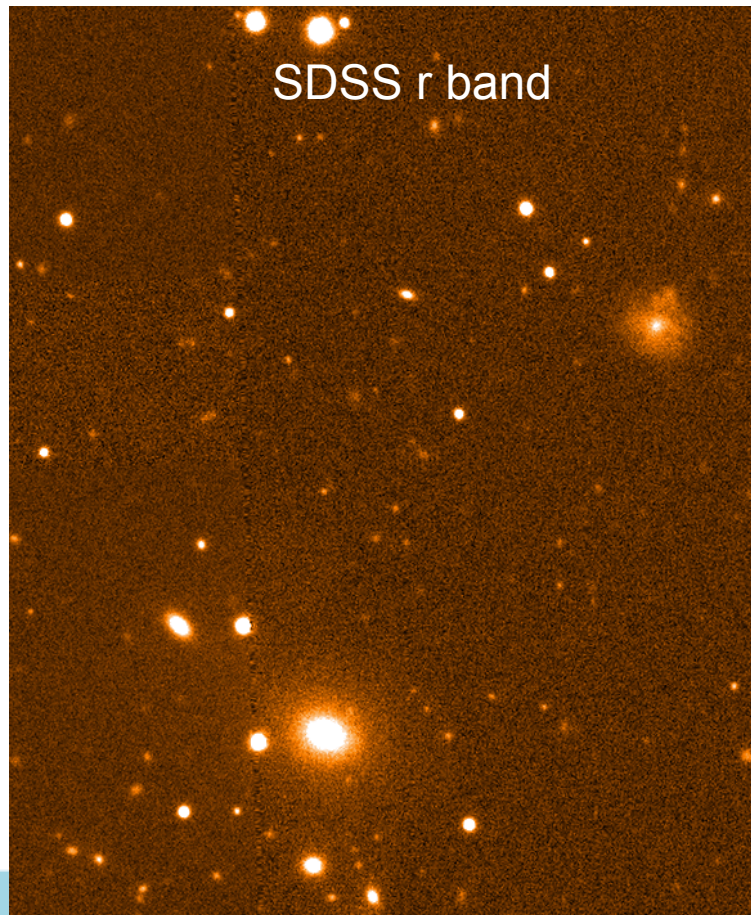


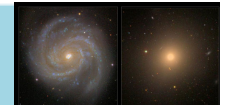
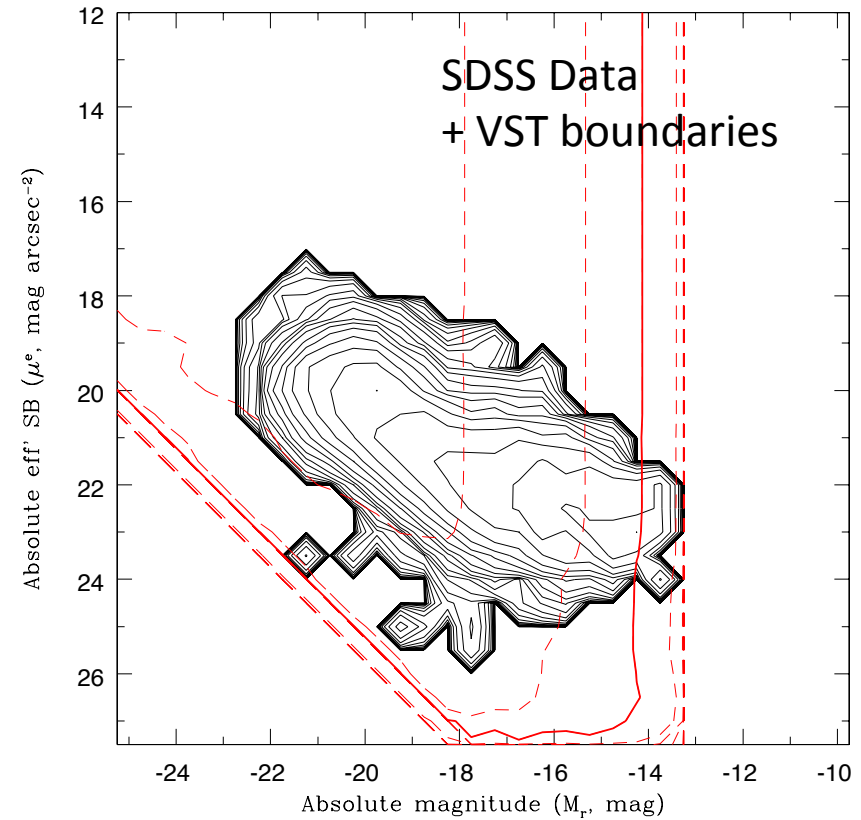
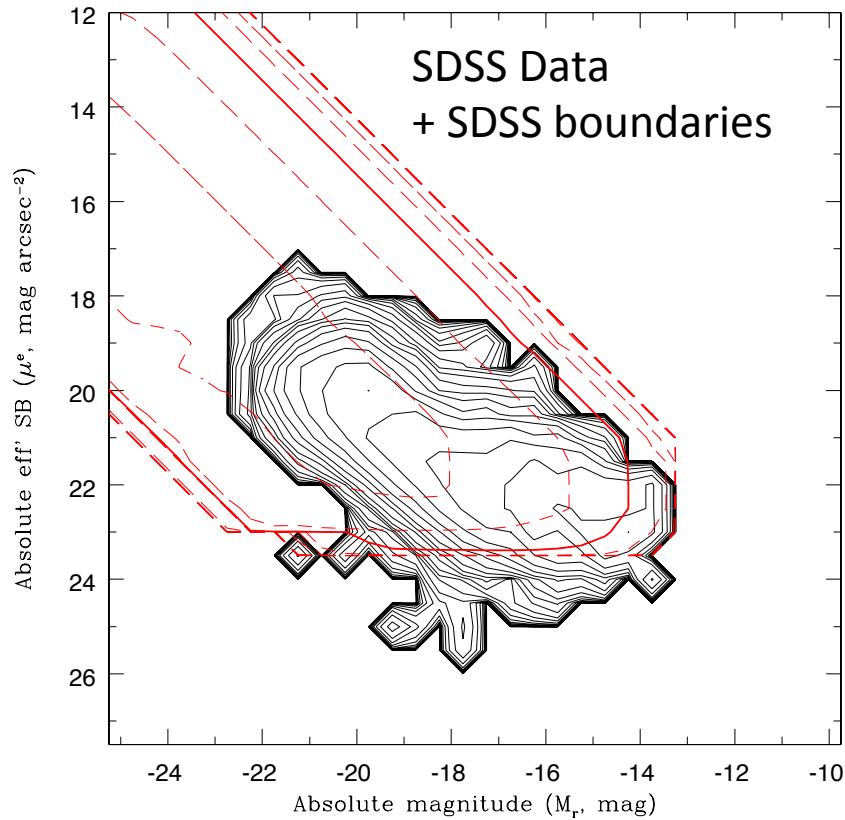
Tform: 9.758685112 Gyrs
 Gamma: 0.8150000095
 [Z/Z_sun]: -0.6197887659

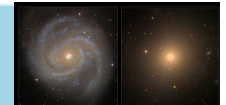
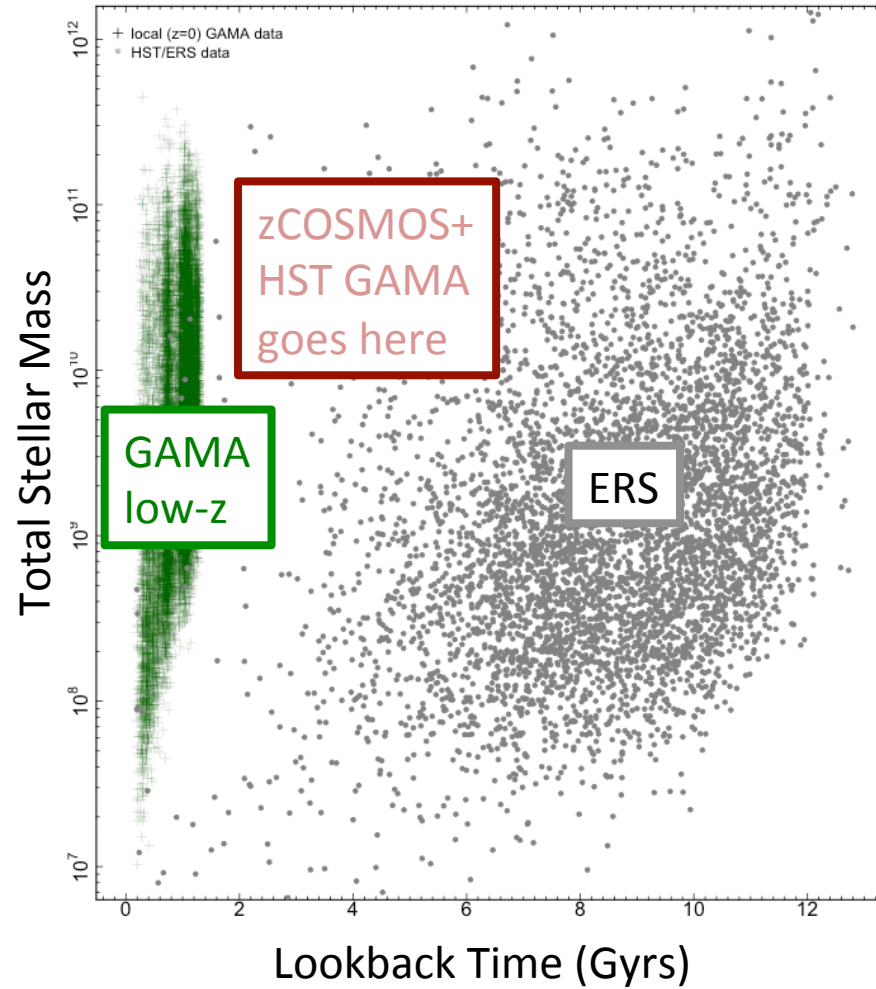
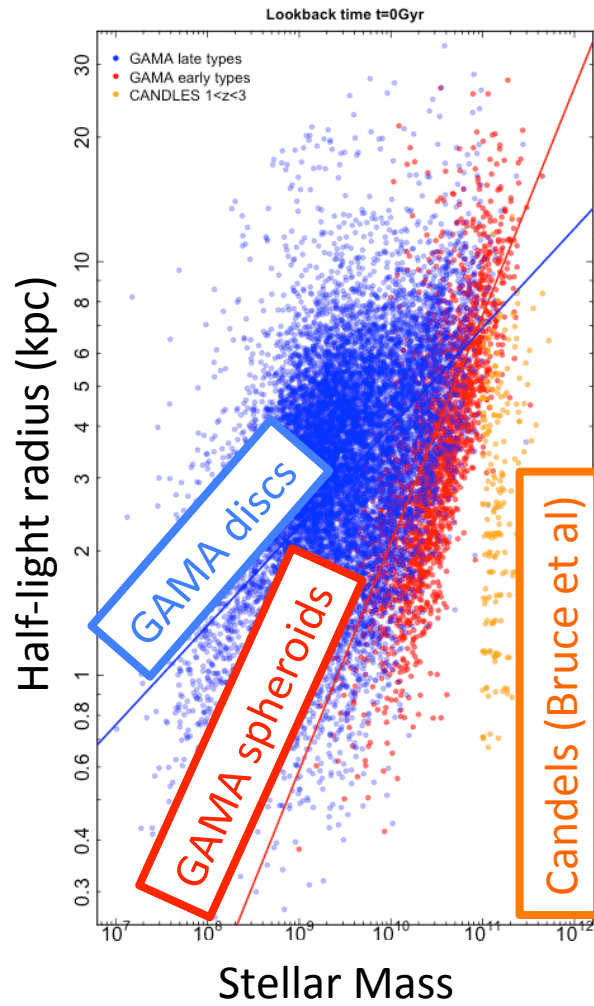




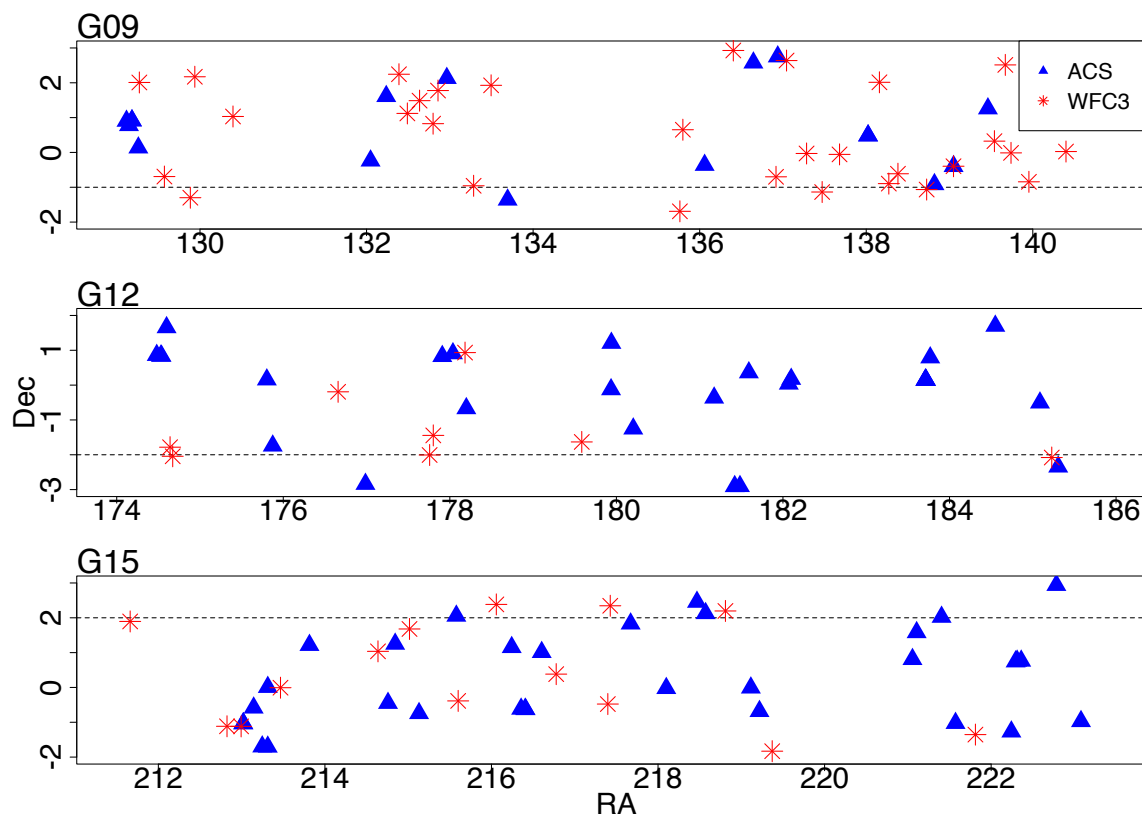
Imaging resolution & depth
 $1.5'' \rightarrow 0.7''$, $r \sim 22 \rightarrow r \sim 24$



