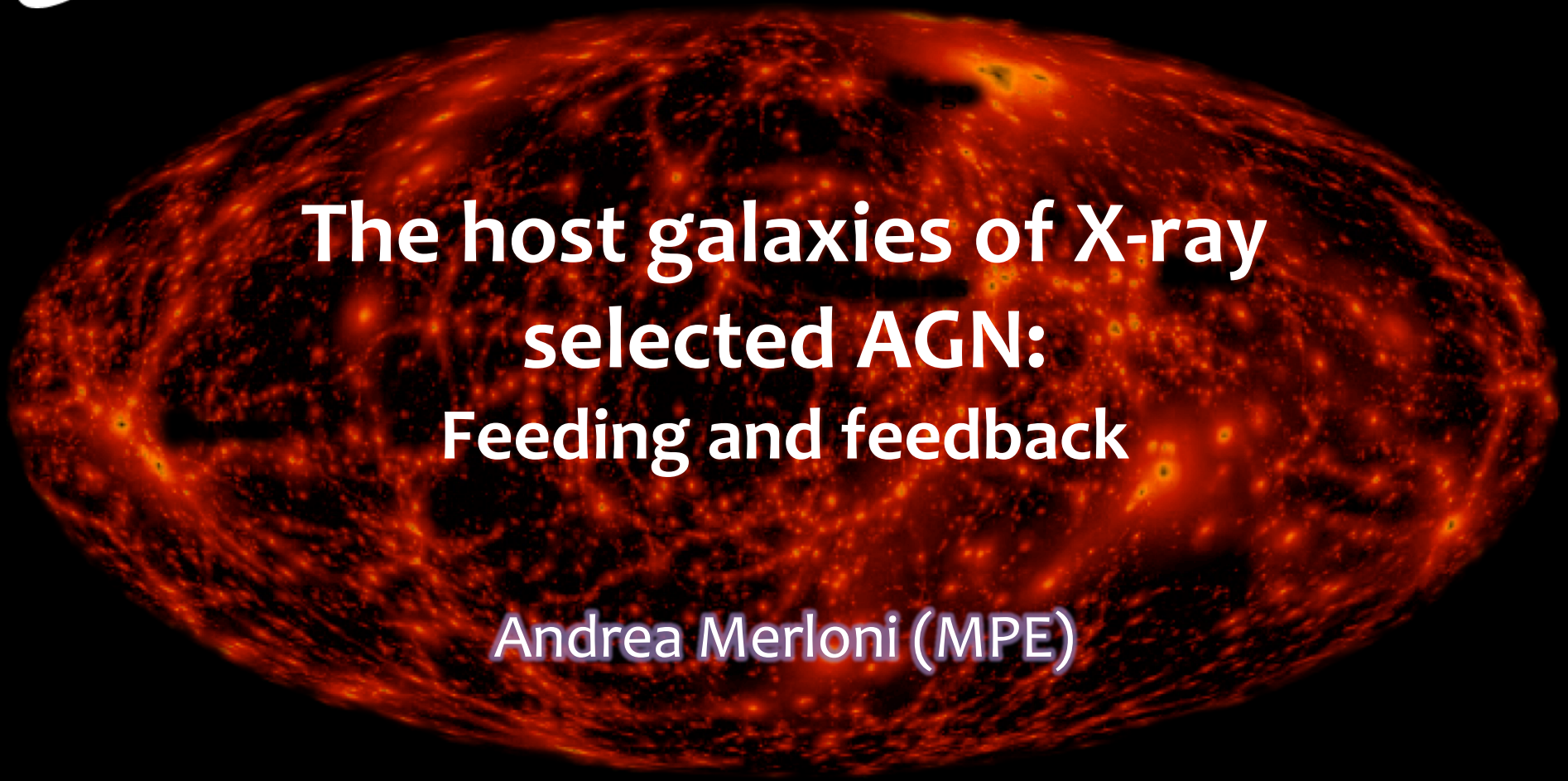
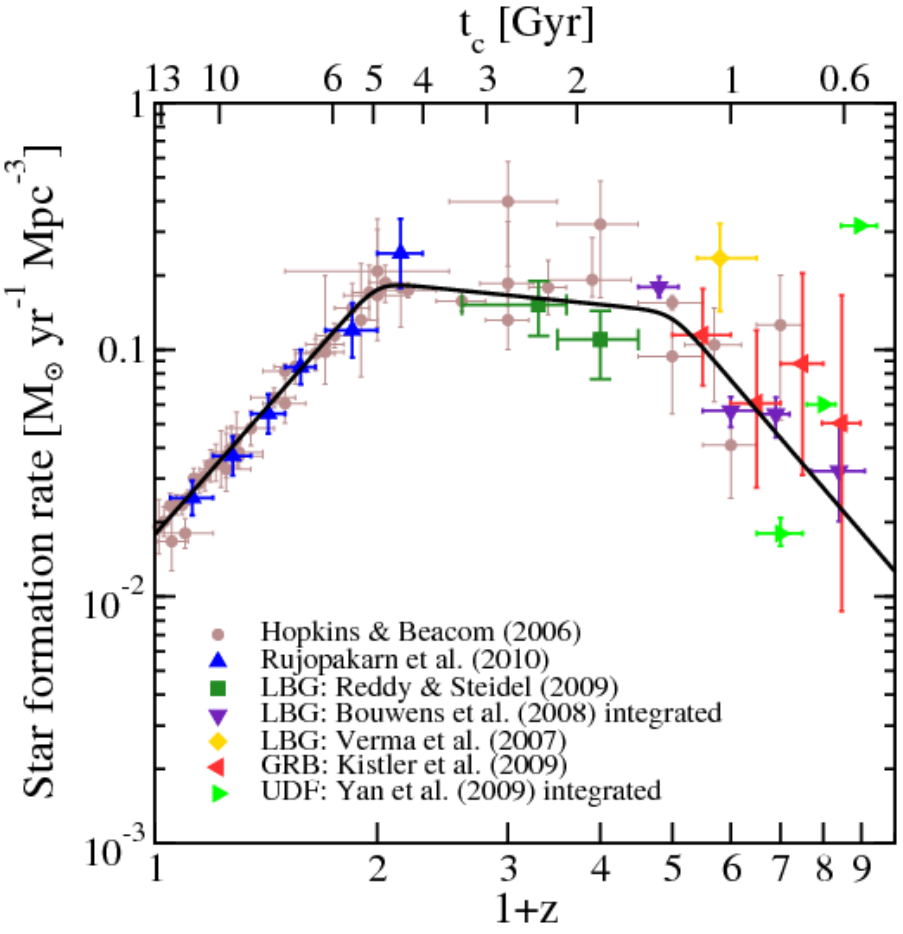
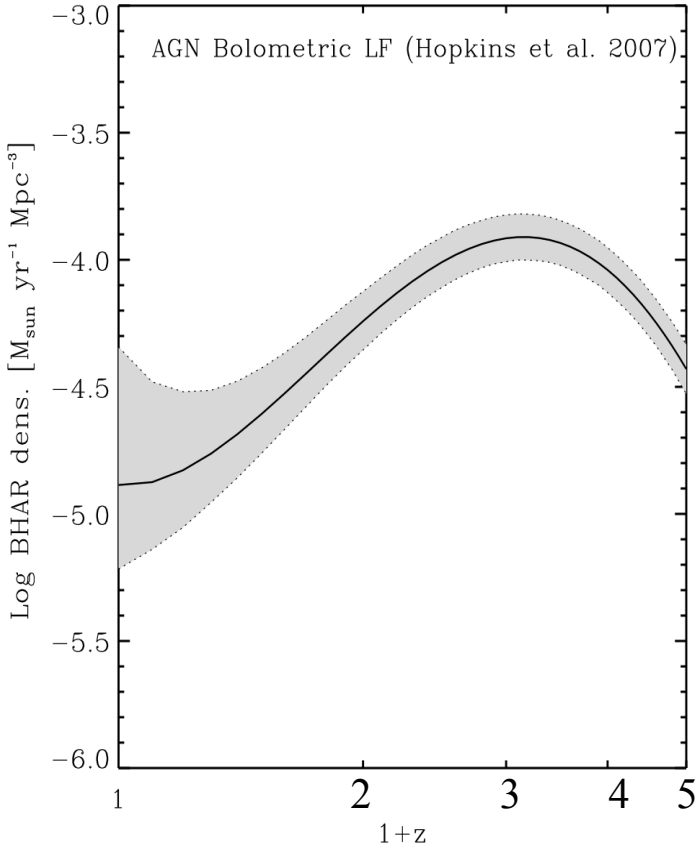


