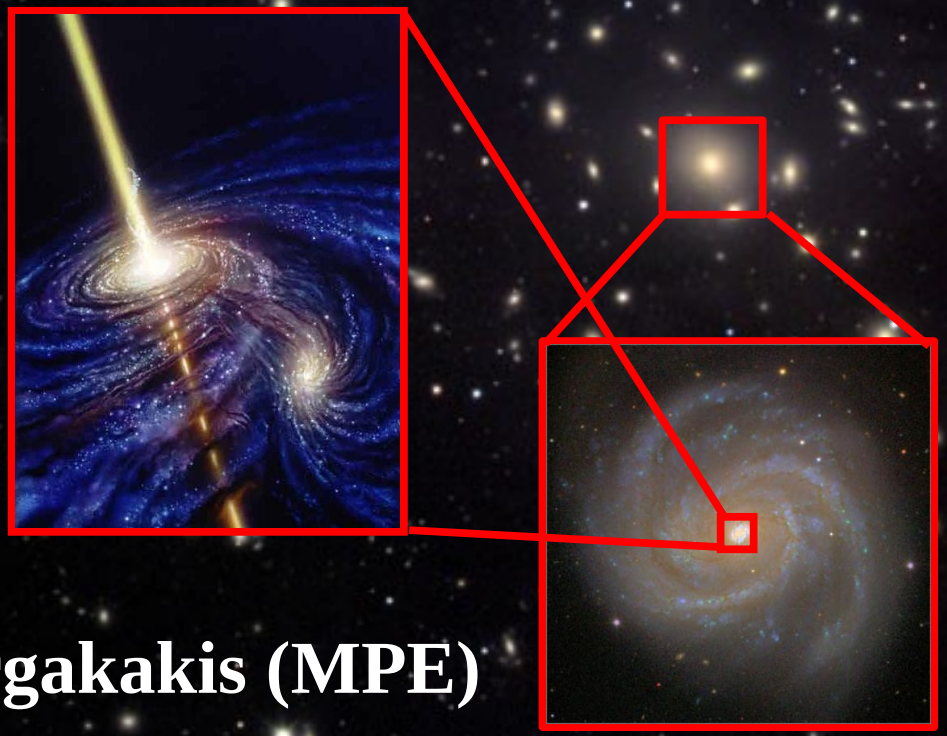
Studying the clustering of AGN with eROSITA



Antonis Georgakakis (MPE)

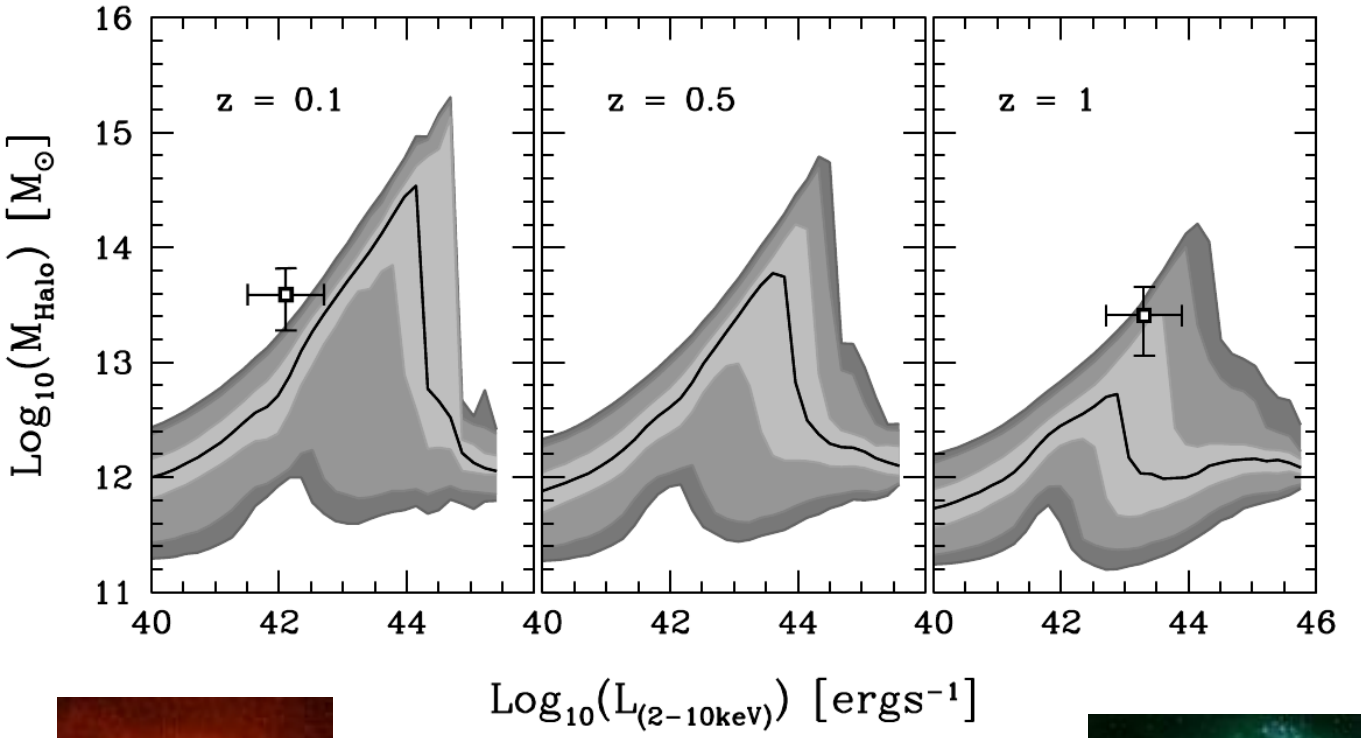
G. Mountrichas (Athens), N. Fanidakis (Heidelberg)