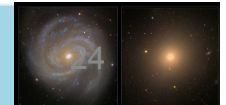
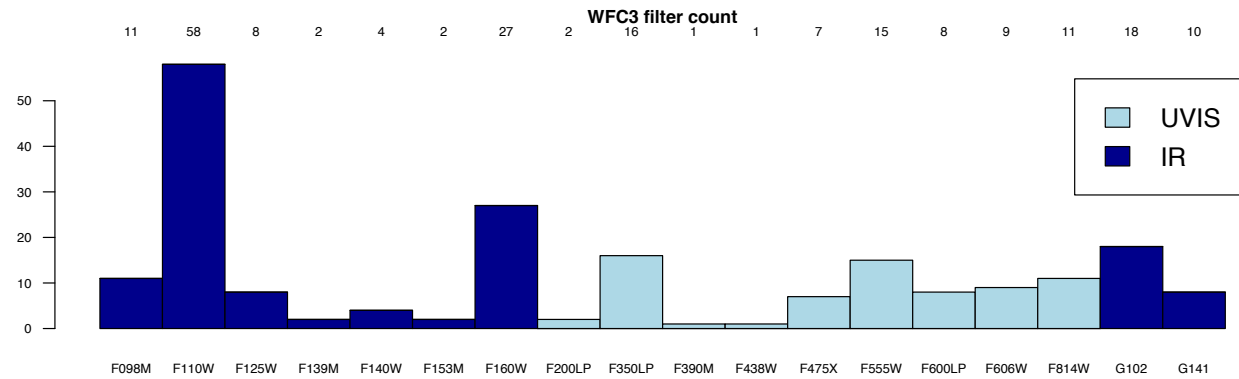
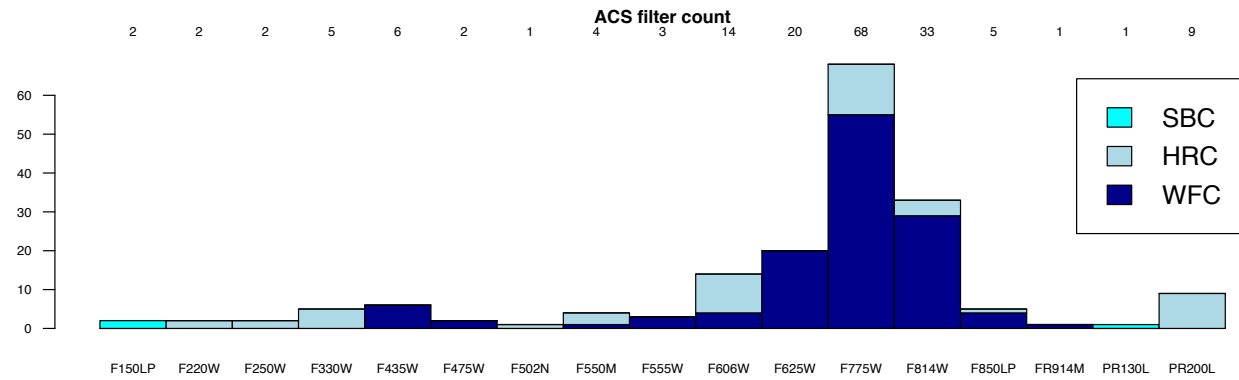




Currently ~100 pointings exist with more coming due to Hatlas SNAP follow-up mainly WFC and ACS in a variety of filters

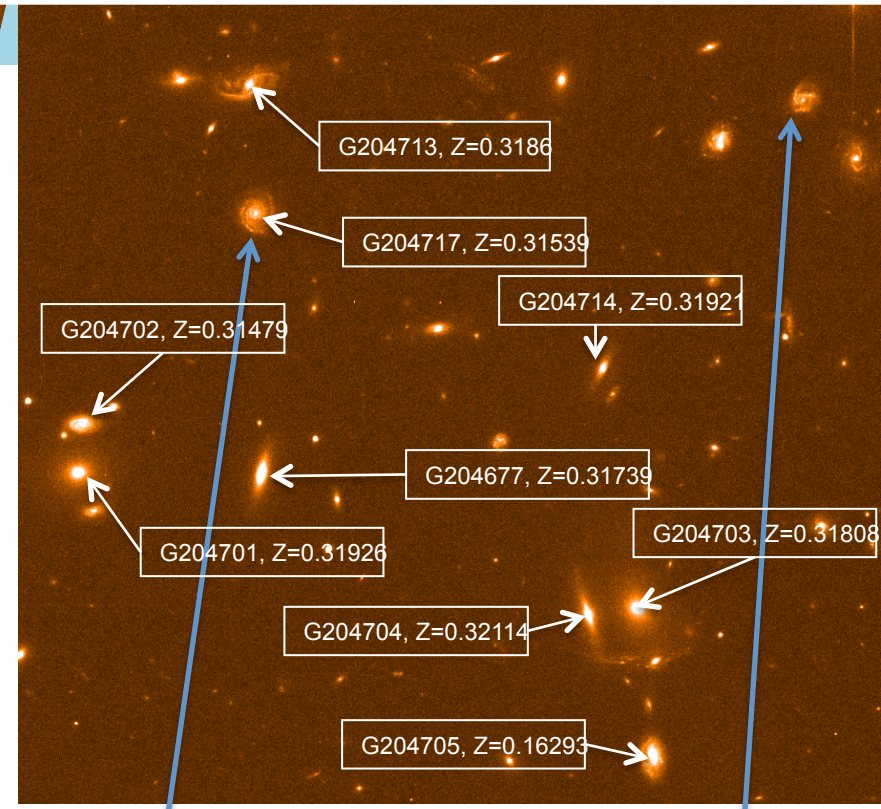
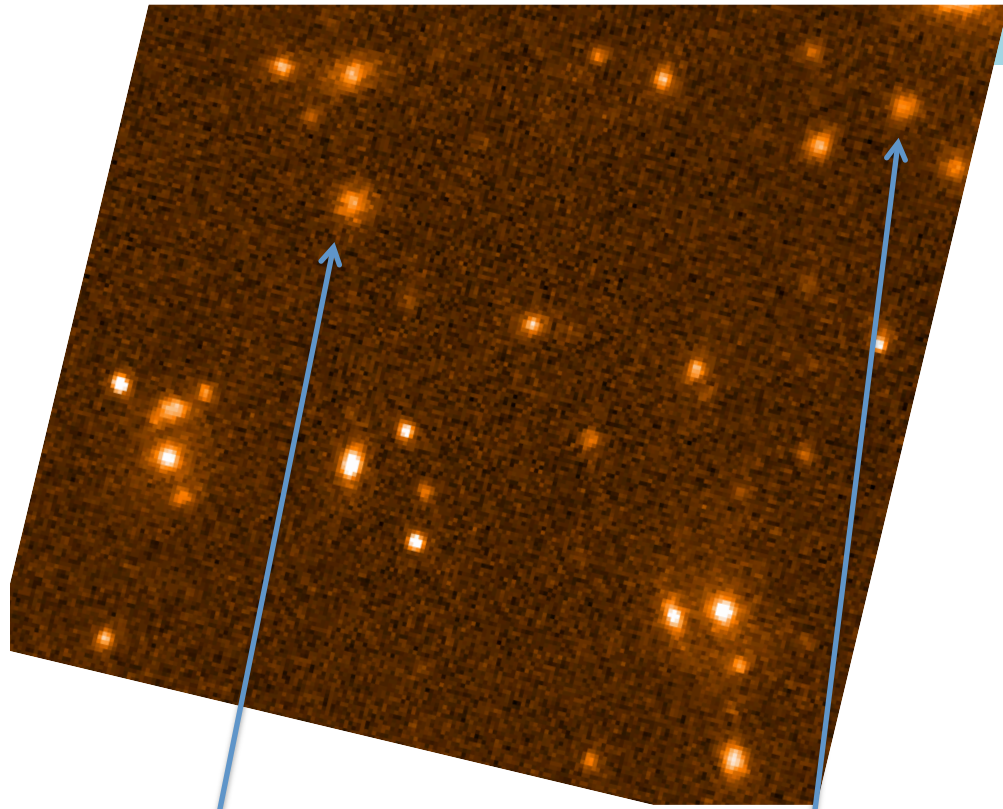


F814W most popular filter (i) for ACS or F110W for WFC

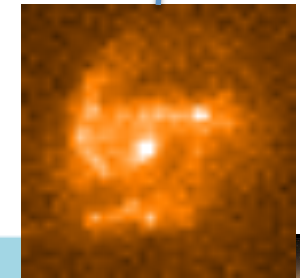
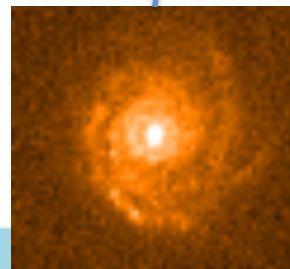
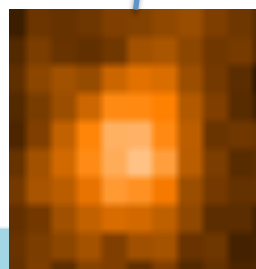
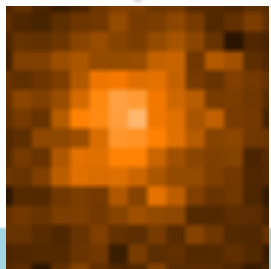


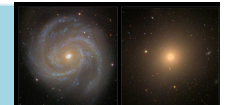
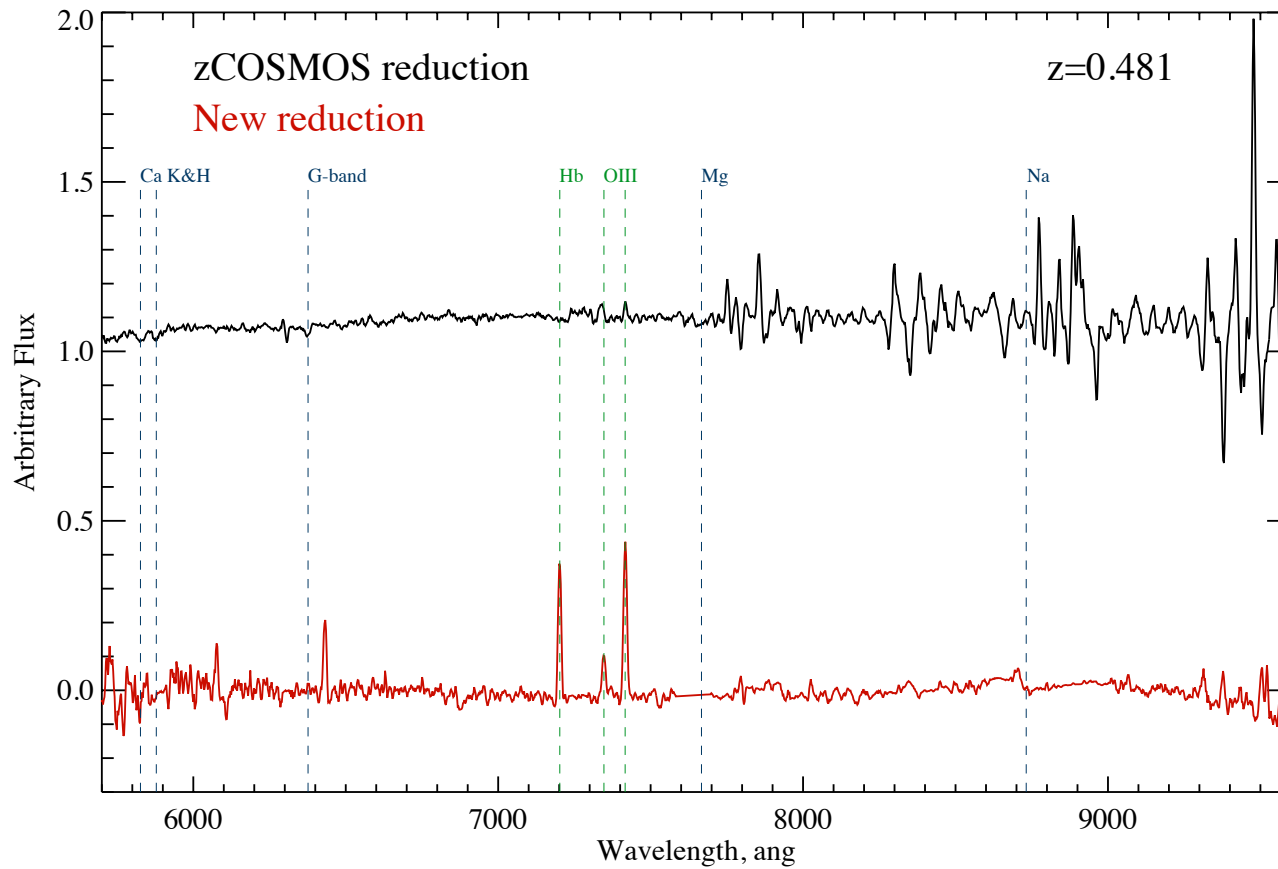
SDSS r-band imaging