The host galaxies of X-ray selected AGN: Feeding and feedback

Andrea Merloni (MPE)

Feeding vs feedback

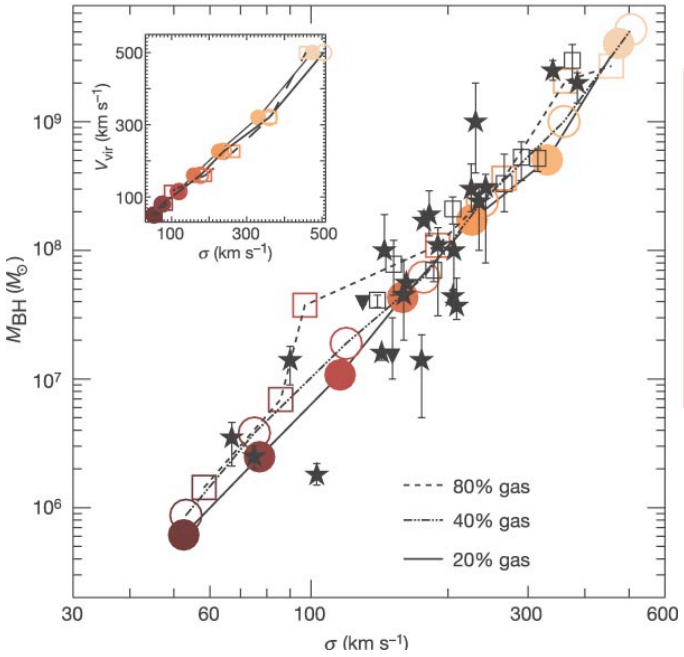




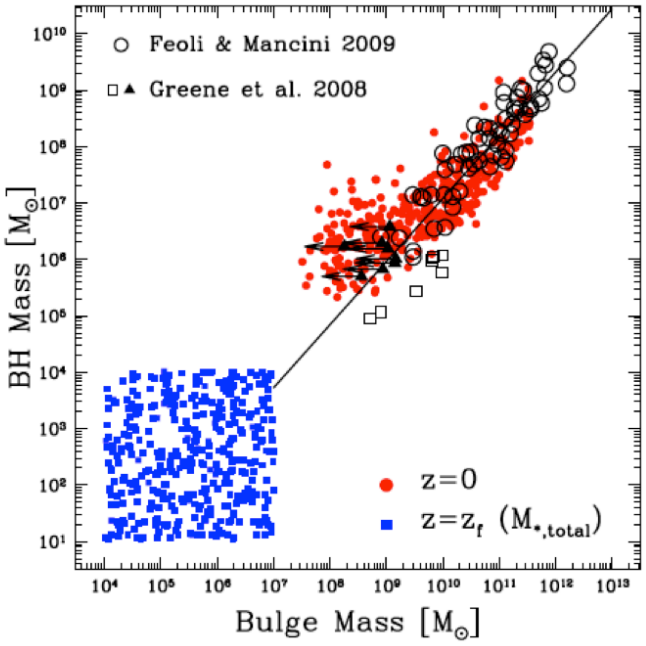
See also Aird+2010; Delvecchio +2014; Ueda+2014; Buchner+2014

Do AGN evolve following gas consumption/SF in galaxies or do galaxies evolve under the strong influence of AGN feedback?

Feedback vs. stochastic



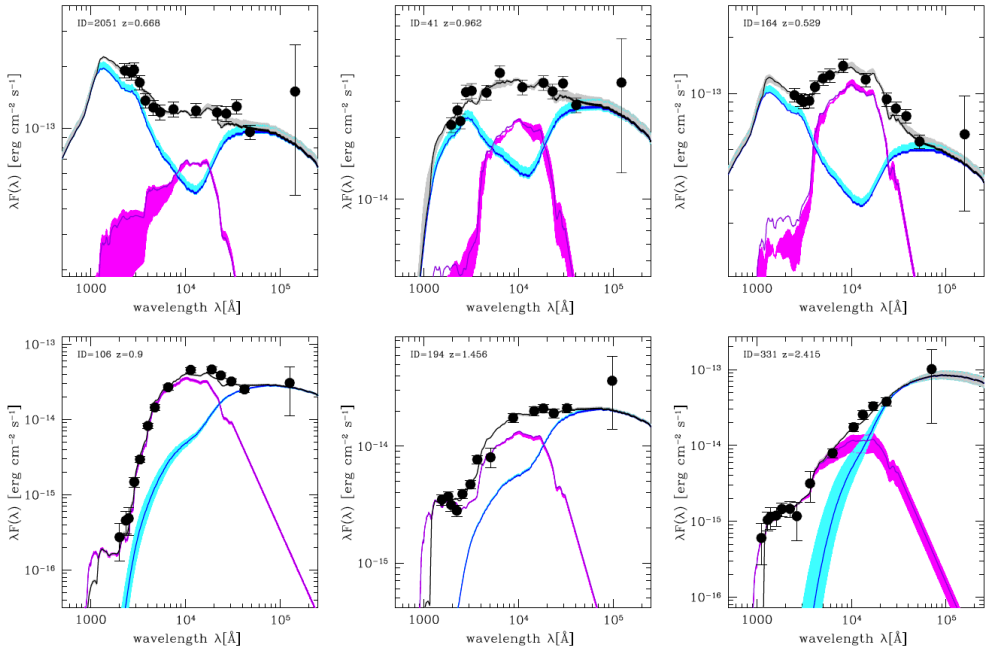
To reproduce M-σ relation, do we need AGN feedback to stop its own growth or host's star formation?
[Di Matteo+2005; King2005; Hopkins+2009]



Do M_{BH}-M_{galaxy} relation arise from the stochastic nature of the merging process?
[Jahnke and Maccio' 2010]