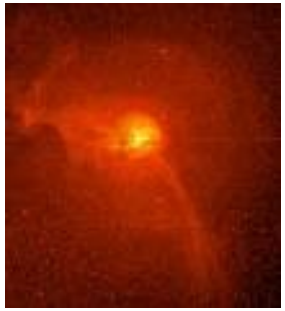
Outline

- The environment of AGN is a powerful diagnostic of the physical conditions of SMBH growth
- eROSITA will provide large samples of luminous AGN which dominate the accretion history of the Universe
- Novel analysis methods are required to make the most of eROSITA data: clustering from photo-zs

Semi-Analytic Model predictions

Durham SAM: Bower et al. 2006, Fanidakis et al. 2011





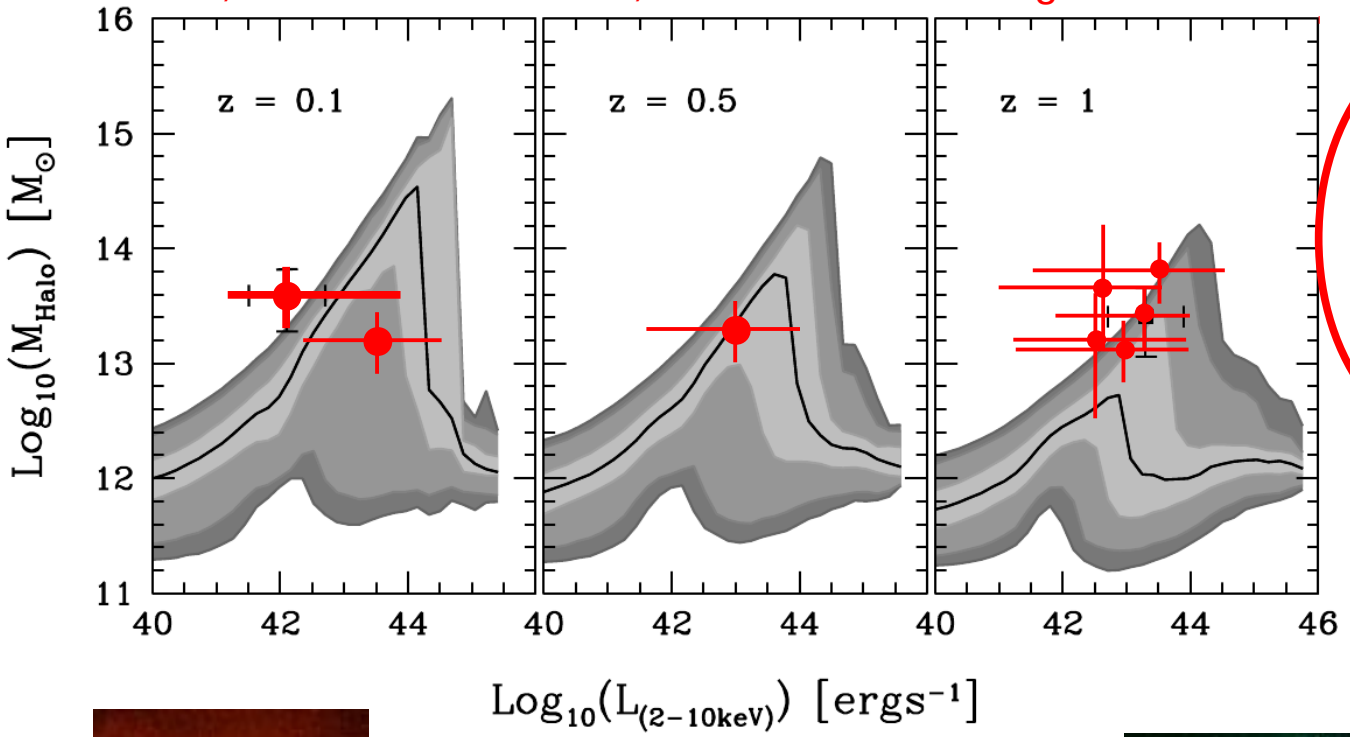
