

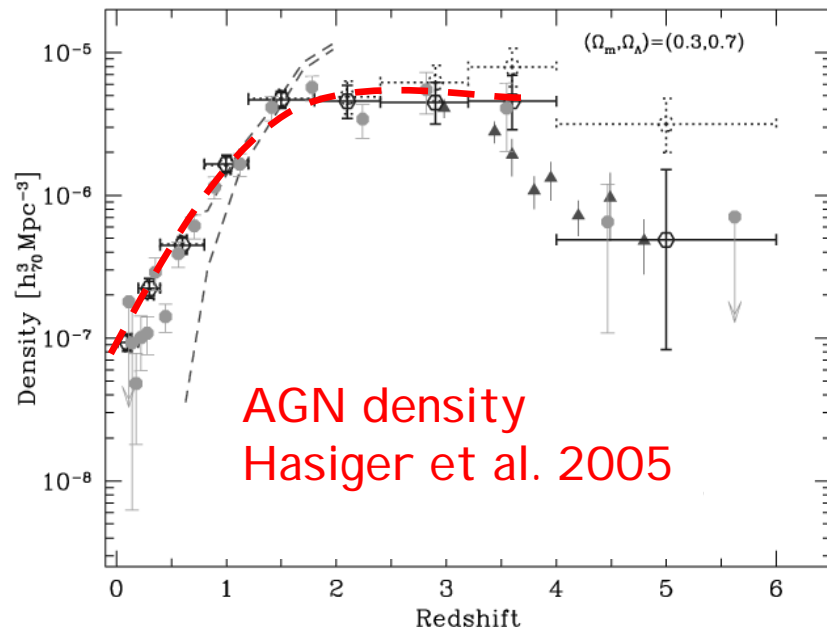
An X-ray survey of low redshift AGN



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The physics of AGN evolution



- Rapid decline since $z \sim 1$
- What is the physical process driving this evolution?
 - Smaller BHs at lower redshift
 - Decreasing accretion rate
 - Decline of gaseous mergers
 - Different accretion modes at different epochs (e.g. QSO mode, Seyfert mode, radio mode)

The physics of AGN evolution

Seyfert mode (Hopkins & Hernquist 2006)



- Cold gas accretion (no mergers)
- Small BHs, high \dot{M}
- Low mass spiral galaxies
- young stars
- low galaxy density regions

Radio mode (Croton et al. 2006)



- Hot gas accretion (no mergers)
- Massive BHs, low \dot{M}
- Massive elliptical galaxies
- evolved stars
- high galaxy density regions



QSO mode: Major mergers

- On-going interactions
- Merger remnants
- Moderate galaxy density regions

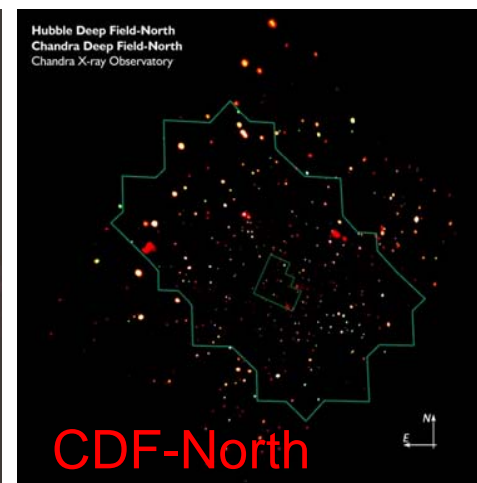
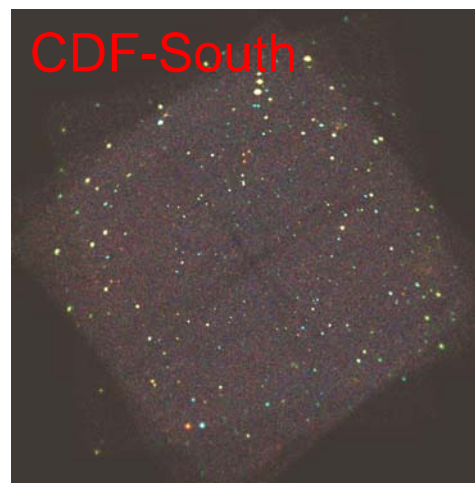
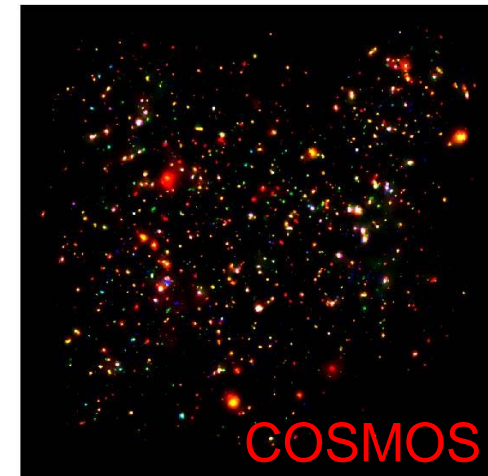
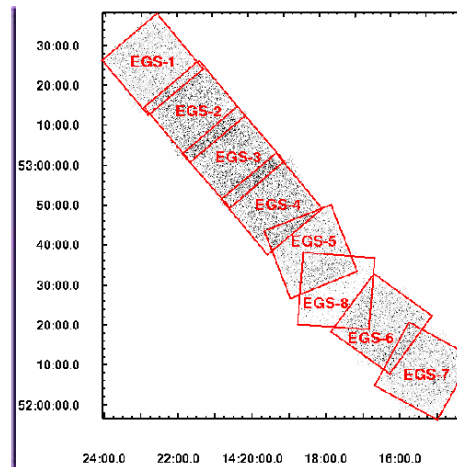
Low Redshift