XMM-COSMOS AGN

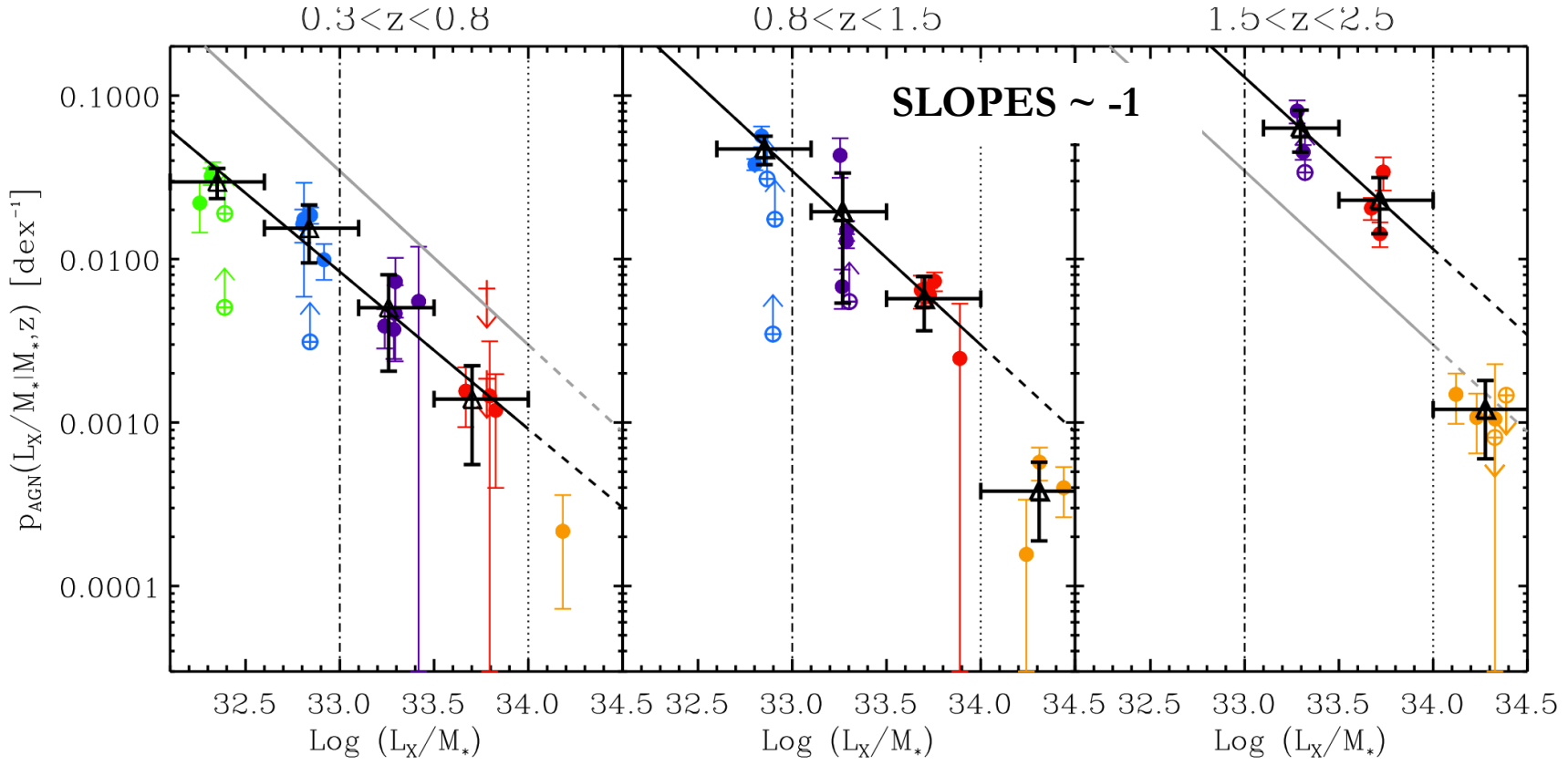
- 1555 X-ray selected AGN (XMM; f_{lim}~ **5×10^{-16}**[0.5-2]; **3×10^{-15}**[2-10])
- **100% redshift complete** (54% specz; 46% photoz)
- 602 Unobscured (71% specz); 953 Obscured (42% specz)
- **Parent sample** ~200k IRAC galaxies (photoz, M_*; Ilbert et al. 2010)



- Uniquely rich multi-wavelength photometry used to **decompose AGN and host galaxy light** in SED fitting

Bongiorno et al. 2012; Brusa+ 2010; Salvato+ 2009; Lusso+ 2011, 2012; Merloni+ 2014

Specific accretion rate distributions

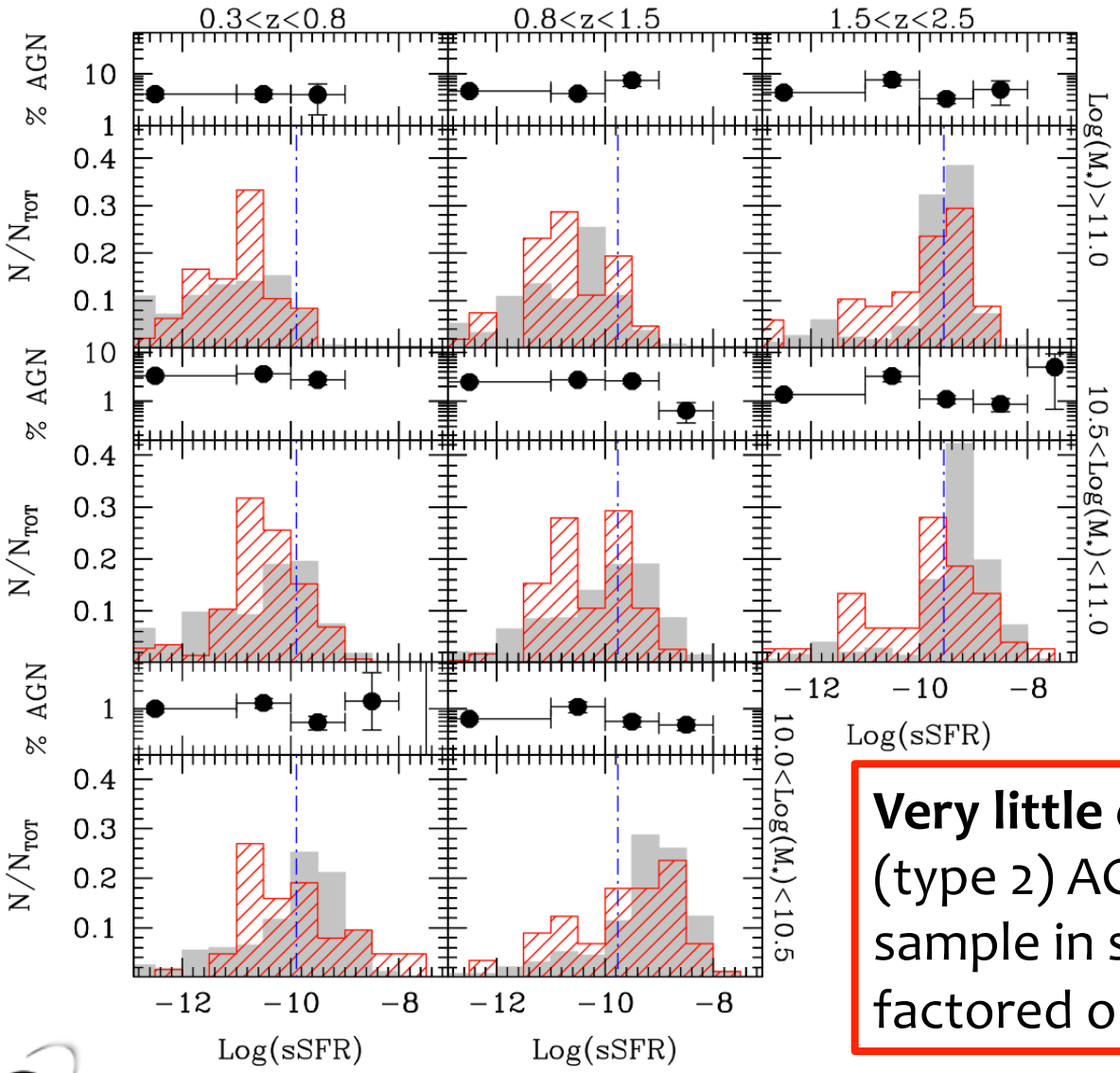


Bongiorno et al. 2012

"Specific Accretion rate" (Aird et al. 2012, 2013)