Hot gas accretion

Redshift - Luminosity

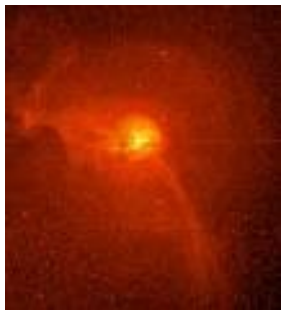
cold gas accretion

Semi-Analytic Model predictions

Gilli et al. 2005, 2009, Yang et al. 2006, Coil et al. 2009, Cappelluti et al. 2010, Starikova et al. 2011, Mountrichas & Georgakakis 2011



- wide z/L_X bins
- small samples
- systematics (cosmic variance)
- limited information at bright L_X.



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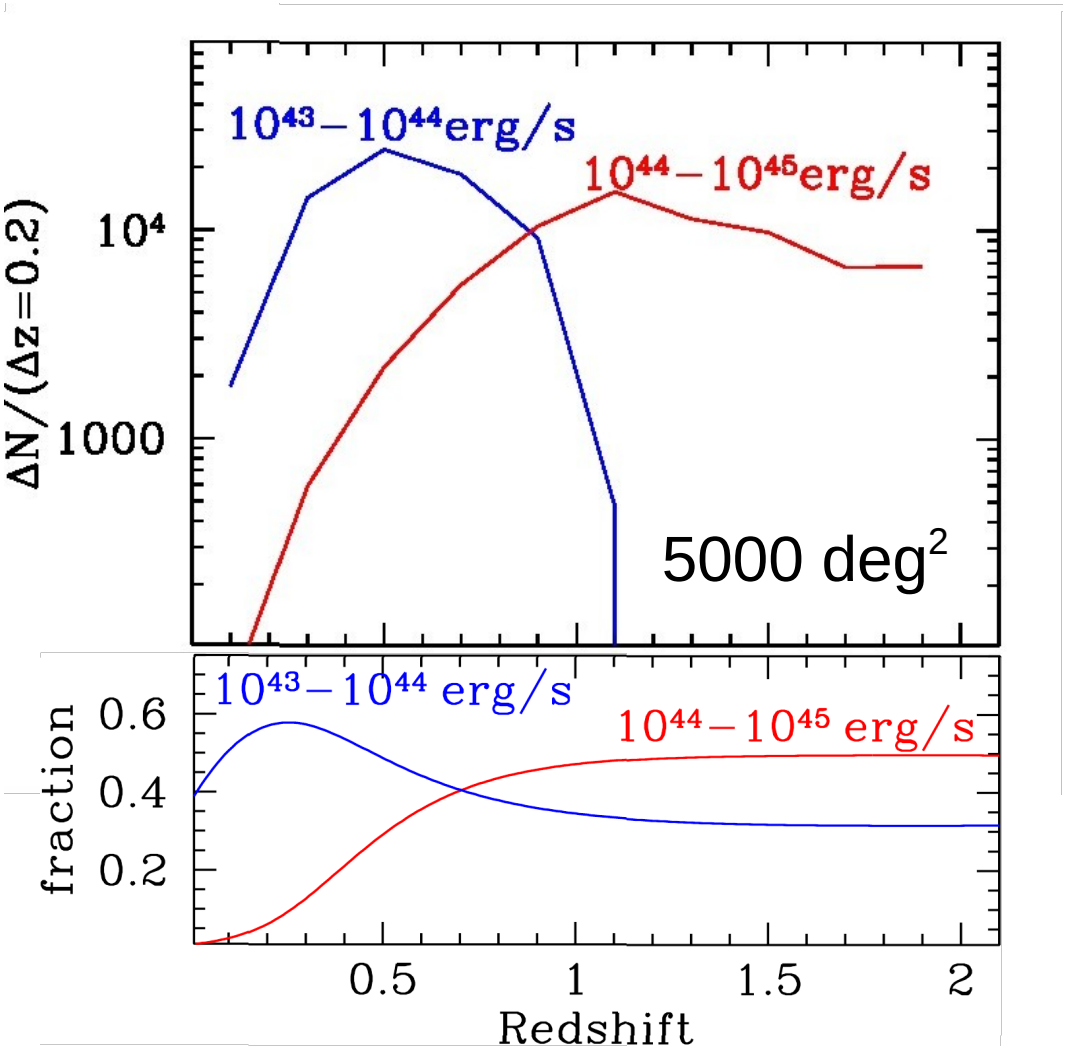
eROSITA surveys