$z \sim 1$

High Redshift

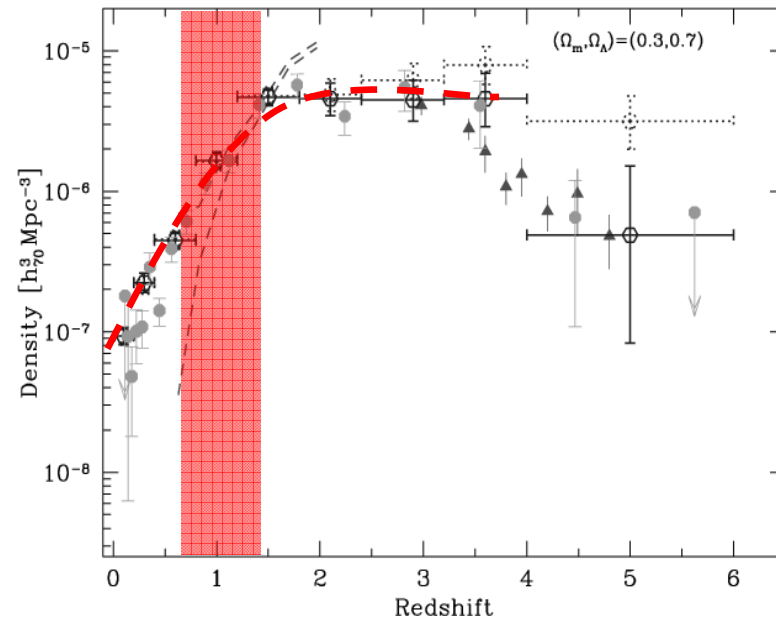
Multi-wavelength surveys at $z \sim 1$

- X-Boötes, AEGIS, COSMOS, CDFs:
 - ✓ Chandra/XMM X-ray
 - ✓ Optical/near-IR
 - ✓ HST (morphology)
 - ✓ Spitzer mid/far-IR
 - ✓ Sub-mm
 - ✓ Radio (1.4GHz)



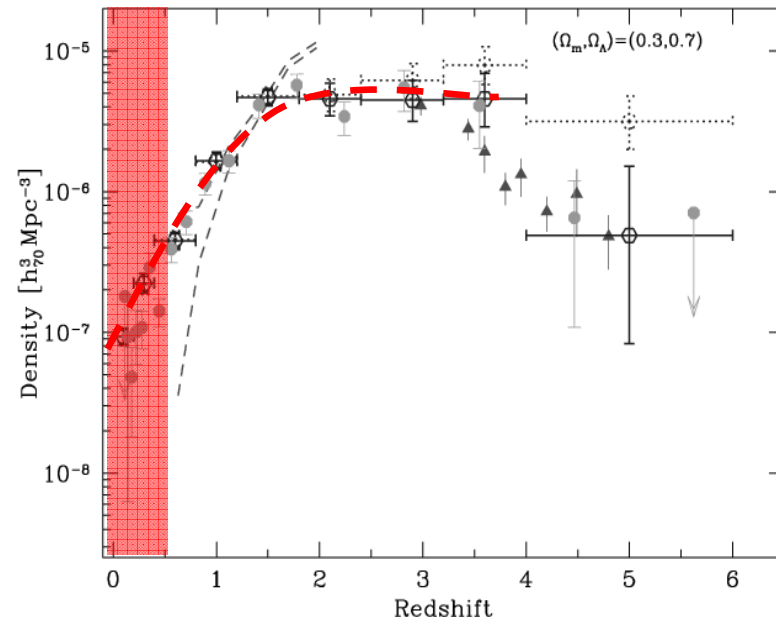
AGN host galaxy properties at $z \sim 1$

- Environments: groups
- Stellar populations: evolved stars or post-starbursts
- Stellar Mass: massive
- Morphology: early-types



AGN host galaxy properties at $z < 0.5$

- Environments: ?
- Stellar populations: ?
- Stellar Mass: ?
- Morphology: ?