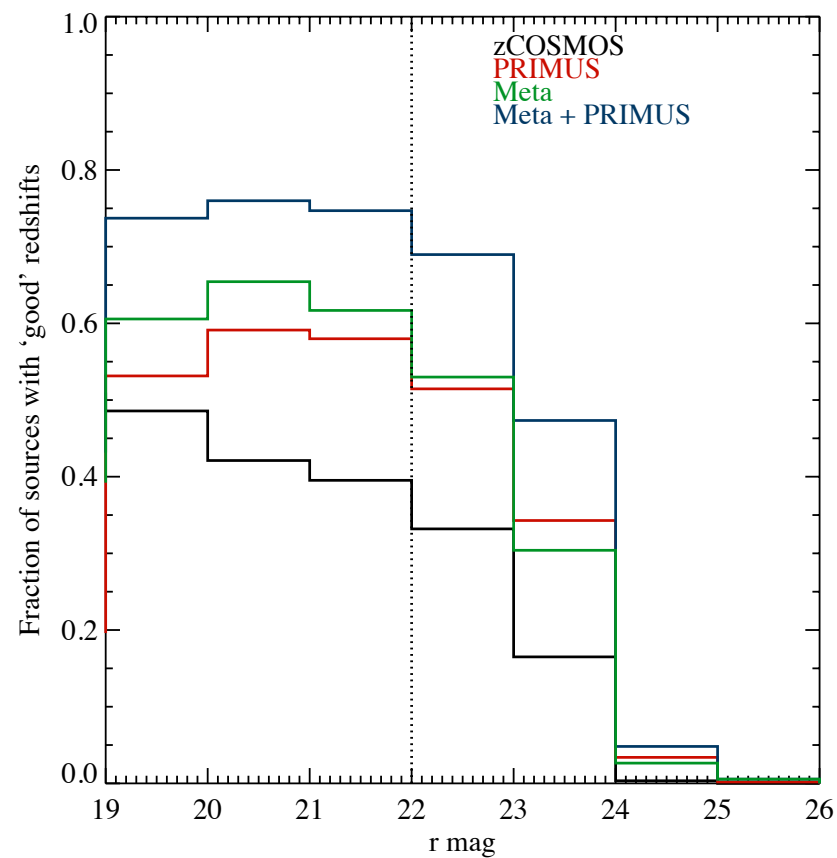
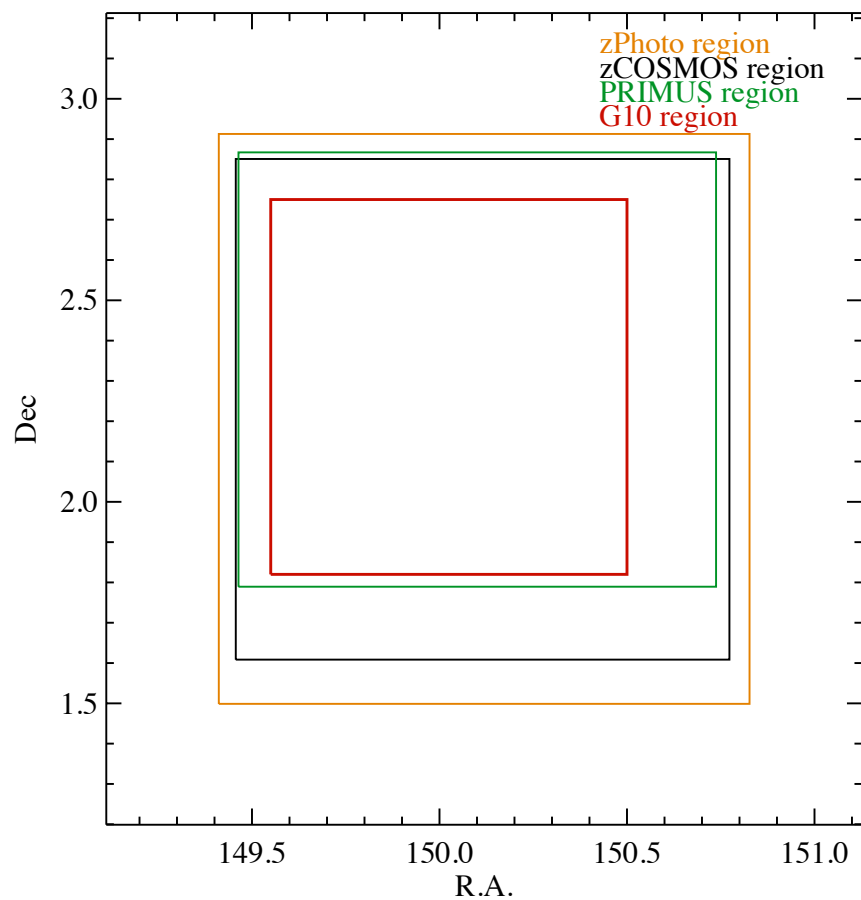
HST F775W imaging



60 arcsecs







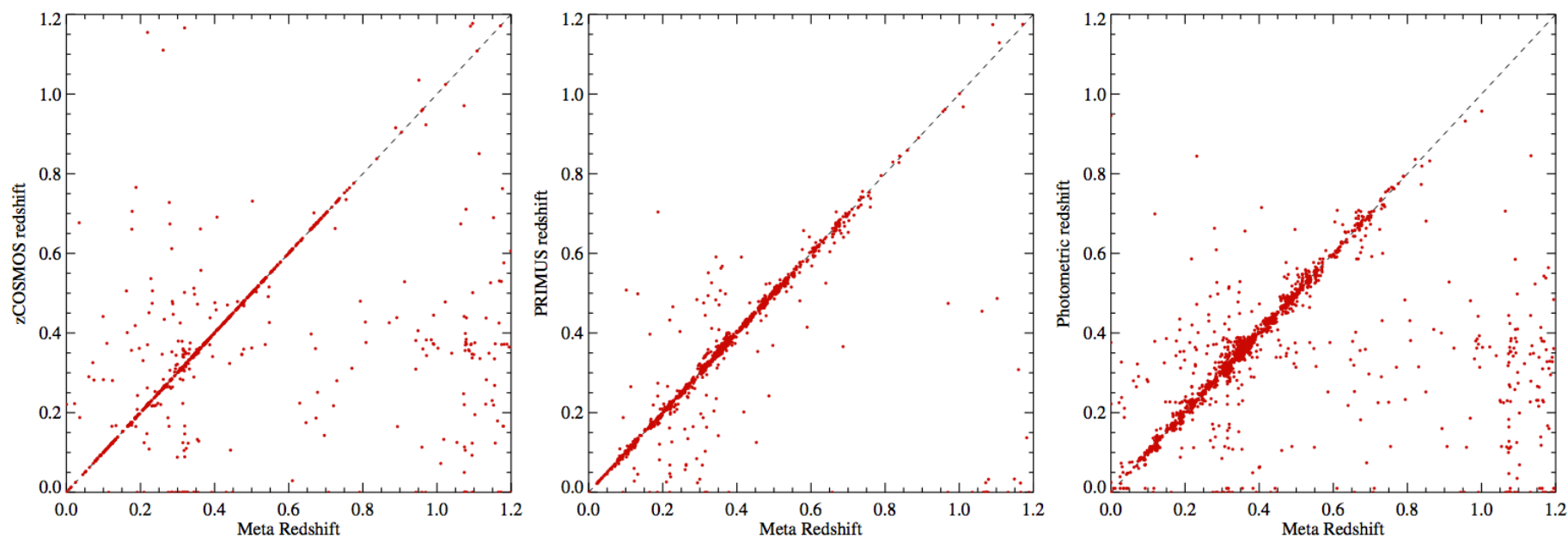
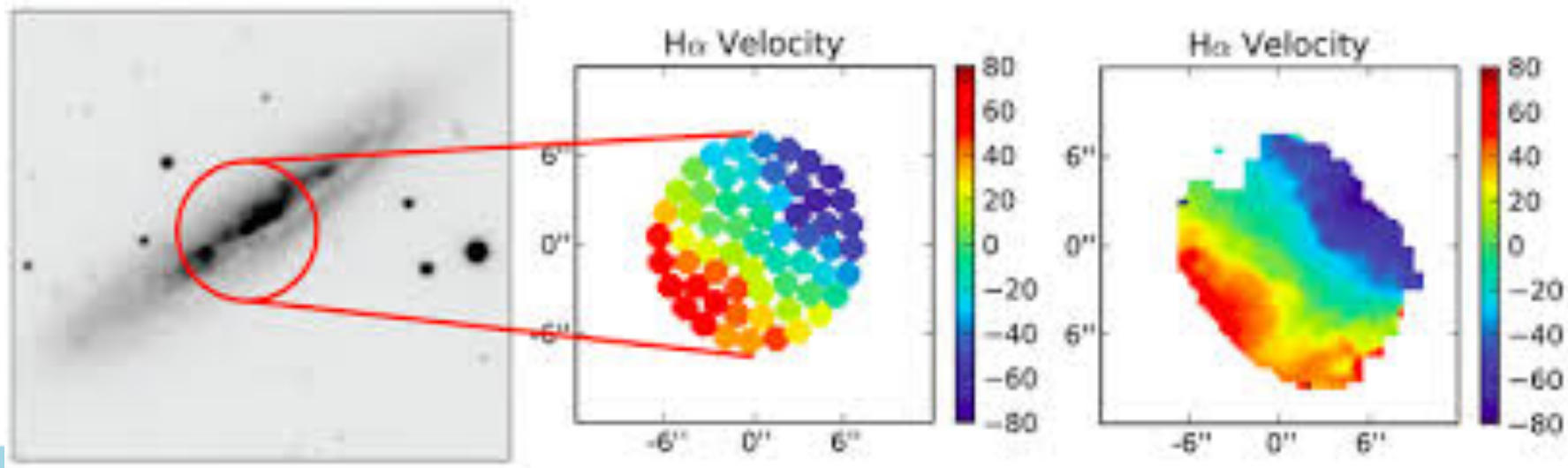


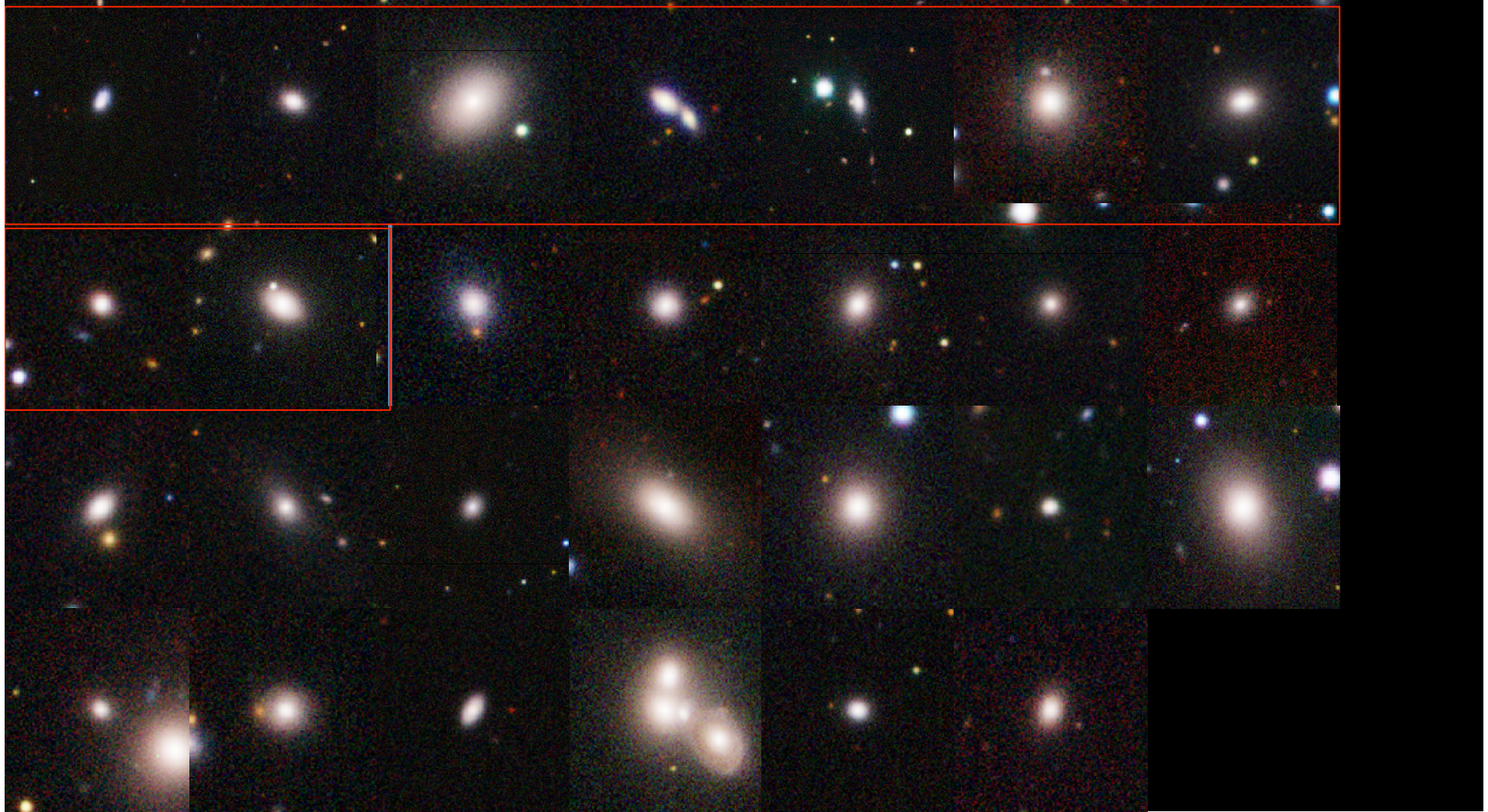
Figure 7. Comparison between our $r < 22$ meta G10 sample and various other redshift campaigns in the region.