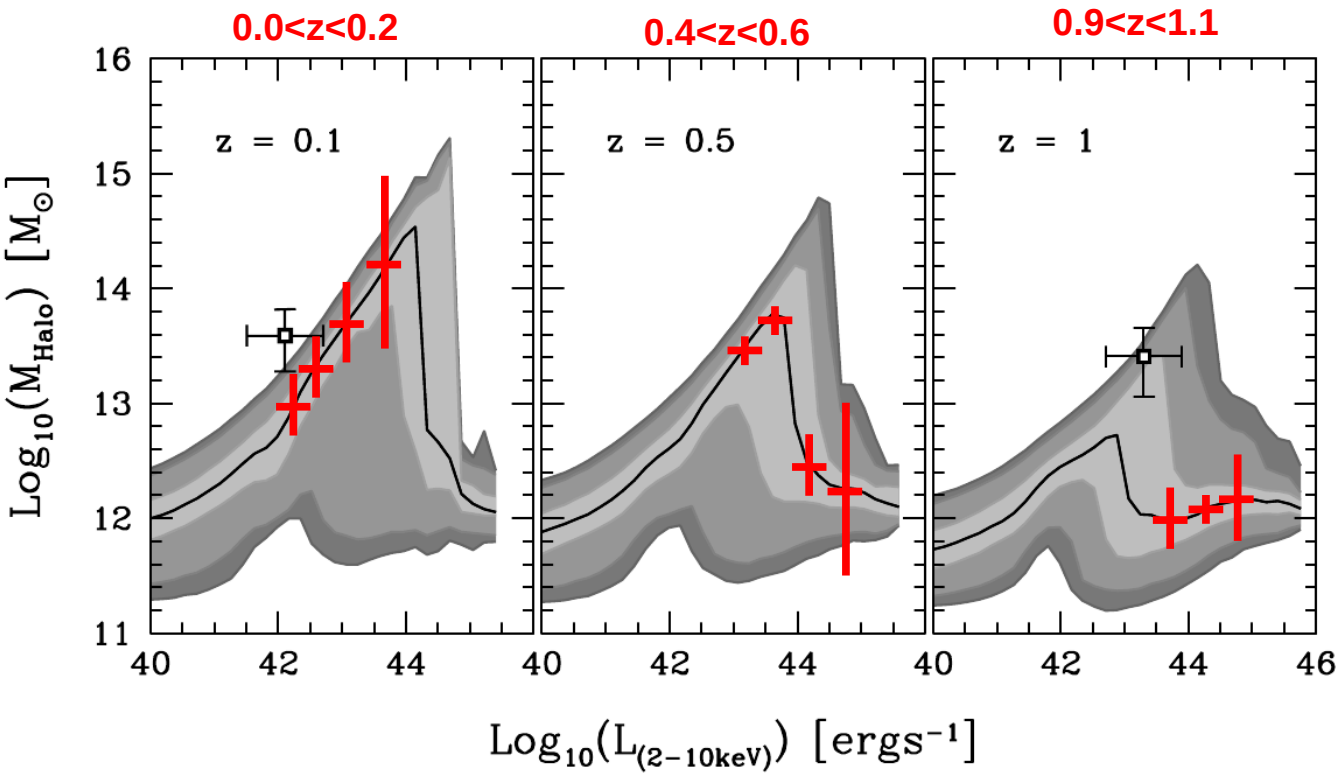


eROSITA will detect many thousands of powerful AGN, L_X~10^{43}-10^{45}erg/s out to high redshift