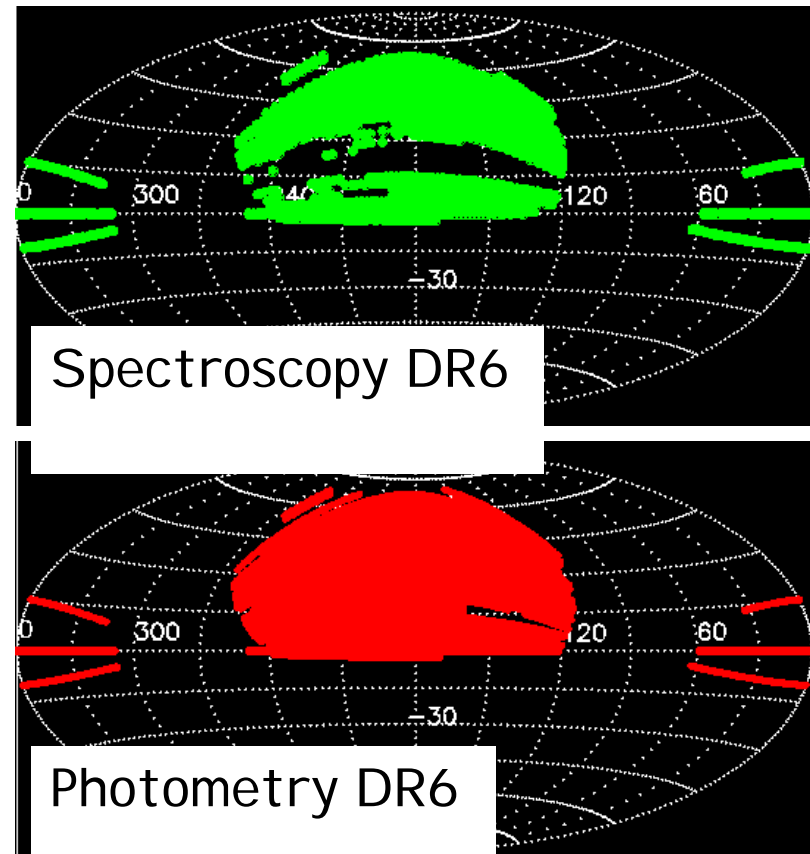
X-ray Survey of AGN at low redshift

- Multi-wavelength data available
- Sample selection function similar to AGN surveys at $z \sim 1$
 - Similar co-moving volume (area)
 - Similar part of the AGN X-ray Luminosity Function (depth)