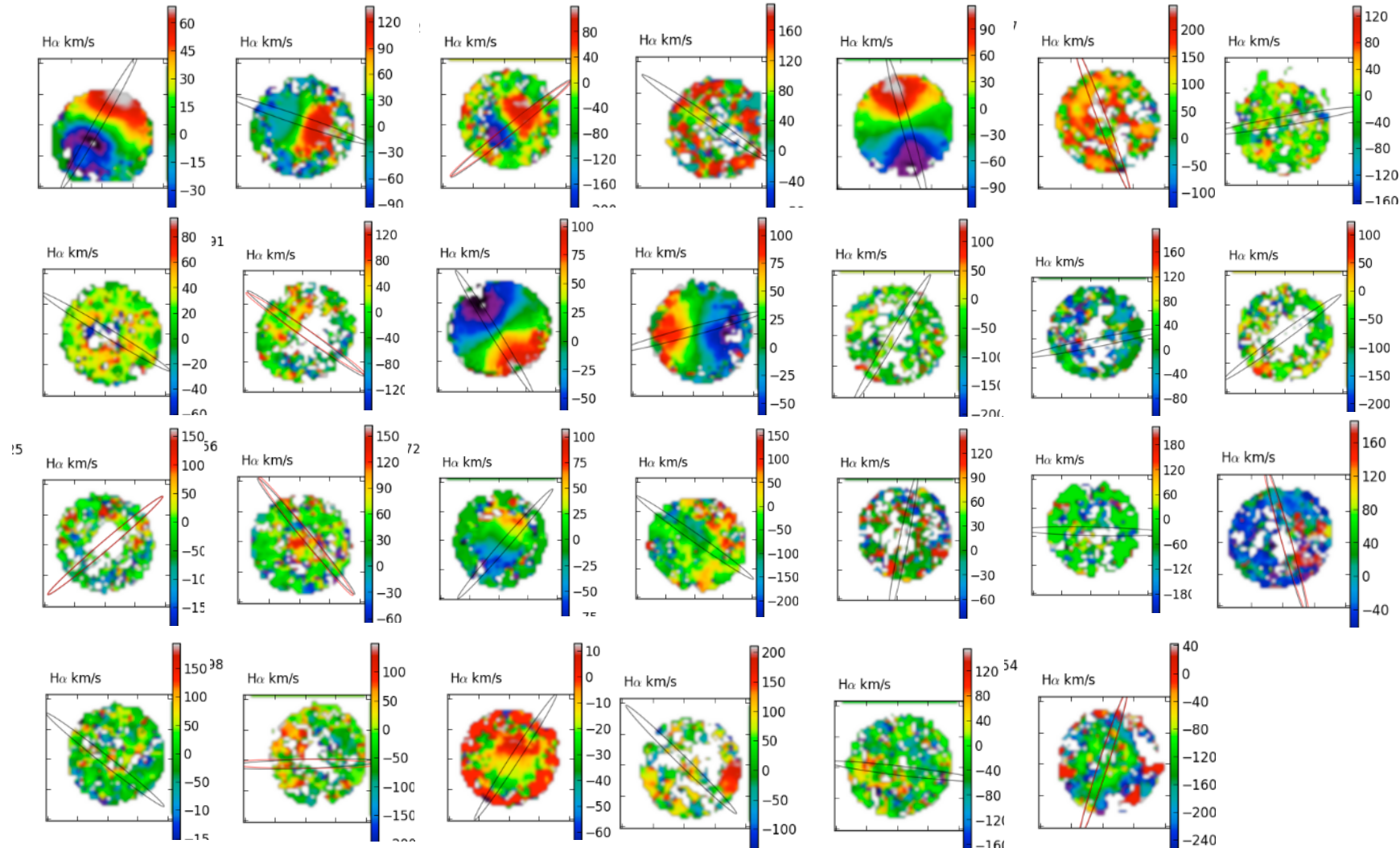
- Independent programme led by Scott Croom
- SAMI=Sydney AAO Multi-object IFU
- Following up of ~ 2000 GAMA+Cluster selected targets
- Mostly $z \sim 0.04-0.08$
- Will produce velocity maps, SFR maps, Z maps etc



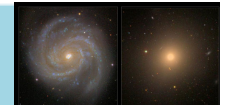
Can we distinguish E's from S0's?



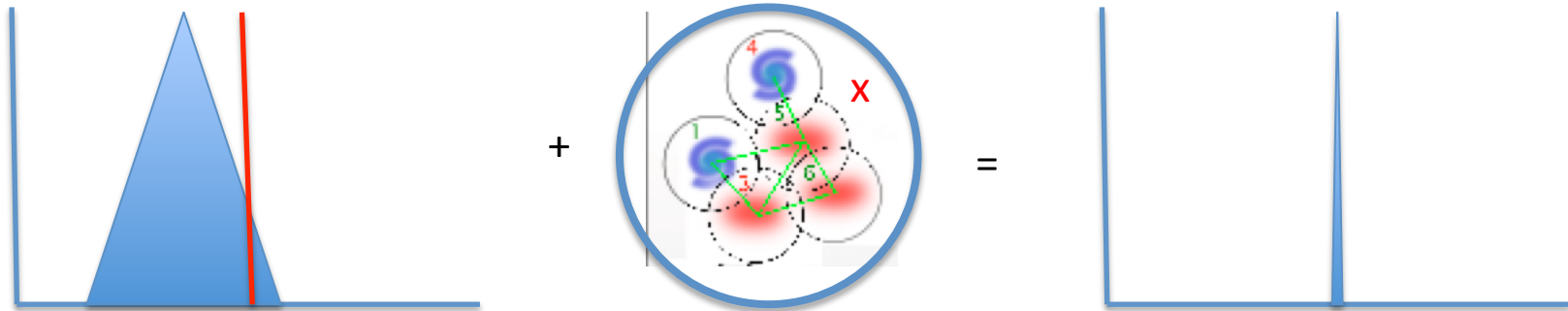
Can we distinguish E's from S0's?



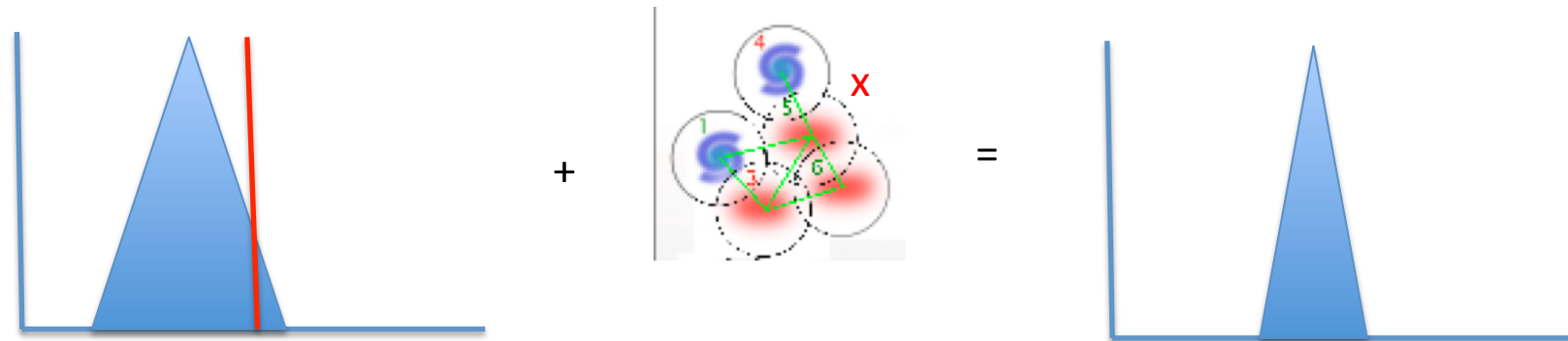
See Lisa Fogarty's talk)



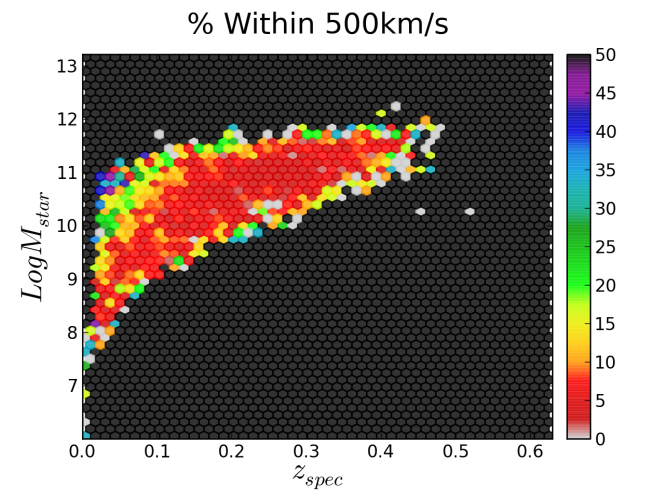
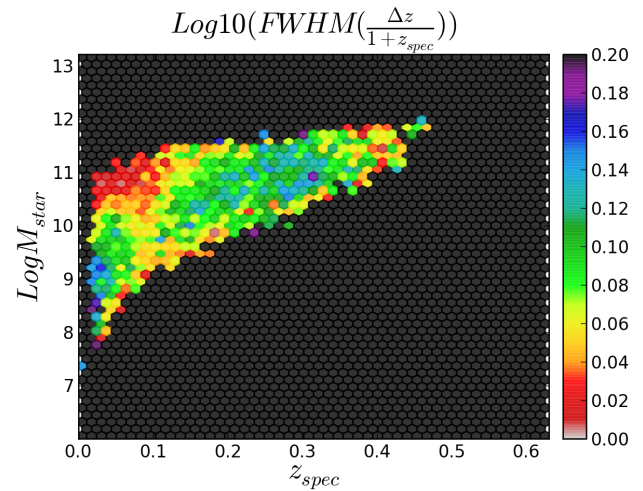
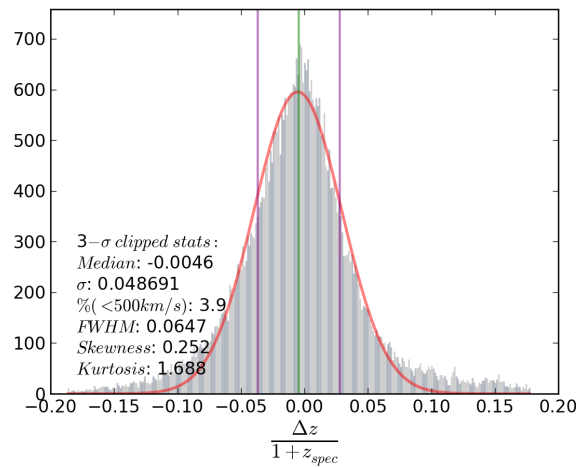
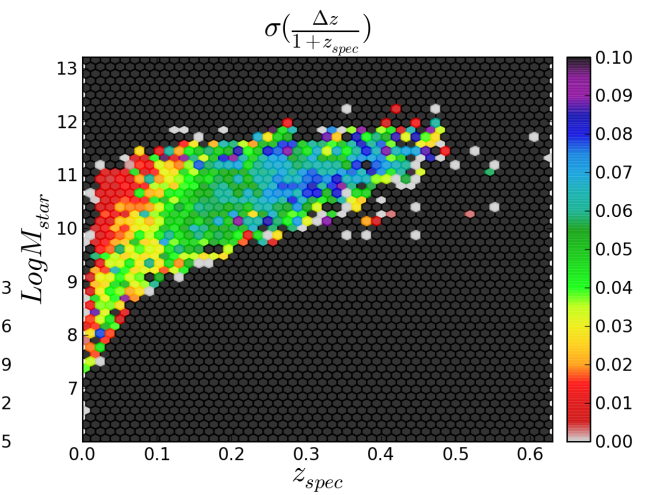
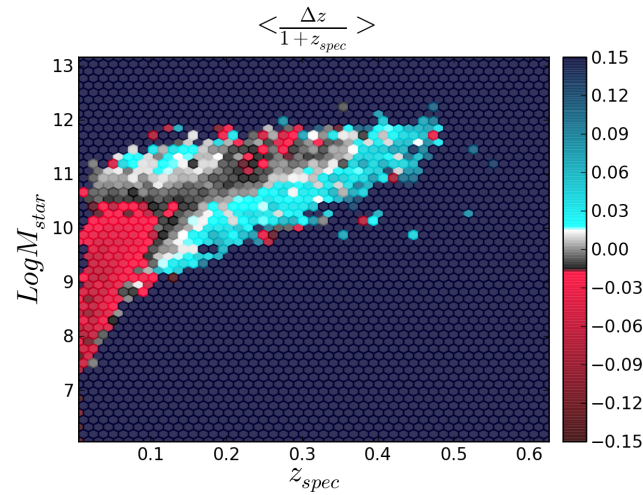
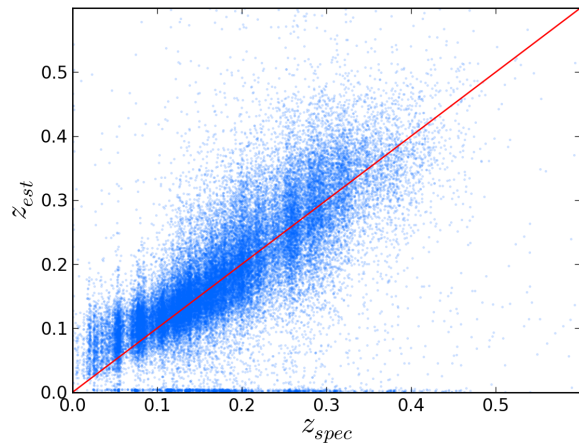
- Two methods:
- Combine photo-z PDF with l-o-s group radius