- Chandra/XMM surveys lack the volume to detect large numbers of those sources
- These are the AGN that dominate the accretion power of the Universe at any given redshift

Semi-Analytic Model predictions

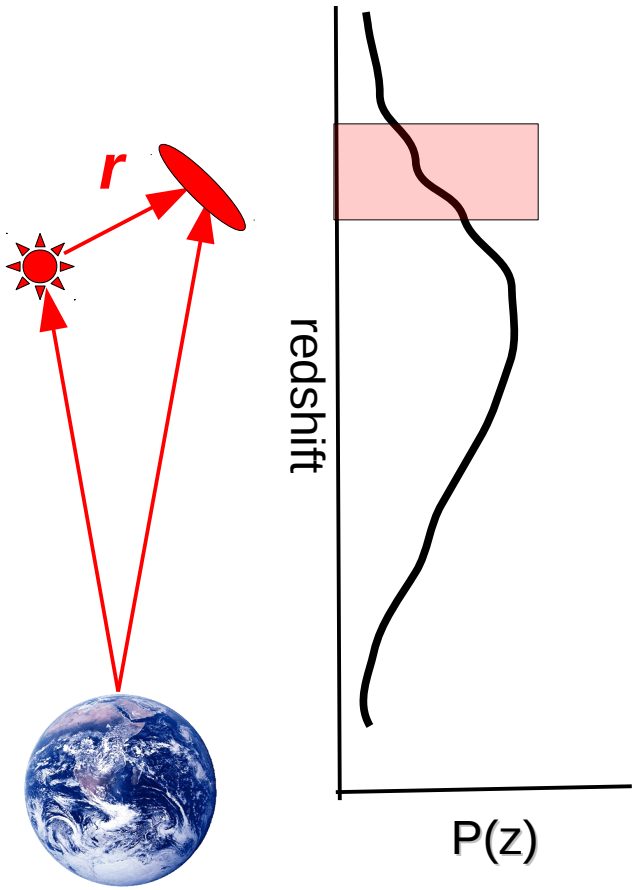
see also M. Krümpe's poster



eROSITA will detect large numbers of luminous AGN:

- assume a 5000 deg^2 area with spectroscopy for the AGN
- split AGN in dlogL_X=0.5dex, δz=0.2
- scale errors to Krumpe et al. (2010) DMH error budget based on the AGN/LRG cross-correlation function

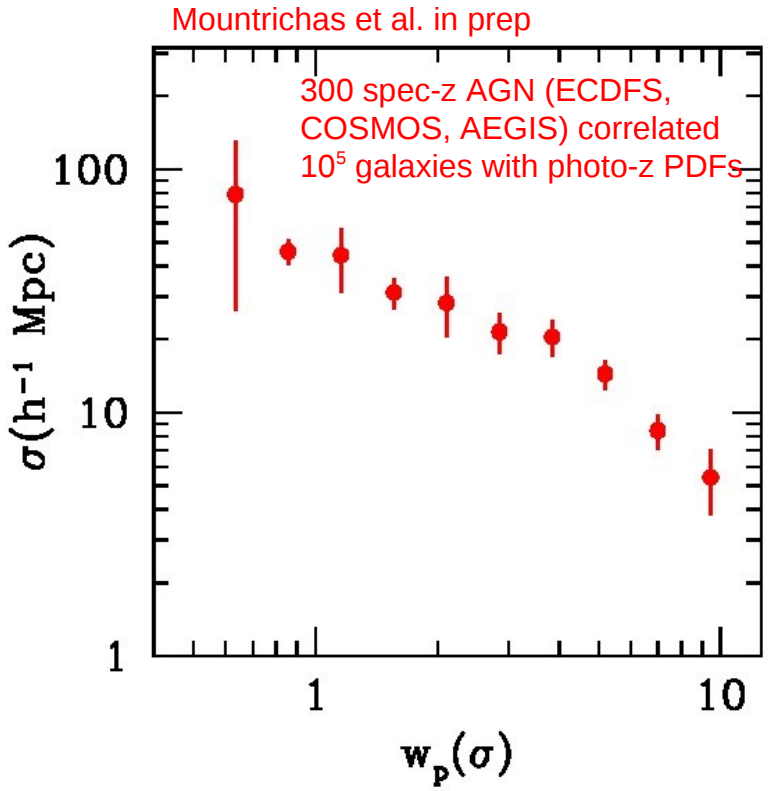
Cross-correlation function using photometric redshifts