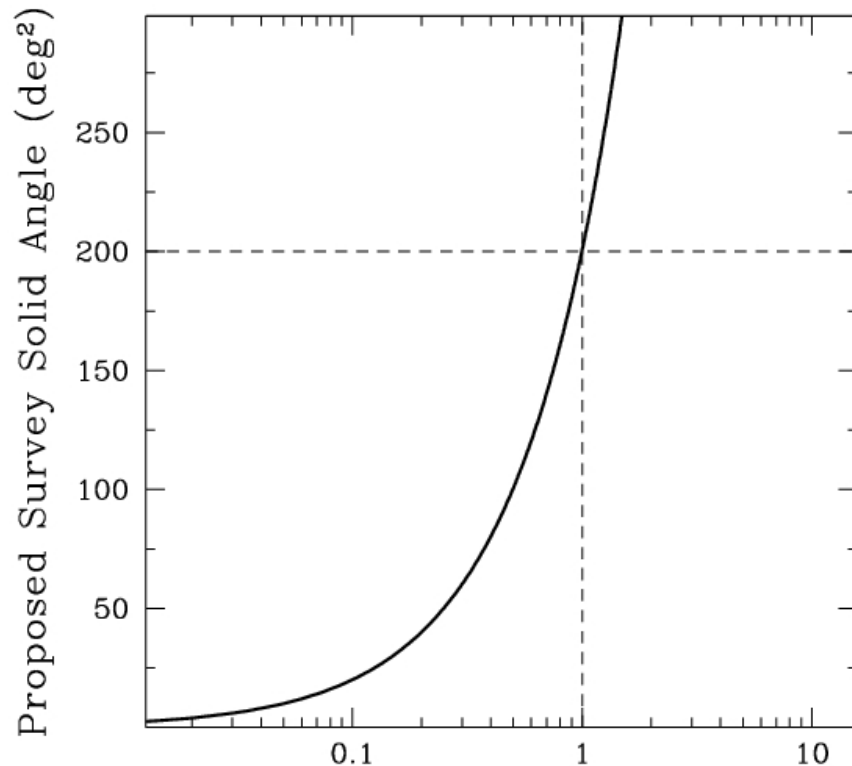
Region of the proposed survey

Sloan Digital Sky Survey

- DR6: 9500deg²
 - Optical photometry ($r \sim 22.5$)
 - Spectroscopy ($r < 17.7, z \sim 0.1$)
- Multi-wavelength data
 - FIRST (1.4GHz)
 - UKIDSS (YJHK)
 - AKARI (1.7-180 μm)
 - Herschel (100-500 μm)



Solid angle of the proposed survey: 200deg²

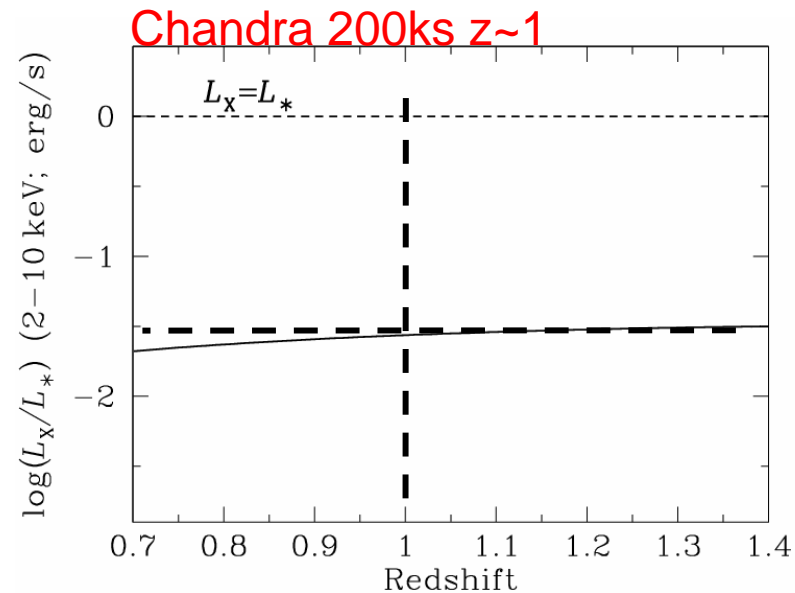
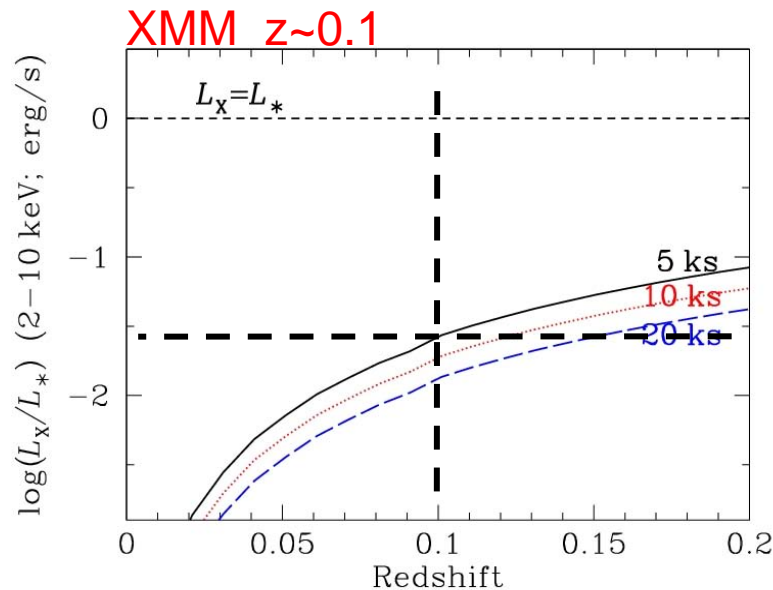


- SDSS main spectroscopic sample extends to $z \sim 0.2$
- Same volume as deep *Chandra* surveys at $0.7 < z < 1.4$ (i.e. CDF + AEGIS + COSMOS + ECDFS)

200deg² XMM survey

$\frac{\text{Comoving Volume of proposed XMM survey at } z < 0.2}{\text{Comoving Volume of deep Chandra surveys at } 0.7 < z < 1.4}$