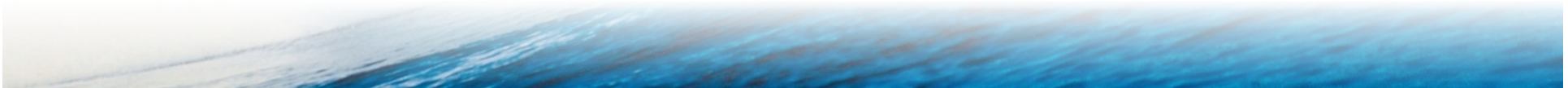
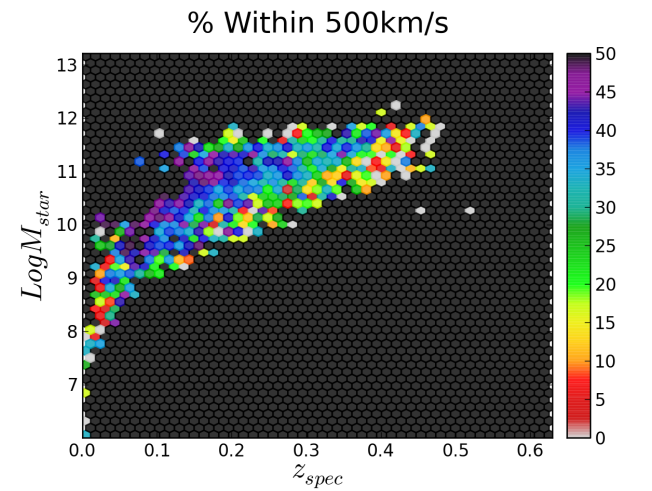
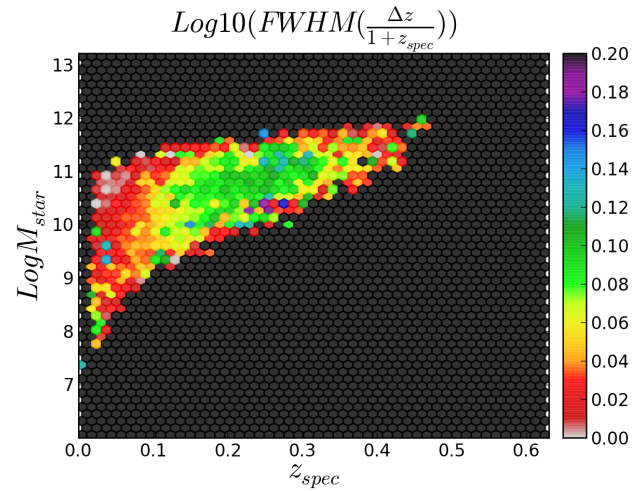
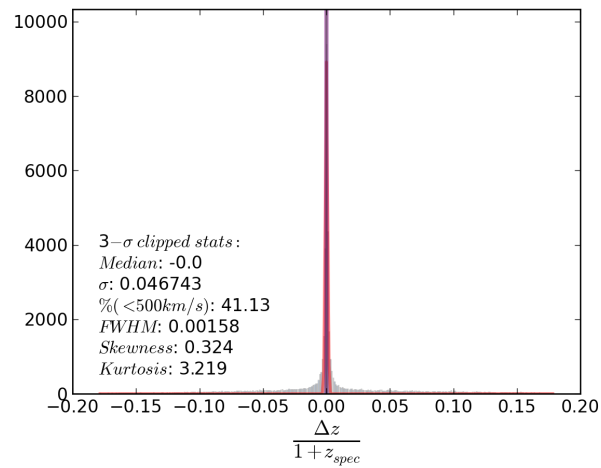
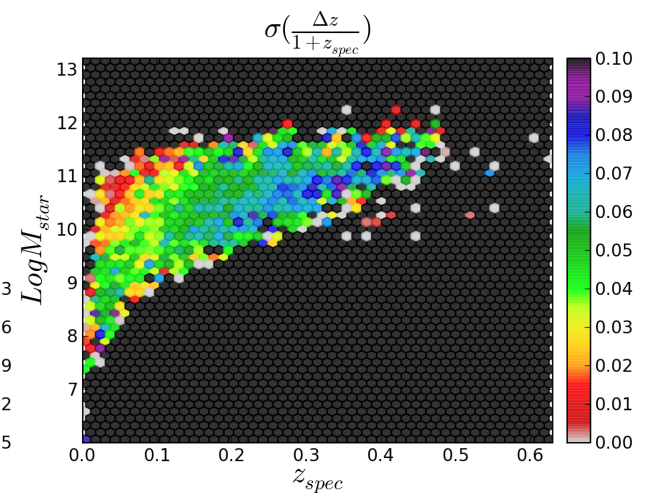
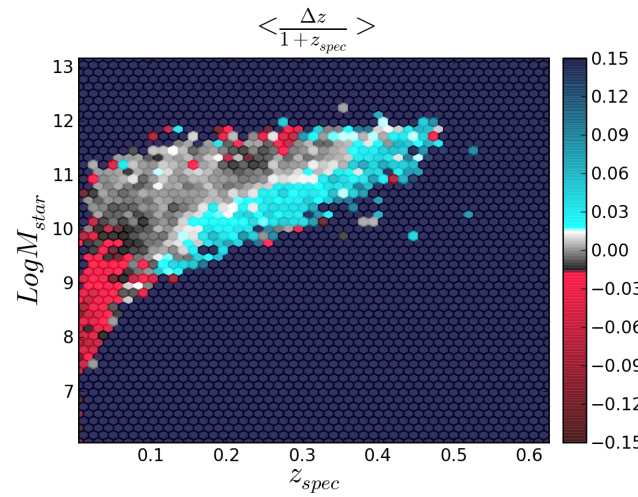
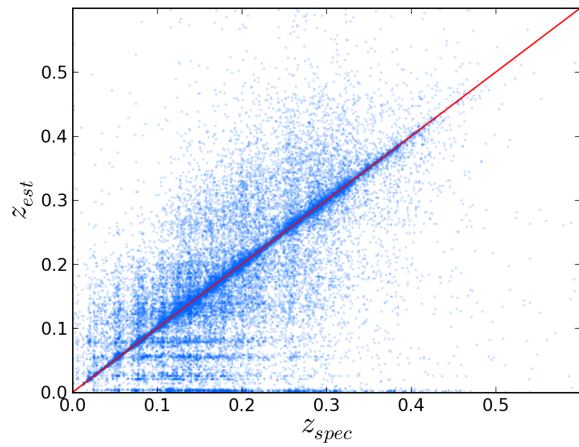
- Combine photo-z PDF with group mean linking length



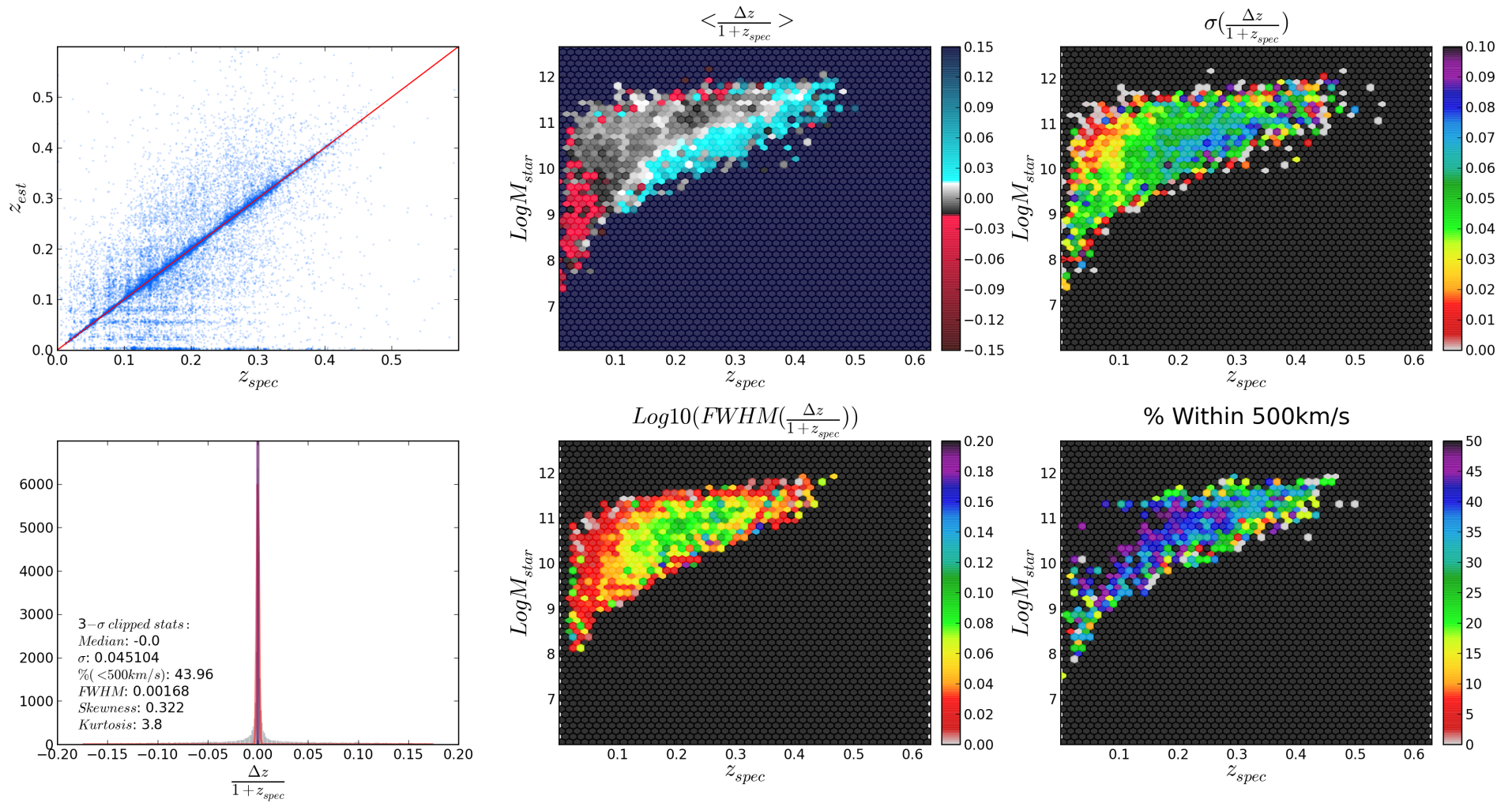
ugriZ-emp_priors-groups_only

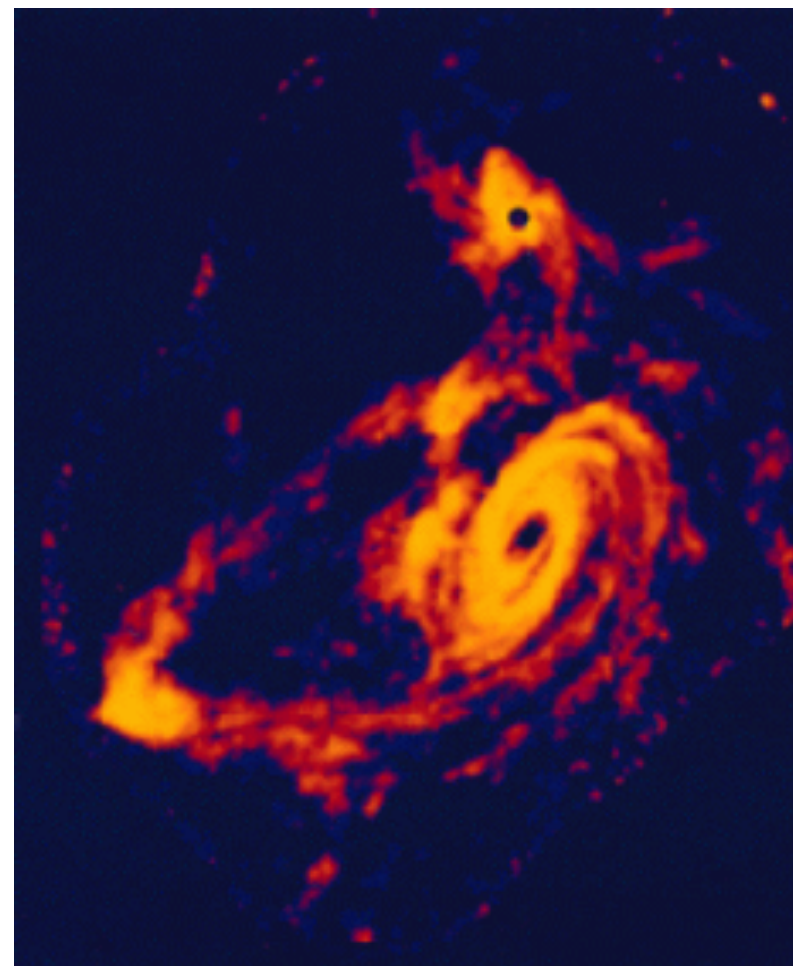
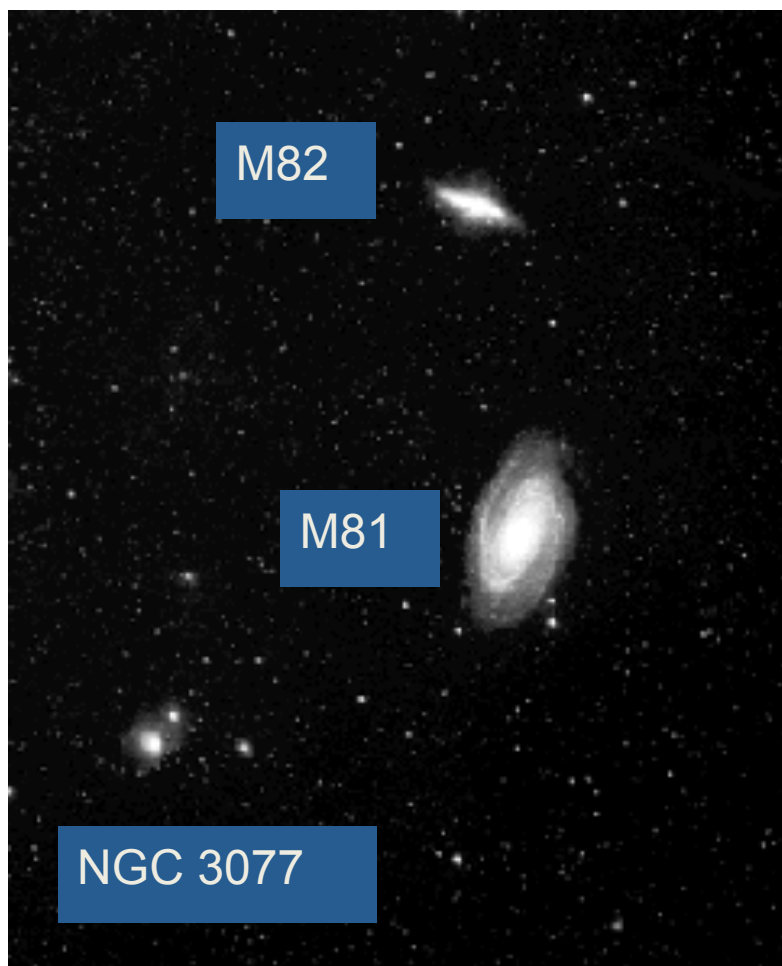