- AGN/galaxy cross-correlation function with photo-zs for galaxies
- When counting pairs weigh each galaxy with the probability that it is at a given redshift
- For large galaxy samples photo-z PDFs can substitute spectroscopy.
- Spec-z for the AGN are still needed

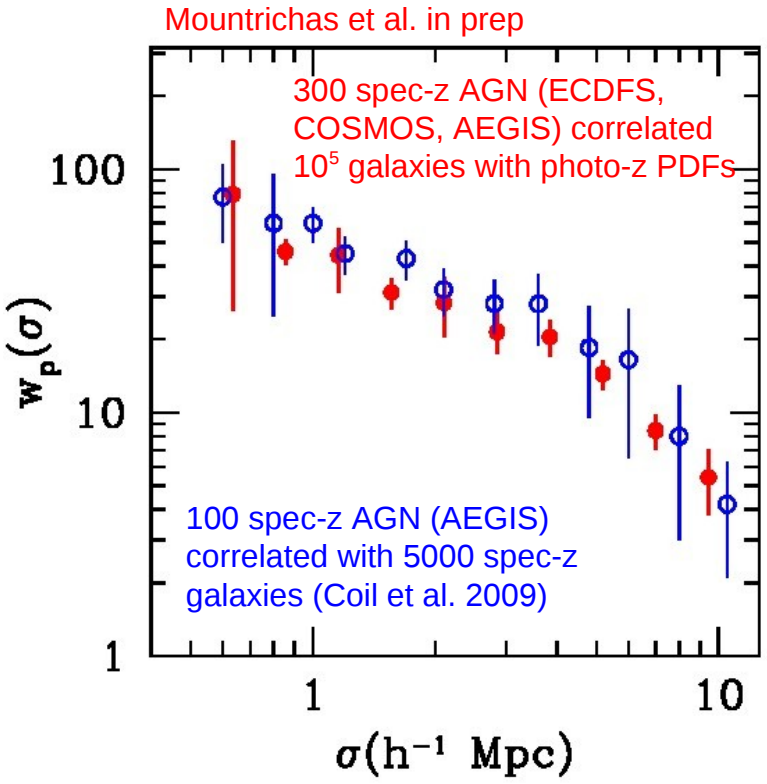
Myers et al. 2009, Mountrichas et al. in prep.

Cross-correlation function using photometric redshifts



- AGN/galaxy cross-correlation function using PDFs for galaxies
- Errors include cosmic variance and Poisson uncertainties