AGN fraction at fixed L/M ~independent on galaxy mass!
Its normalization increases as **~(1+z)^4** [cfr. sSFR density]
There appears to be a break consistent with **~Eddington limit**

Elusive feedback

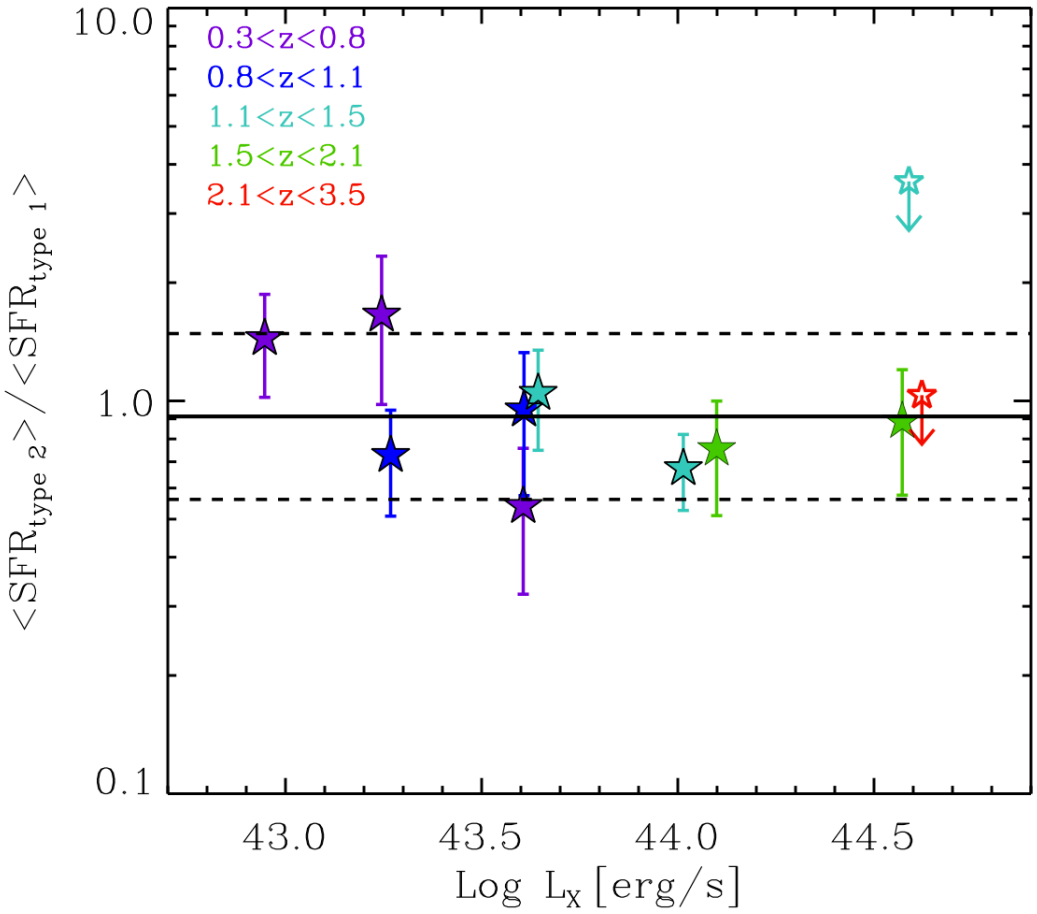


- From **complete** XMM-COSMOS AGN sample (~1600 sources)
- **Optimal SED sampling** -> stellar masses and SFR

Bongiorno et al. 2012

Very little difference between (type 2) AGN hosts and parent sample in sSFR (once z and M_* factored out)