Depth of the proposed survey: 5ks/pointing

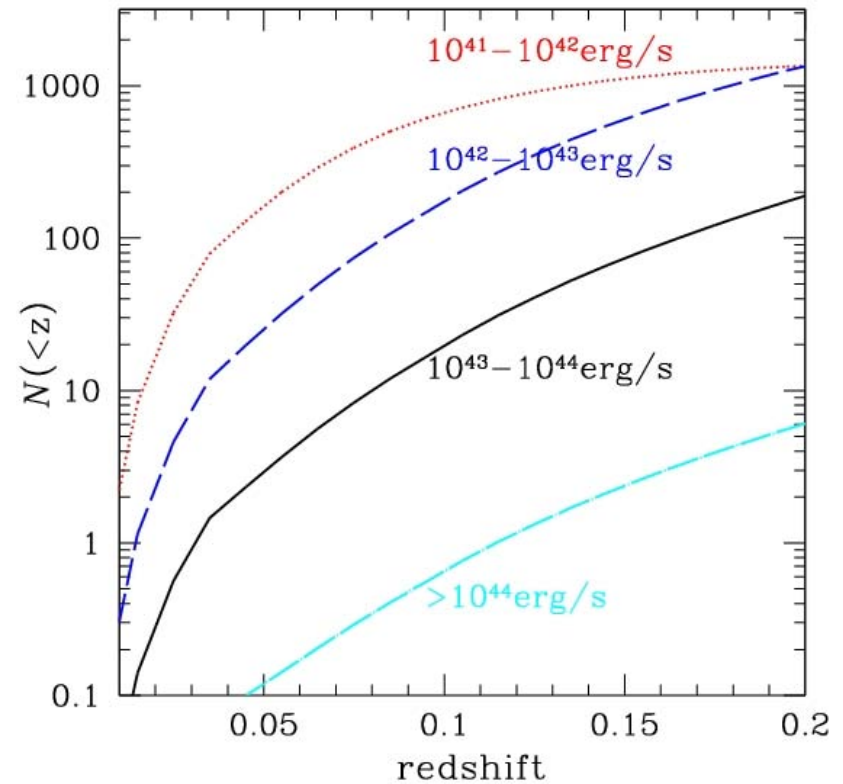


A 5ks XMM-Newton survey probes:

- $\delta \log L \approx 1.5$ fainter than L_*
- the same part of the XLF as deep (~ 200 ks) *Chandra* surveys at $z \sim 1$

Number of $z < 0.2$ AGN in the proposed survey

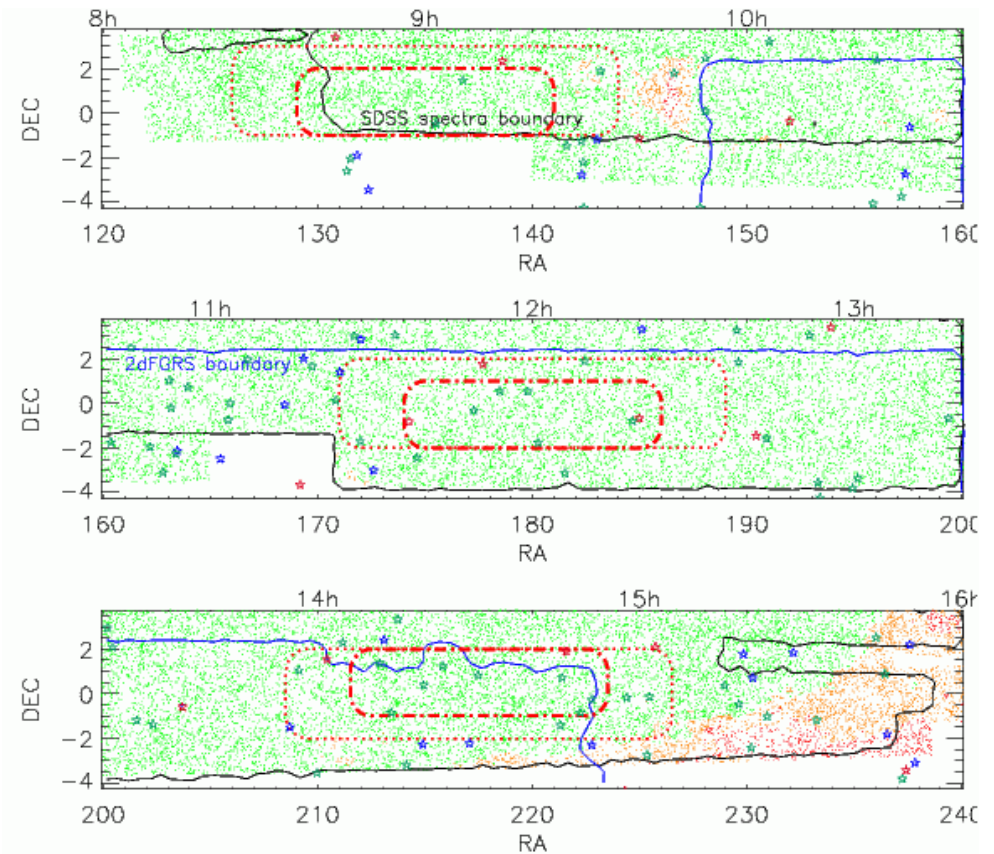
- $L_x = 10^{41} - 10^{42}$ erg/s:
~1300 sources
- $L_x = 10^{42} - 10^{43}$ erg/s:
~1300 sources
- $L_x = 10^{43} - 10^{44}$ erg/s:
~200 sources