ugriZ-emp_priors+group+improv-0.1



ugriz-emp_prior+links+improv-0.03

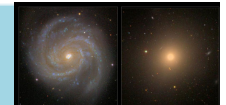




Optical data (stars)

Radio data (hydrogen)

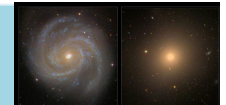
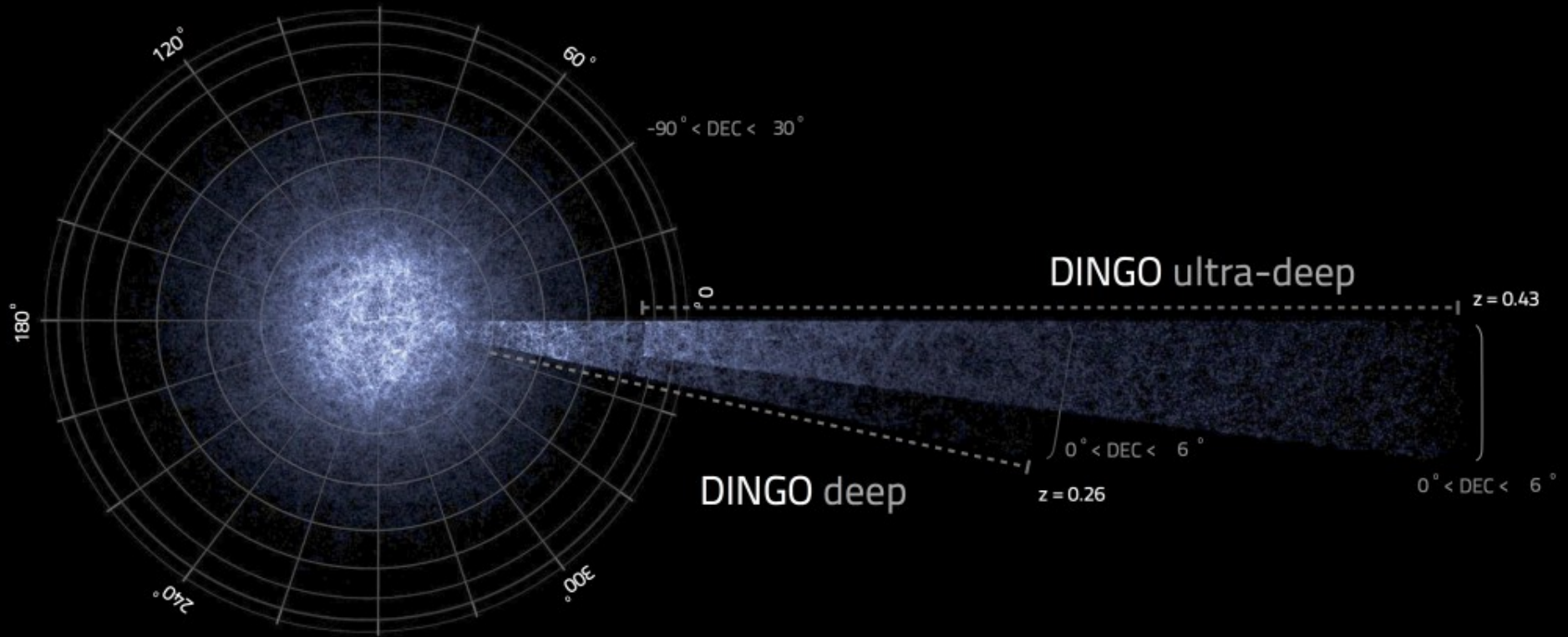




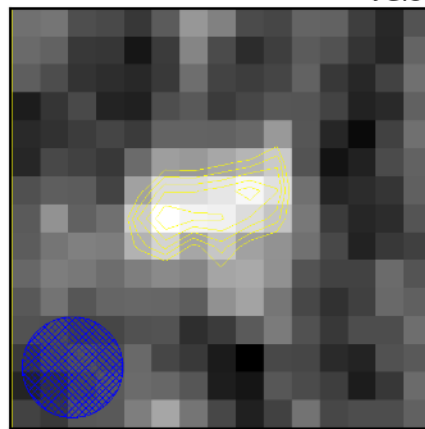
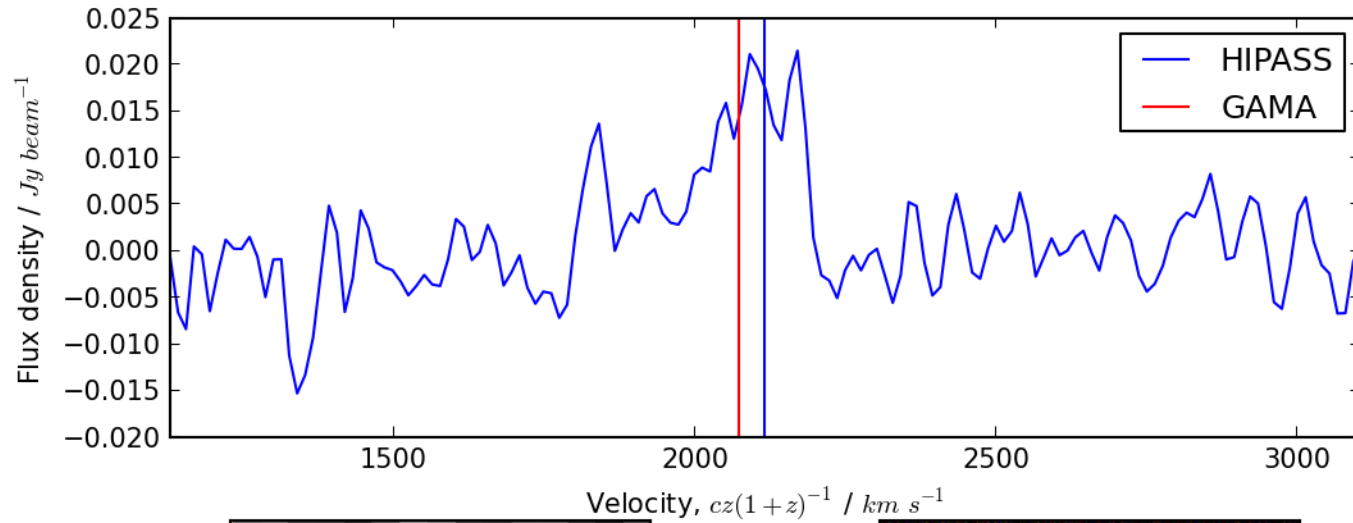
thirty-six 12m antennas with phase array feeds
30 sq deg field of view
GAMA23 region primary deep target
operations with 12 antennas commence Dec-2014
HI to $z=0.45$



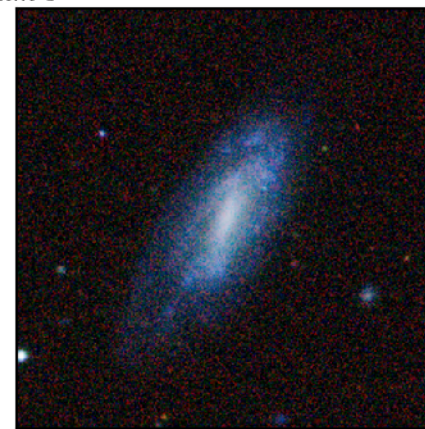
WALLABY



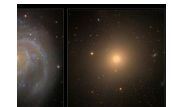
GAMA ID: 220687, HI RA: 12:11:12.0, HI Dec: +01:28:23
 GAMA RA: 12:11:19.9, GAMA Dec: 1:29:33.0, Separation: 0:2:17.6

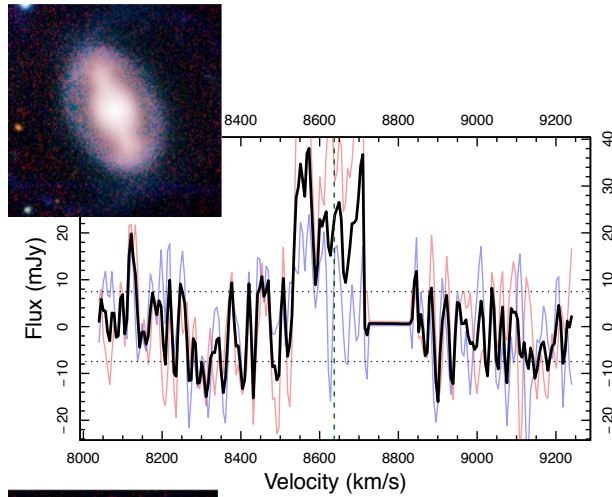


HIPASS zero-moment map

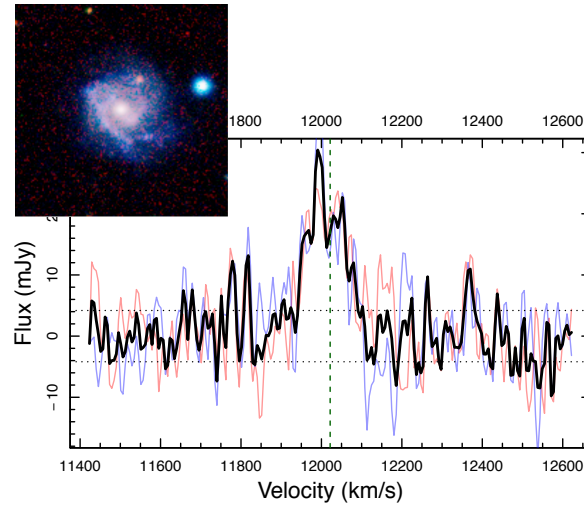
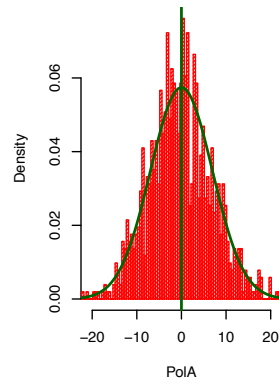


GAMA image

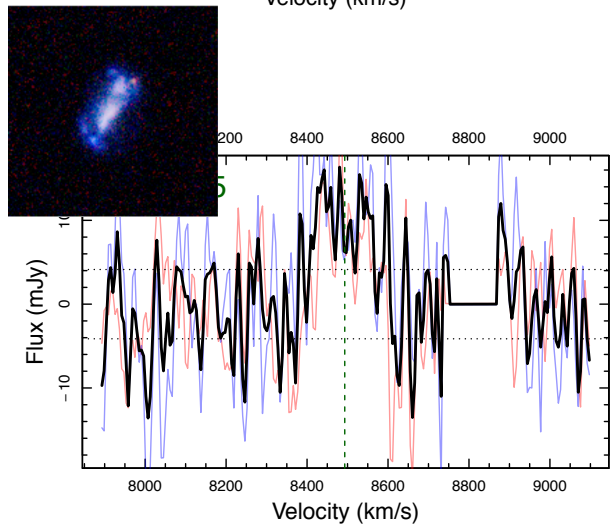
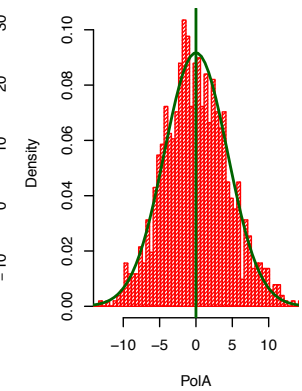