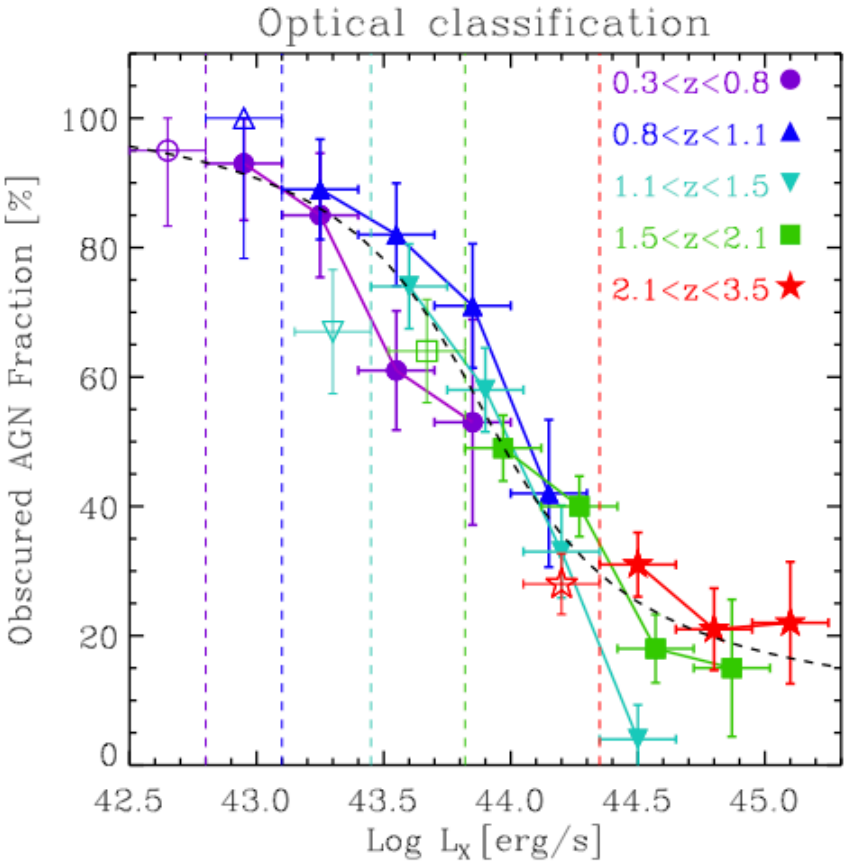
No link of AGN obscuration with SFR

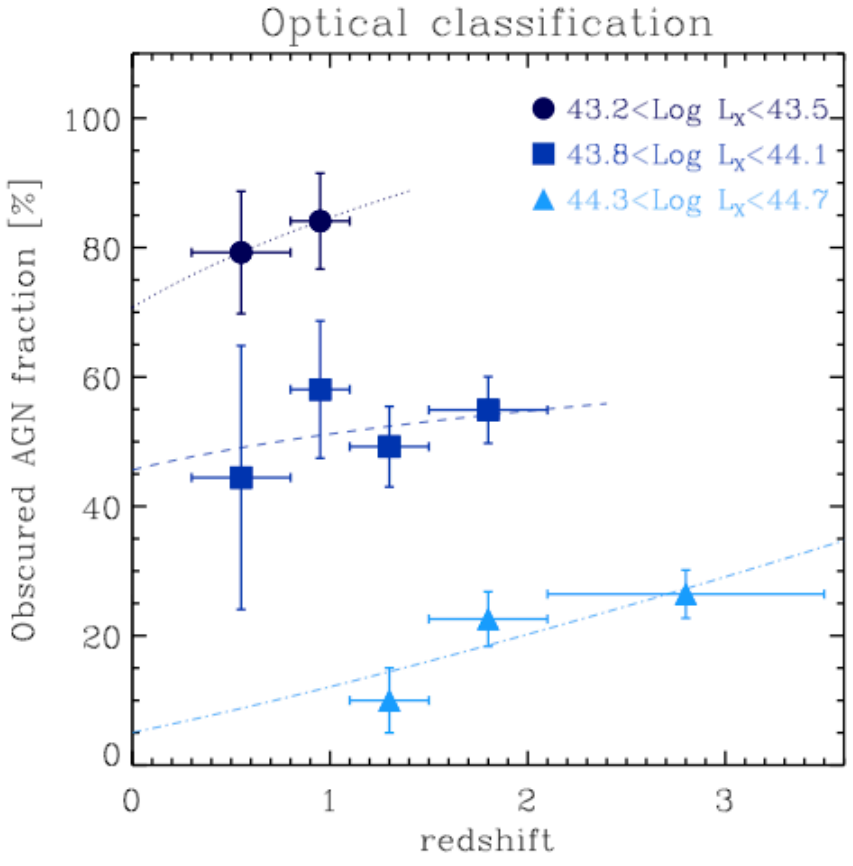


Merloni et al. 2014

The Galaxy-wide SFR of AGN hosts does not correlate with the properties of the obscuring medium

Optical Obscuration



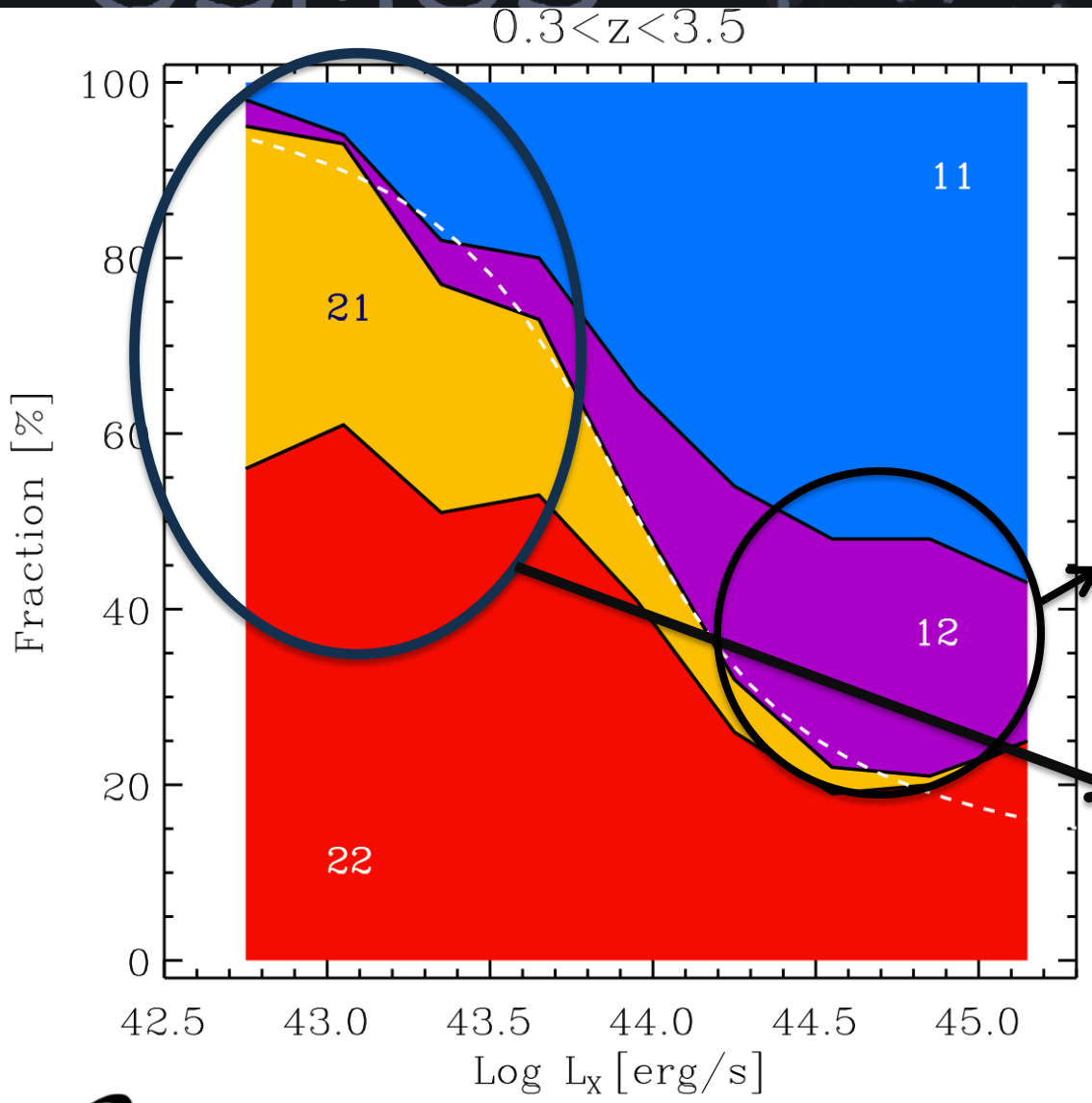


Merloni et al. 2014

The fraction of Optically obscured AGN depends on the nuclear luminosity, and on redshift only for the most luminous

Ueda+'03; Simpson'05; Maioliono'07; Ueda+2014

X-ray vs. Optical obscuration



Merloni et al. 2014

Blue: X-ray & Optical type 1
Red: X-ray & Optical type 2
Yellow: X-ray type1, no BL
Purple: BLAGN,
X-ray obscured

X-ray absorber within, or inside BLR (Winds, QSO feedback)