Galaxy And Mass Assembly (GAMA) survey

GAMA: 200deg²

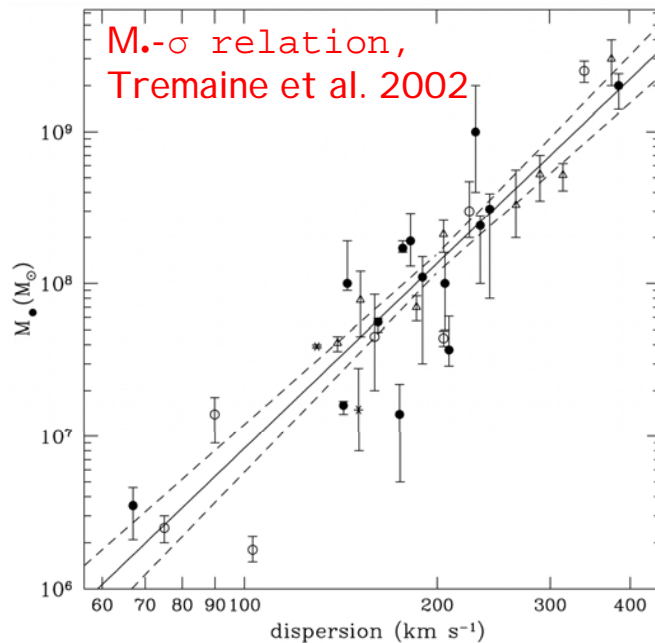
- SDSS ($r \sim 22$)
- Spectroscopy to $r \sim 19.8$;
i.e. $M_{*} + 1$ at $z = 0.2$
- VIKING ($K_{AB} \sim 21$)
- KIDS ($r \sim 25$)
- Herschel-ATLAS
(100-500 μm)



Summary

- We know more about the X-ray Universe at $z \sim 1$ than locally
- Need for a low redshift X-ray AGN survey to complement high- z samples
- Properties AGN hosts: information on the physical conditions of SBH accretion
- XMM: 200deg^2 , 5ks/pointing
 - SDSS+GAMA

The physics of AGN evolution



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Properties of AGN hosts:
information on the physics
driving AGN evolution

Environment of AGN at $z \sim 1$: Groups

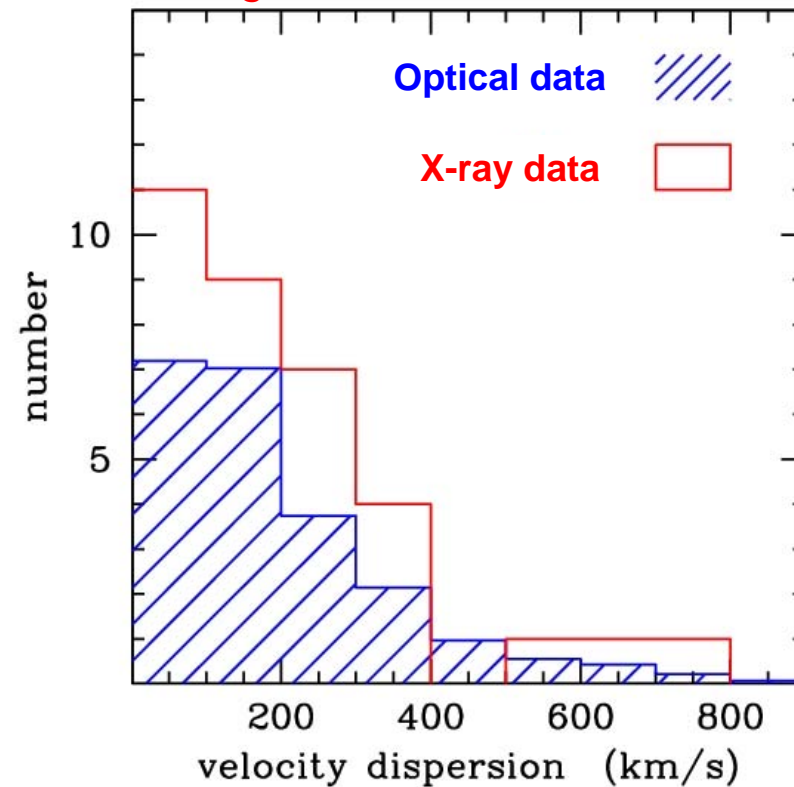
AEGIS group catalogue (Gerke et al. 2005)