Cross-correlation function using photometric redshifts



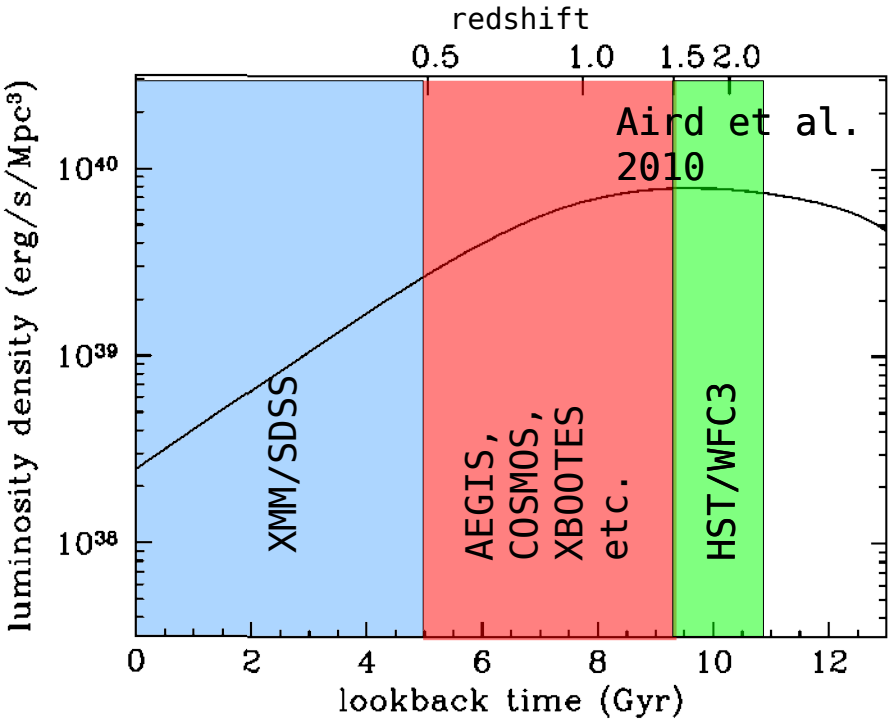
- AGN/galaxy cross-correlation function using PDFs for galaxies
- Errors include cosmic variance and Poisson uncertainties.

Summary

- Study of the environment of AGN as a function of redshift and accretion power is a powerful diagnostic for understanding the
  - physical processes behind AGN evolution
  - conditions of SMBH growth
- eROSITA will allow accurate constraints on the clustering properties of the AGN that dominate the accretion power of the Universe
- New analysis techniques are needed to make the most of eROSITA data

X-ray AGN host properties as a function of time

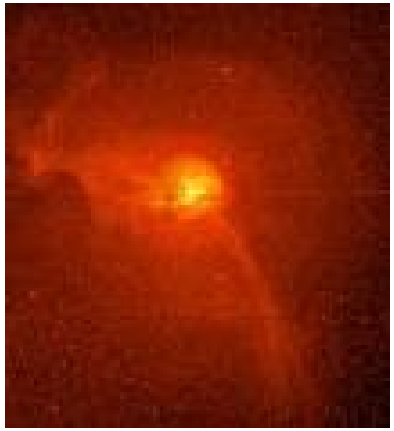
- z<0.5: wide-area/shallow X-ray surveys
  - XMM/SDSS (Georgakakis & Nandra 2011)
- z~1: deep/pencil beam X-ray surveys:
  - AEGIS, COSMOS, GOODS, XBOOTES...
- z~2: CANDELS



AGN fueling/triggering modes

Disk instabilities

Cold gas accretion
low mass BHs, high *M*dot
spiral morphology
young stars
low density regions