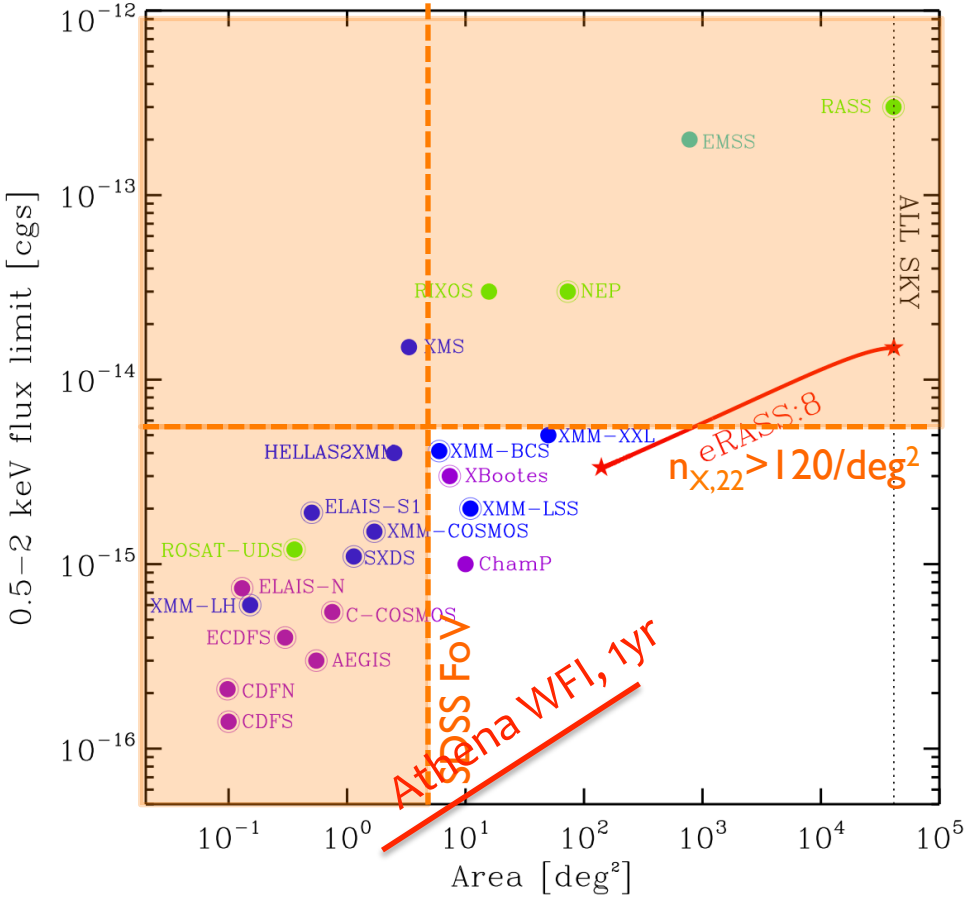
Naked type 2 and/or BL diluted by galaxy light

High-z evolution?
LaFranca+2005; Hasinger2008; Vio+2013; Ueda+2014; Buchne+2014

AGN hosts in XMM-COSMOS

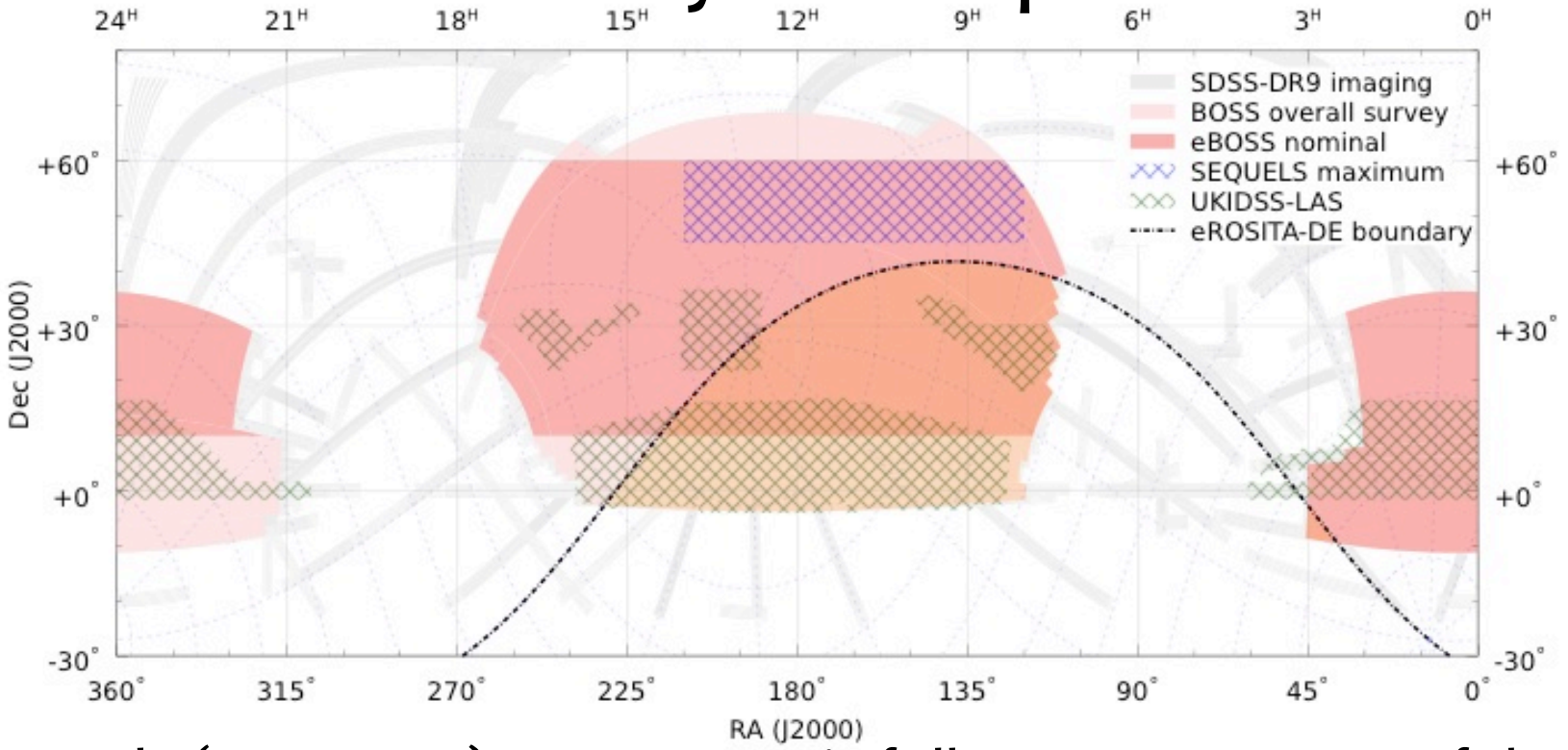
- The probability of a galaxy to host an AGN growing at a given specific accretion rate is (almost) **independent of stellar mass**
- AGN fraction normalization increases **~(1+z)^4** [~sSFR density]
- The AGN fraction distribution shows a break consistent with **Eddington limit**
- Very little difference between (type 2) AGN hosts and parent sample in sSFR (once z and M_* factored out). **Where is AGN feedback smoking gun? (t_{AGN} vs. t_{quench})**
- Nuclear obscuration is clearly **affected by the AGN luminosity,** (and not by Eddington ratio) but **not by any measured galaxy property** (stellar mass or star formation rate)