40% of AGN in groups

See also: Miyaji et al. 2007;
Silverman et al. 2008

Georgakakis et al. submitted

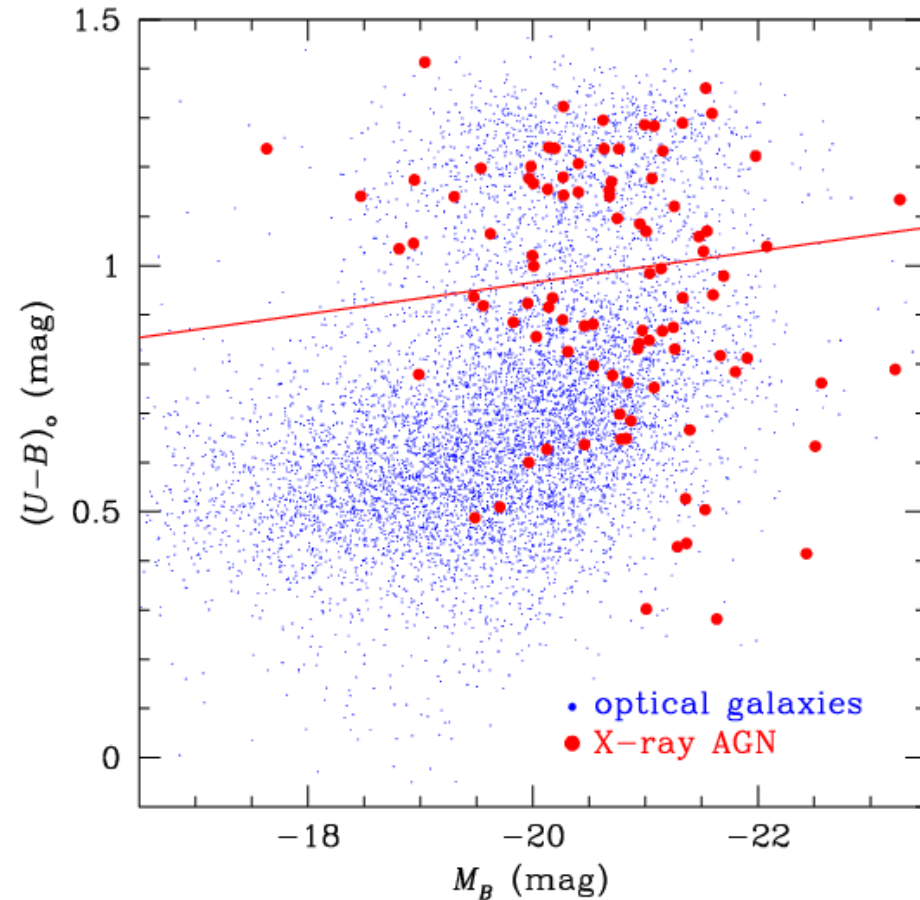


AGN hosts at $z \sim 1$: evolved galaxies

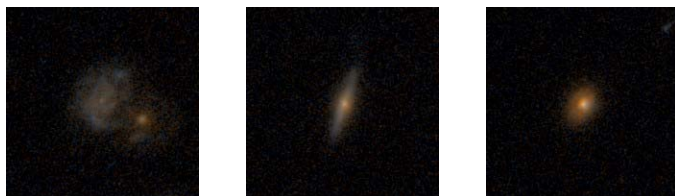
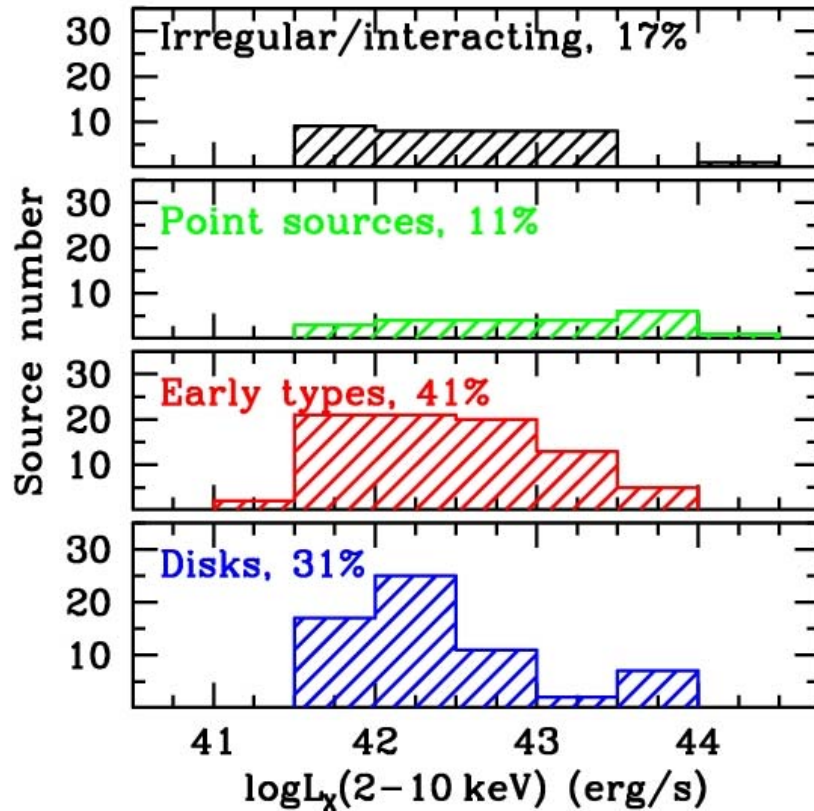
- Highest density of AGN
 - Red cloud
 - Transition region
- Red colours: evolved stars

See also: Silverman et al. 2008; Rovilos et al. 2007