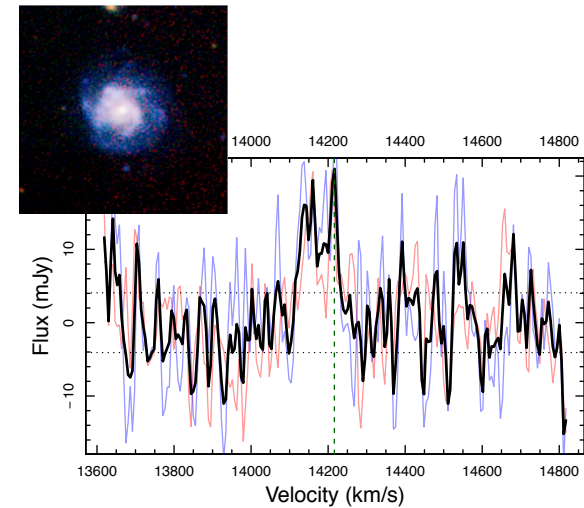
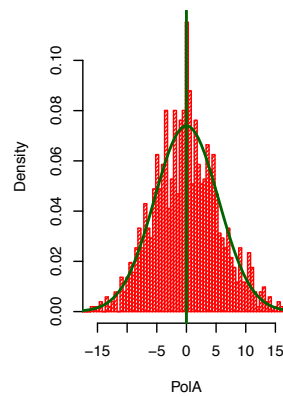
Histogram of Pixel Values in PoI



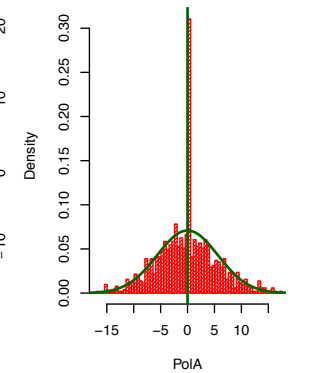
Histogram of Pixel Values in PoI

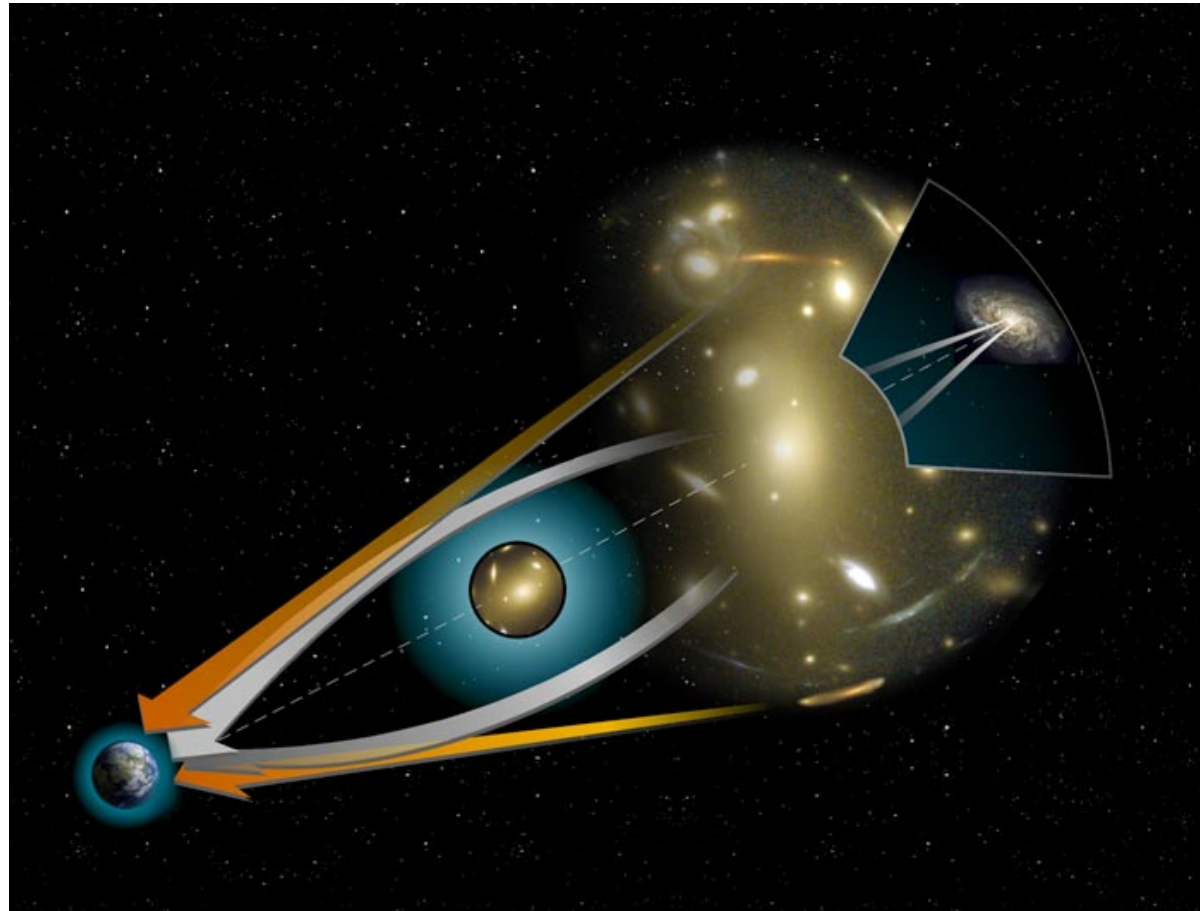


Histogram of Pixel Values in PoI



Histogram of Pixel Values in PoI





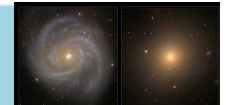
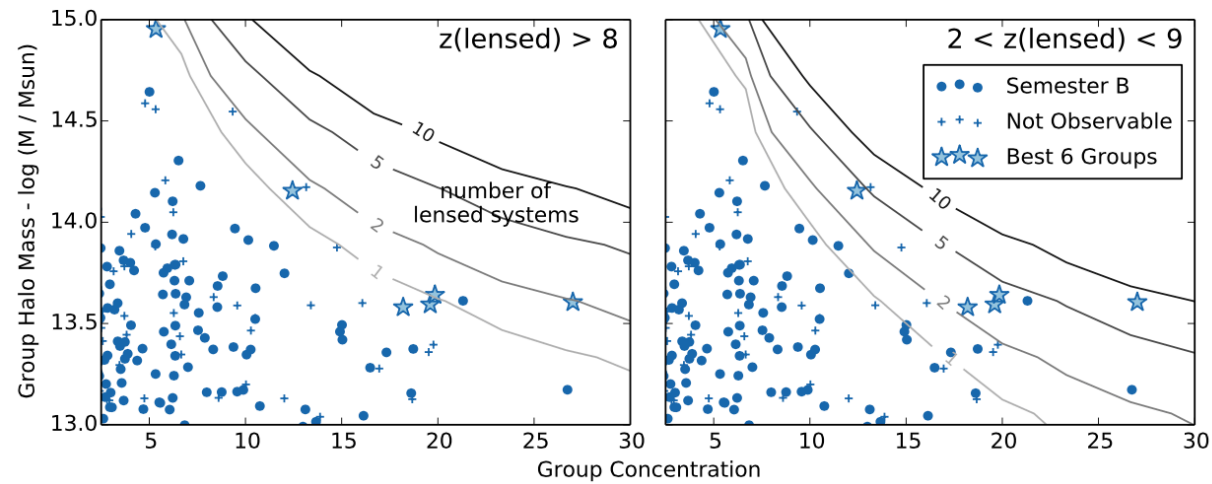
$z \sim 0.7$ compact groups are the best foreground lenses to probe the $z > 10-12$ Universe



$z > 8$ with GAMA groups

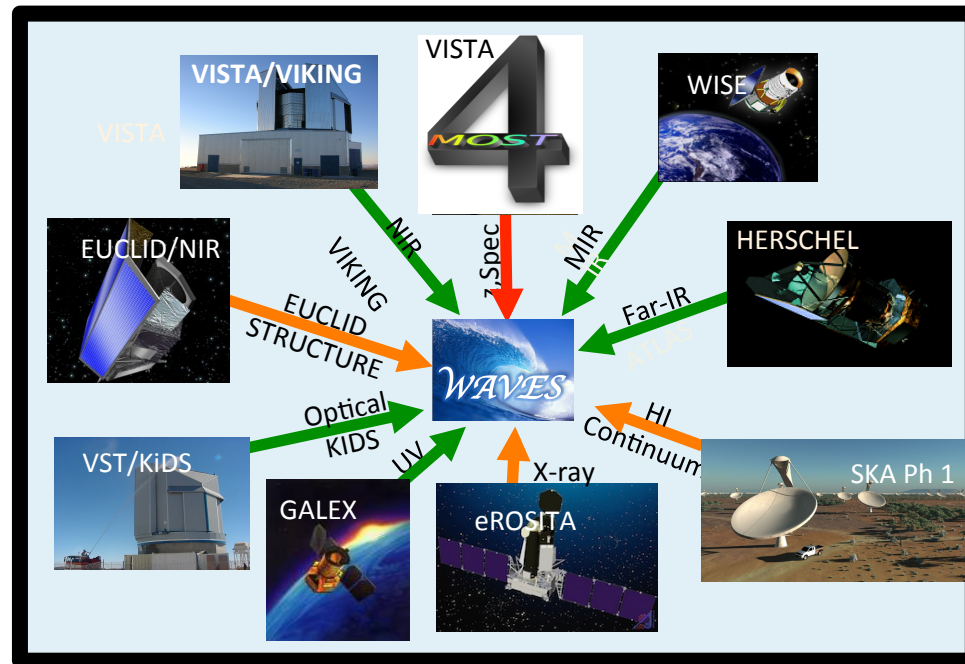


Lensing capability of GAMA groups

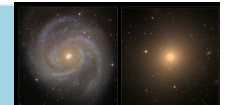


WAVES: Wide Area VISTA Extragalactic Survey

4MOST = 3000 spine R~5000 spectrograph for VISTA capable of probing to $r < 22$ mag



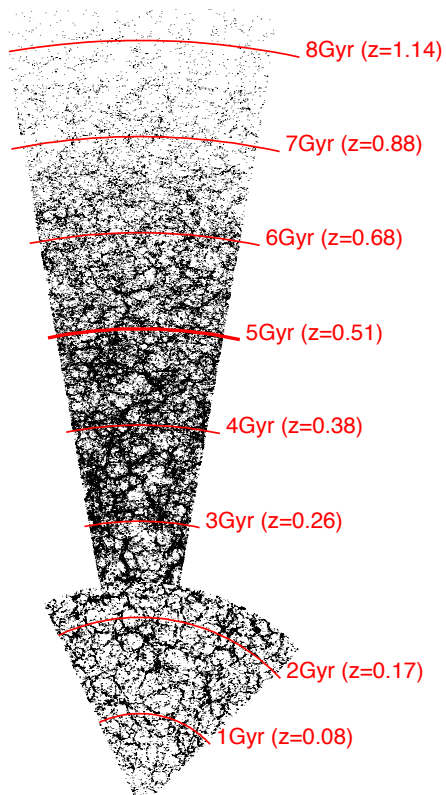
- Testing CDM v WDM v SIDM
- Study of energy and mass on 1kpc to 100Mpc scales (i.e., sub-BAO)
- Creating two legacy surveys with 4MOST spectra + Euclid res imaging + SKA Phase I



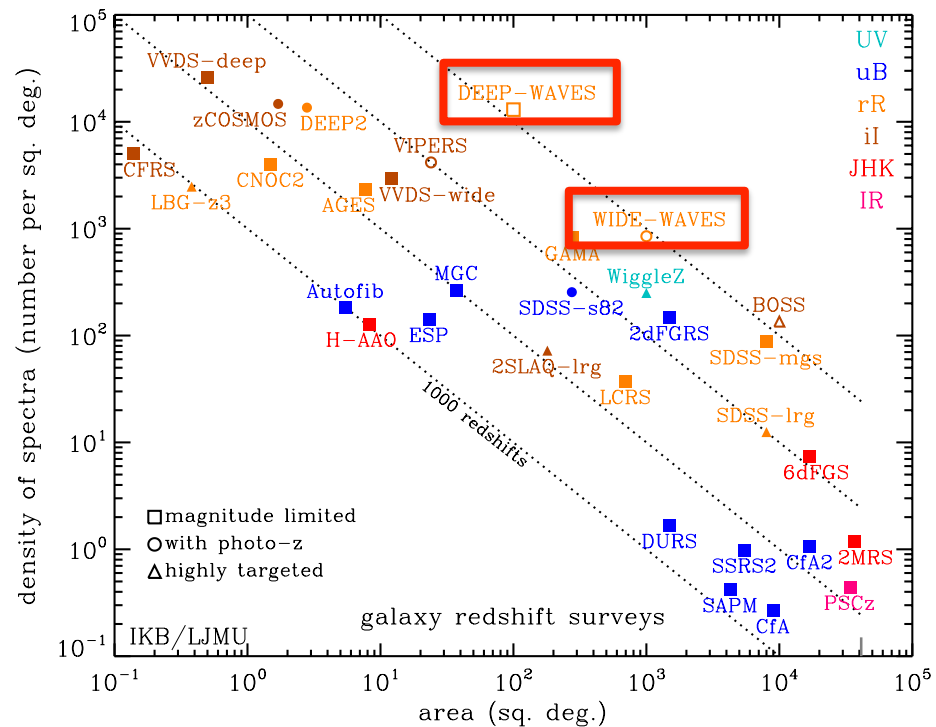
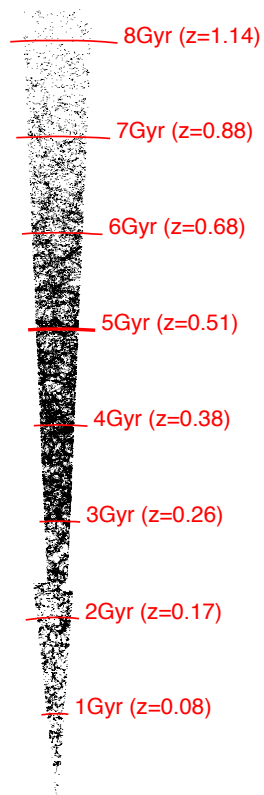
WAVES in context