X-ray surveys in context



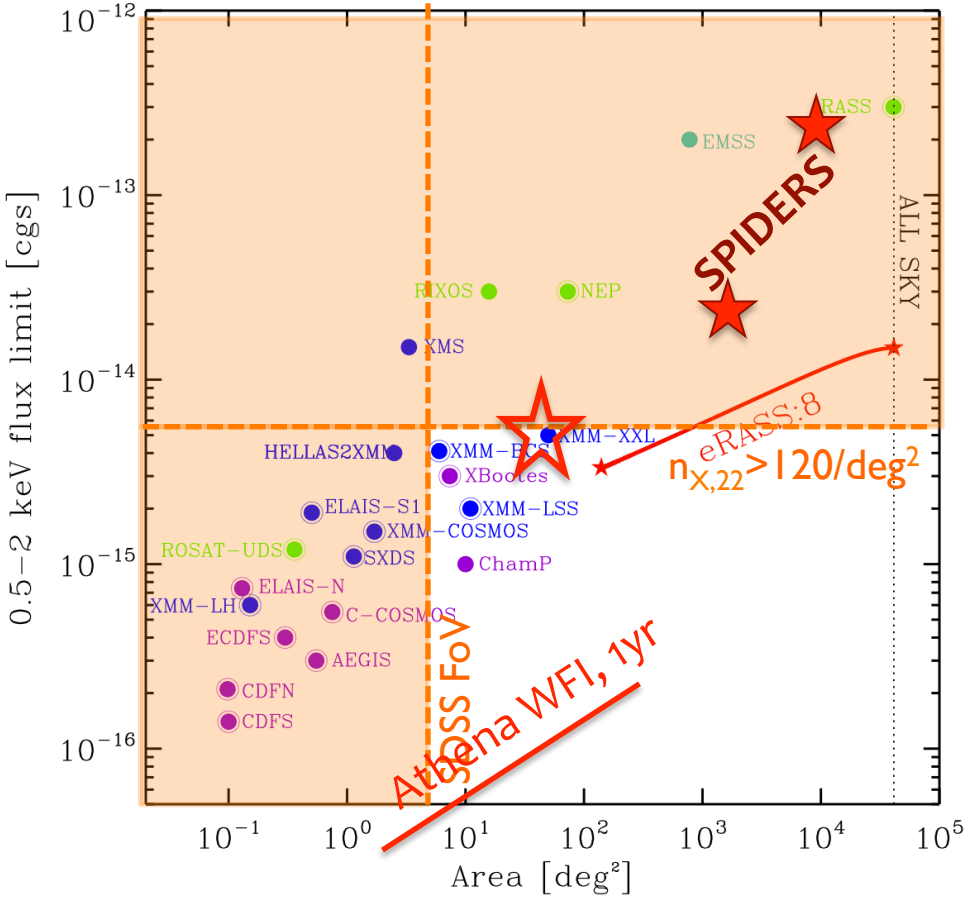
- The combination of X-ray selection and optical spectroscopy is critical
- Wide area X-ray surveys well matched to current (and future) multi-object spectrographs
- **eROSITA** and **Athena** will exploit such a vast potential for exploration

SDSS-IV/SPIDERS: 60k X-ray AGN spectra



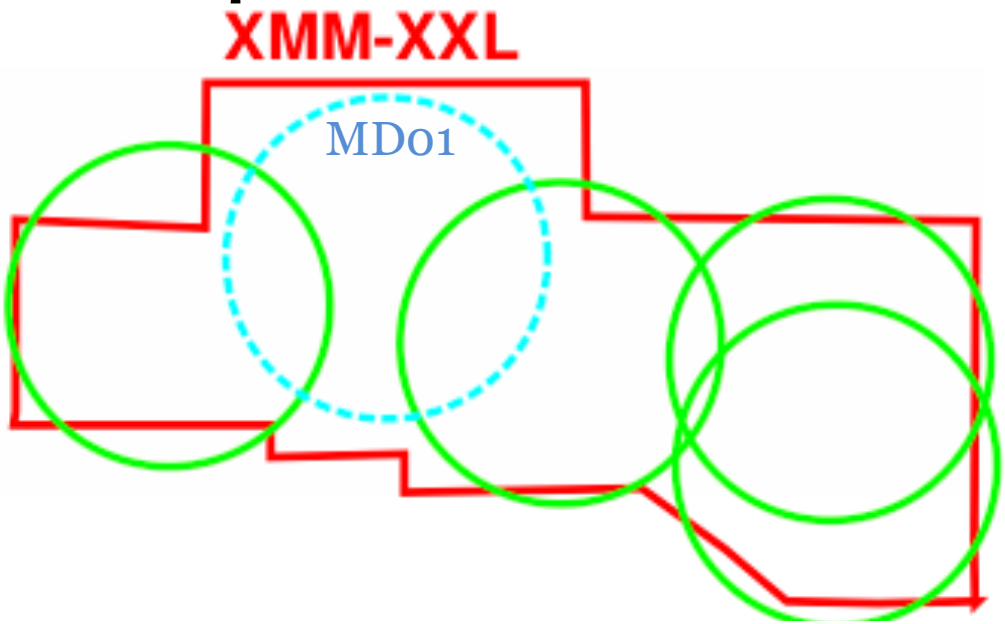
Early (eRASS:1-4) spectroscopic follow-up over most of the eROSITA_DE/eBOSS overlap region (2000-3000 deg^2)
+ complete follow-up of RASS and XMM-Slew AGN
(PI: Merloni & Nandra)

X-ray surveys in context



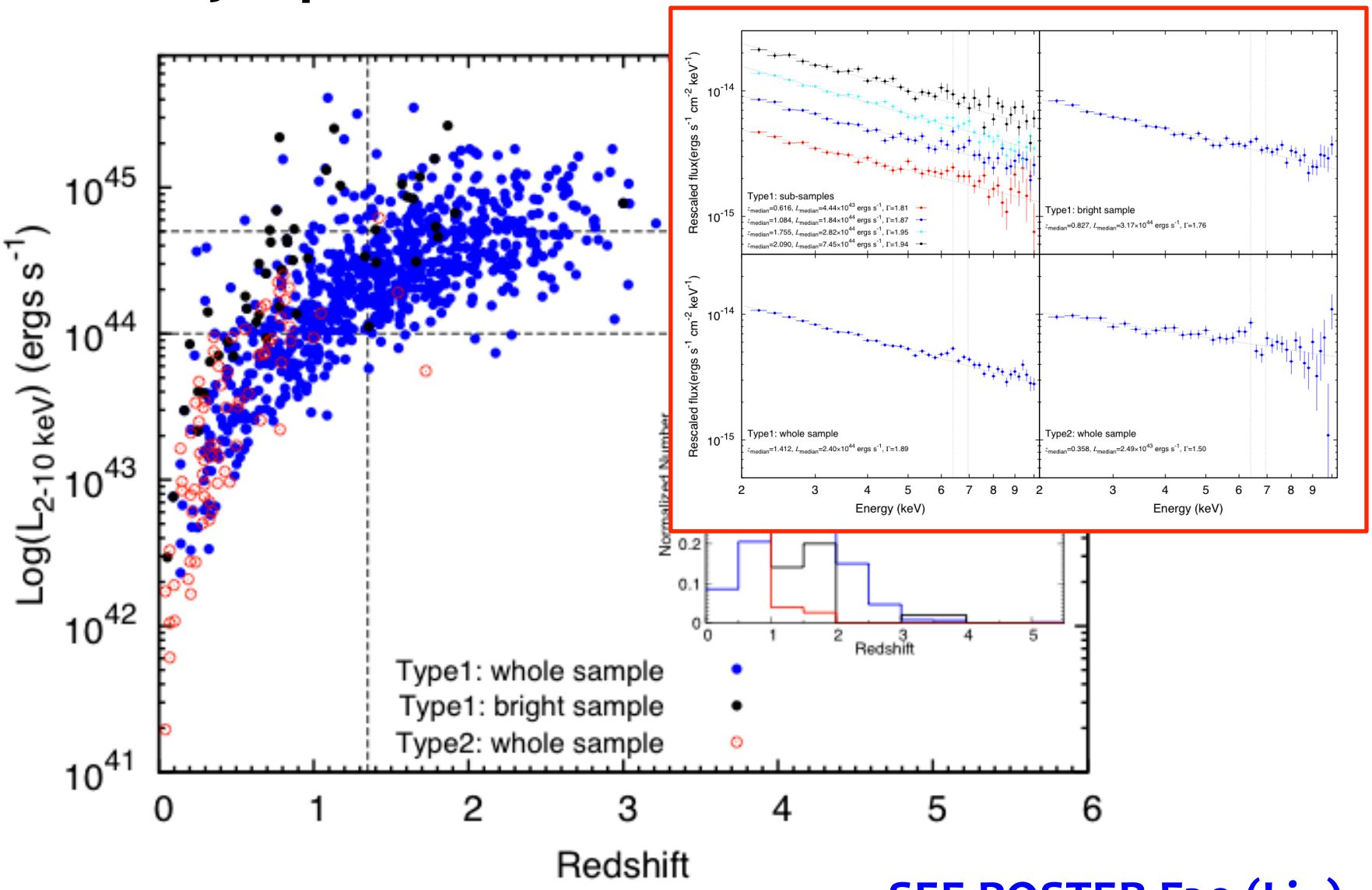
- The combination of X-ray selection and optical spectroscopy is critical
- Wide area X-ray surveys well matched to current (and future) multi-object spectrographs
- **eROSITA** and **Athena** will exploit such a vast potential for exploration
- Today, only a handful of fields available