Nandra et al. 2007; Georgakakis et al. 2008

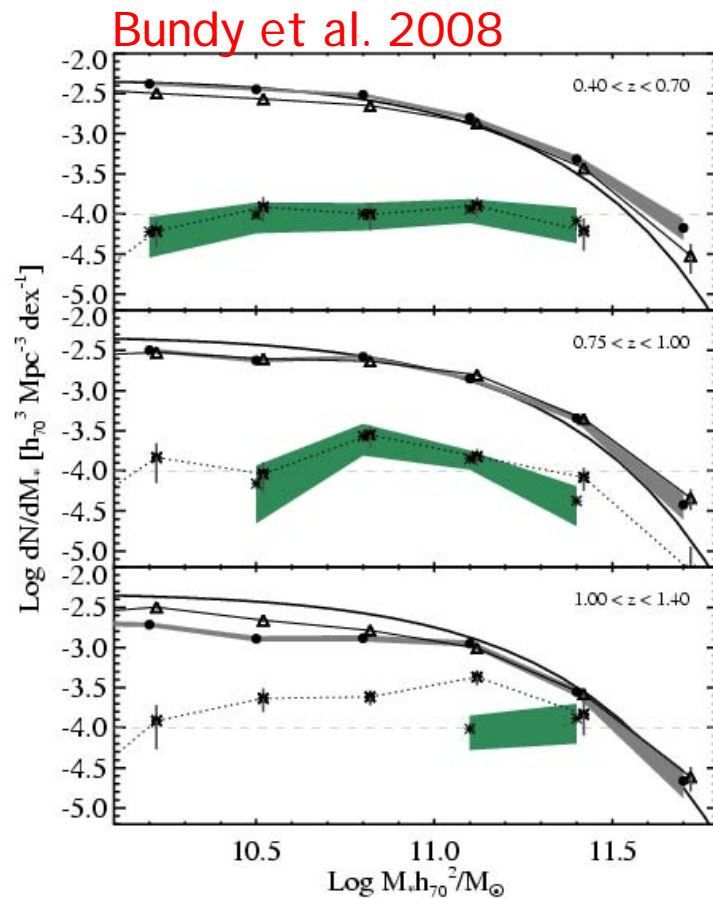


Morphology of AGN hosts at $z \sim 1$



- CDFs+AEGIS
 $0.7 < z < 1.3$
- Bulges dominate
(merger remnants?)
- Spirals 2nd largest group
- Ongoing interactions minority

AGN stellar mass function at $z \sim 1$



- AGN stellar mass function:
 - flat
 - Marginal evolution
- Consistent with evolution of \dot{M} rather than M_{BH}