DEEP-WIDE-WAVES
(0.5° Dec slice in RA)



DEEP-WIDE-WAVES
(0.5° RA slice in Dec)



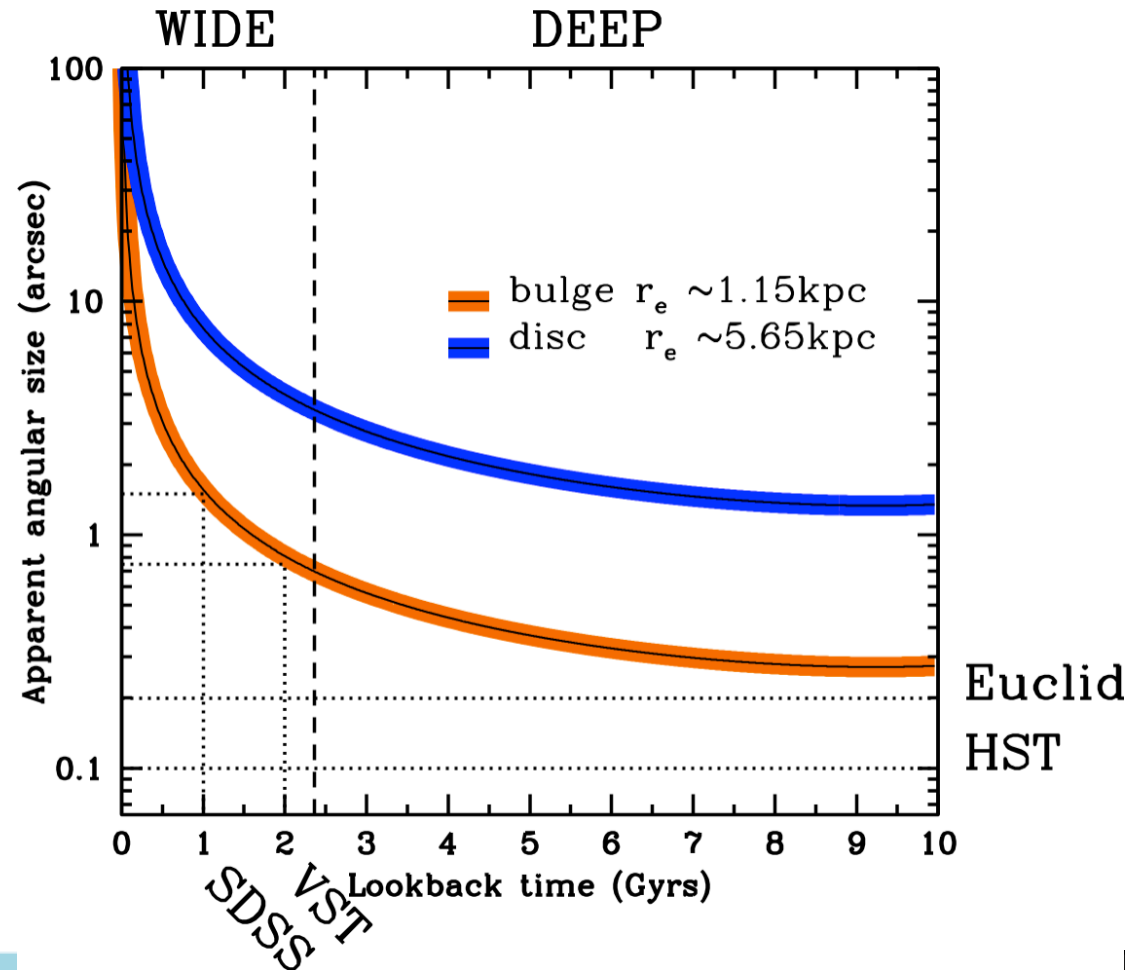
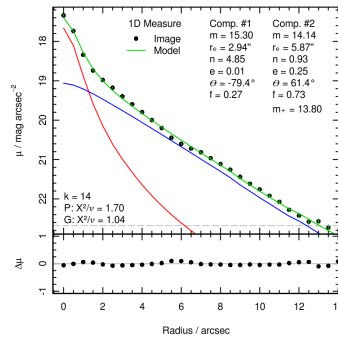
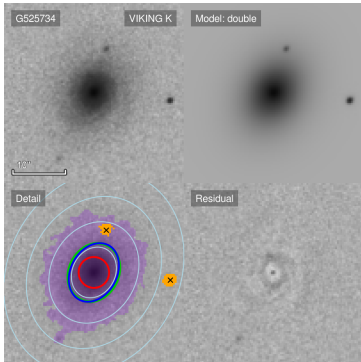
DEEP: Bridge the $z=0.2$ to 1.0 gap: 1.2 million galaxies, 50,000 groups, 5,000 filaments

WIDE: Survey the dwarf domain: 0.8 million galaxies, 50,000 low mass groups, 5,000 filaments





Synergy: Euclid



Cannot resolve structure from ground beyond $z \sim 0.2$ for wide areas

HST field-of-view too small

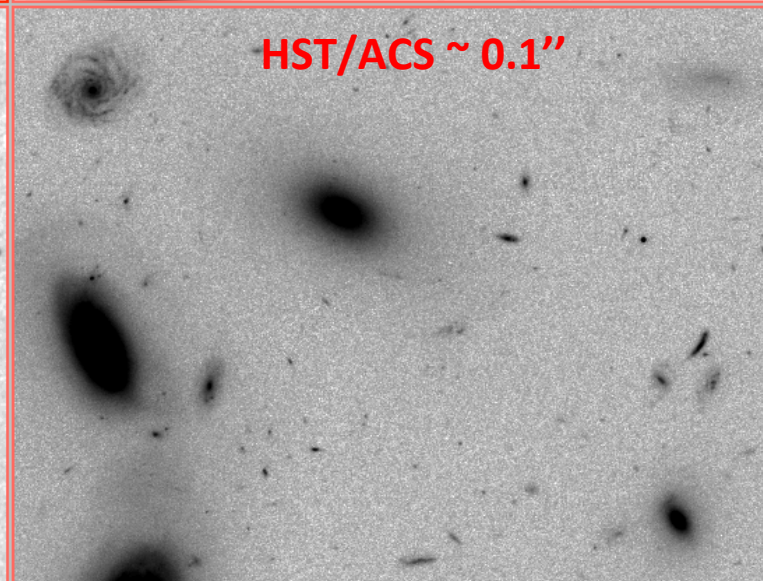
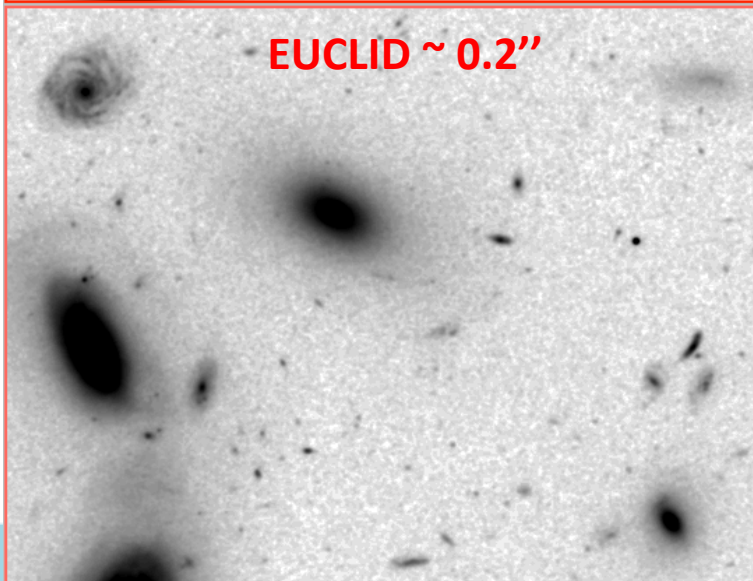
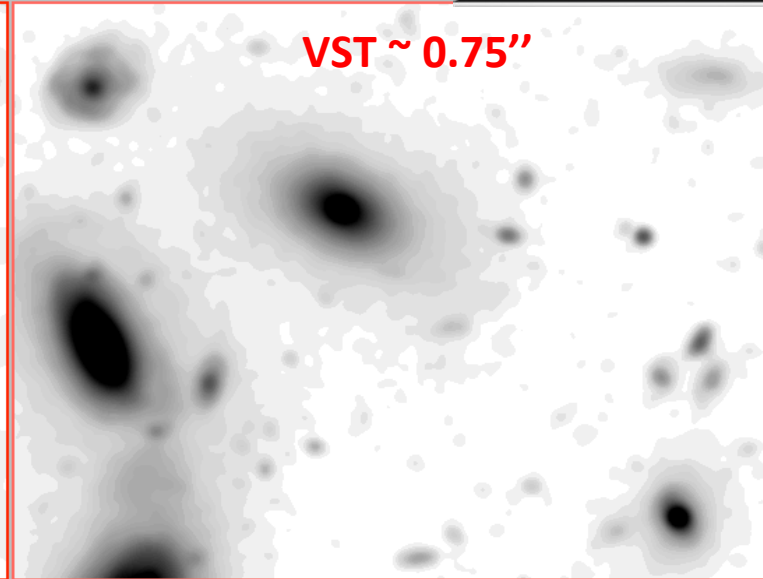
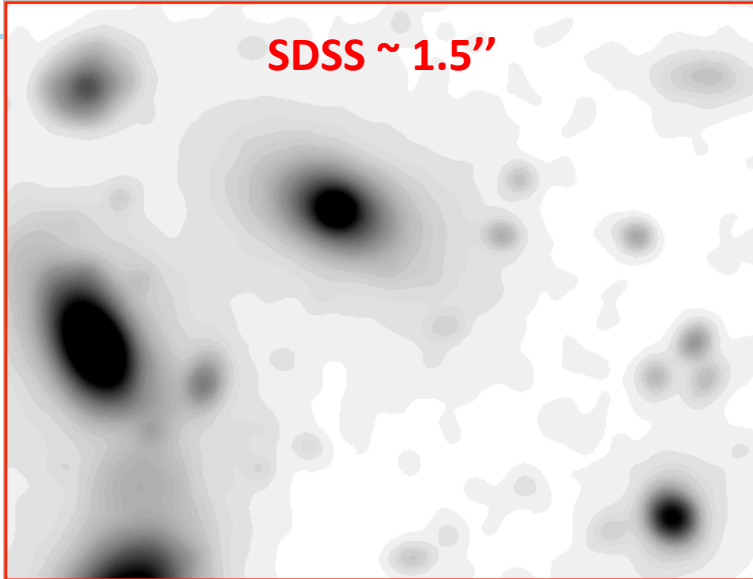
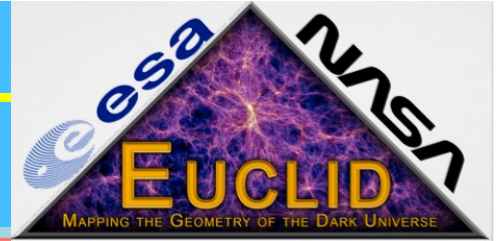
Euclid capable of 0.2" with VIScam

Can resolve bulges to any z



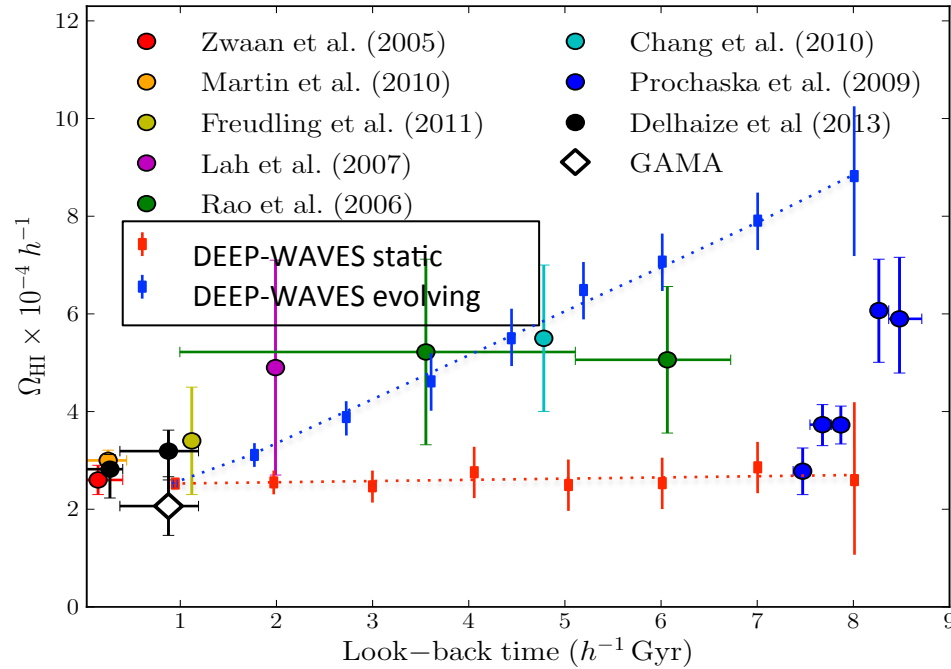


Synergy: Euclid v HST v VST





Synergy with SKA Phase I



A deep 100 sq deg SKA1 survey:

- HI detections of massive systems
 - HI masses
 - HI dynamics
- Optically motivated source finding
 - Expand sample x3
- HI stacking using WAVES selection
 - galaxy type
 - halo mass
 - SFR
- Continuum
 - SFR estimates



A wide 750 sq deg SKA1 survey

- As above by shallower
- Similar to WALLABY & DINGO but to $z \sim 1$