A SPIDERS pilot in XMM-XXL North



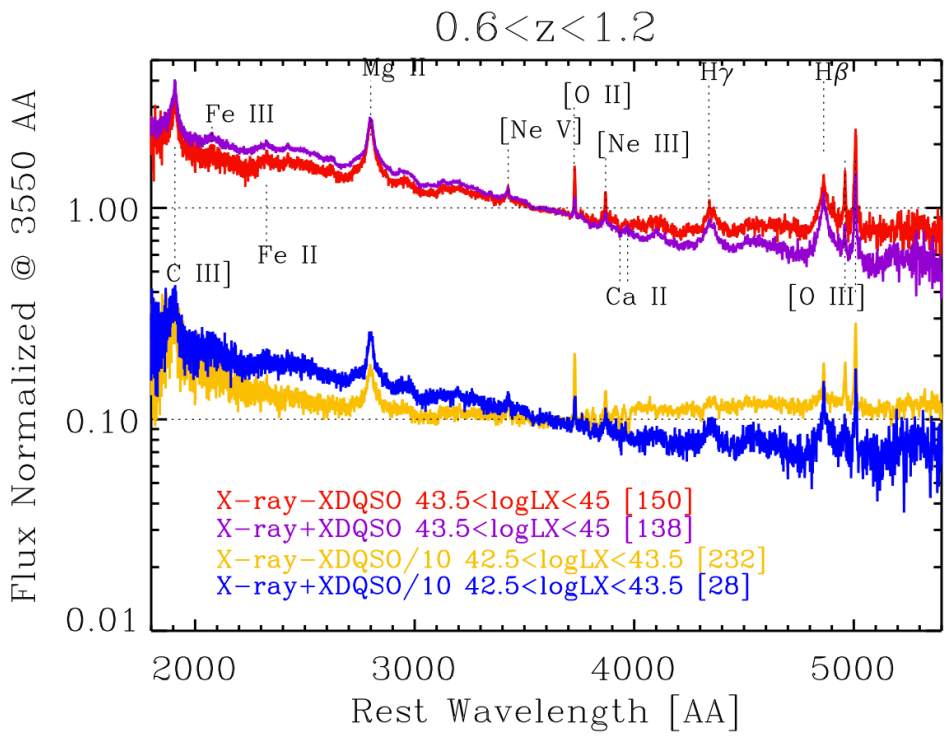
- XMM-XXL (PI Pierre): the largest public XMM survey (25+25 deg^2)
- 5 SDSS-III/BOSS plates fully dedicated to AGN follow-up (PIs: Merloni, Georgakakis, MPE). 1 hour integration each (total 5 hrs)
- Final catalog contains more than 2500 AGN with spec-z -> constraints on bright end of XLF, **SEE POSTER F07 (Buchner)**
- **THE LARGEST CONTIGOUS SPECTROCOPIC FOLLOW-UP of X-ray AGN** (comparable with upcoming XMM survey in Stripe 82, PI: Urry)

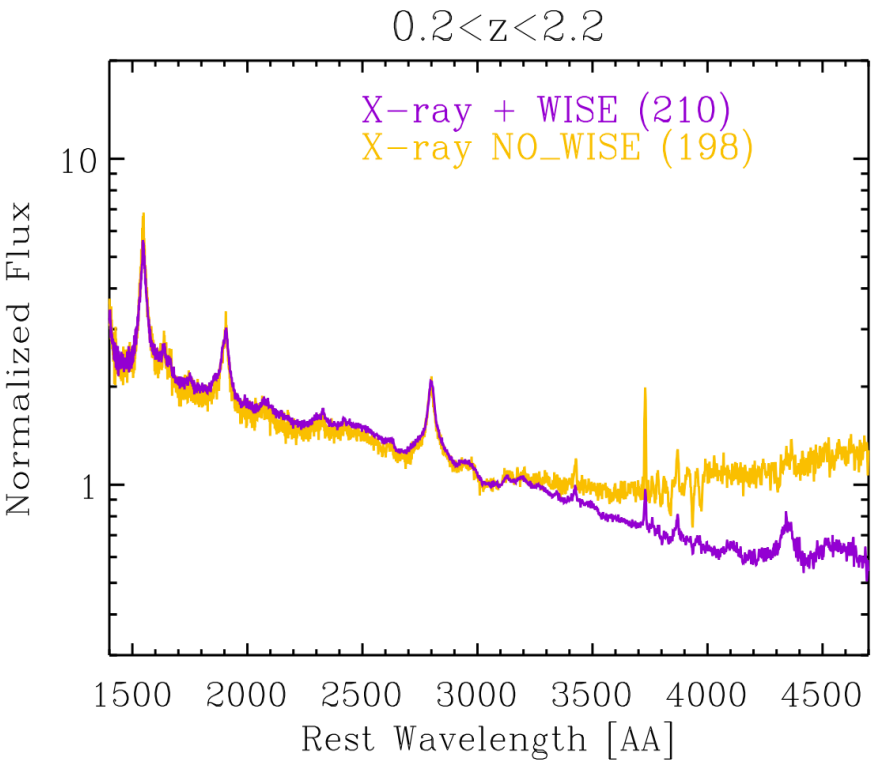
X-ray spectra of BOSS XMM-XXL



SEE POSTER F20 (Liu)

X-ray vs. Optical selected AGN





Optical (XDQSO) and WISE QSO selection are very similar (nuclear light must dominate); (soft) X-ray selection helps with 'galaxy-diluted' AGN. Ideal for studies of AGN-galaxy co-evolution, scaling relations, etc.

Menzel et al. in prep.

Conclusions/outlook

- X-ray surveys provide the **least biased view** of AGN (against obscuration/extinction and galaxy dilution)
- Currently limited by the sample size (~10^3), mainly because of the limited FoV of Chandra and XMM
- **Larger samples are mandatory** to accurately study DISTRIBUTIONS of AGN vs. L, z, NH, SFR, M* (stochasticity of AGN phenomenon)
- **eROSITA** will bring the study of (z<1) AGN evolution to the level of statistical significance of galaxy evolution studies. **SEE POSTER I03 (Kolodzig)**
- **Athena** will enable such studies at the epoch when most SMBH growth took place


Thank you