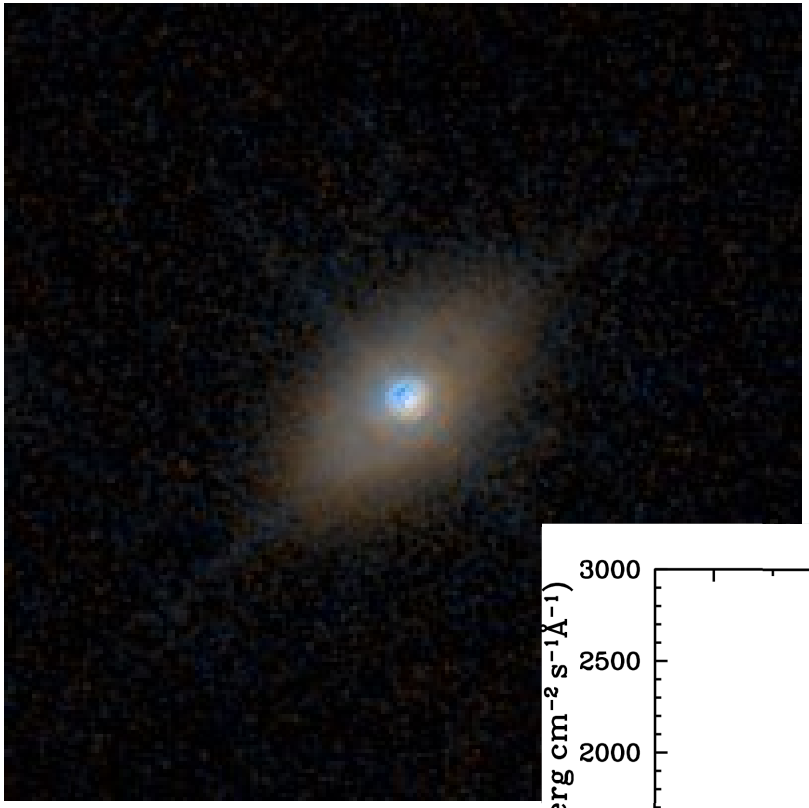
Radio mode accretion

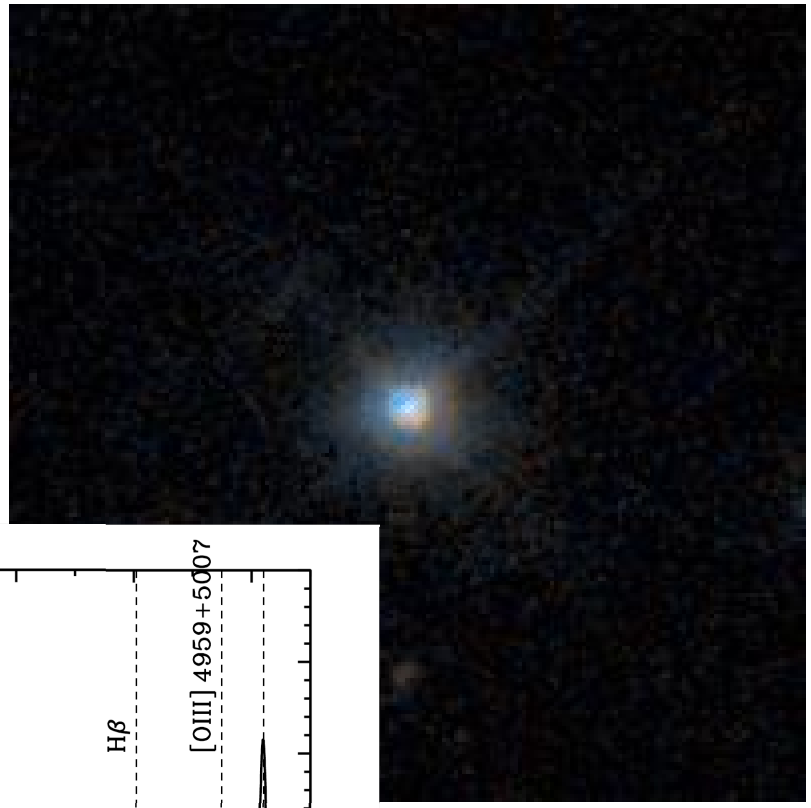
Hot gas accretion
Massive BHs, low *M*dot
Massive ellipticals
evolved stars
high density regions

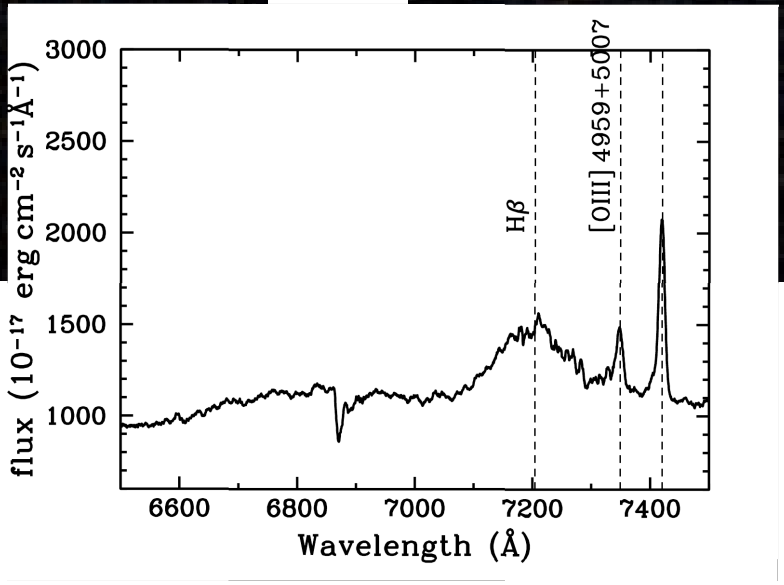
Major mergers

cold gas accretion
disturbed morphology
ongoing star-formation
Moderate density regions

Galaxy contamination by AGN light







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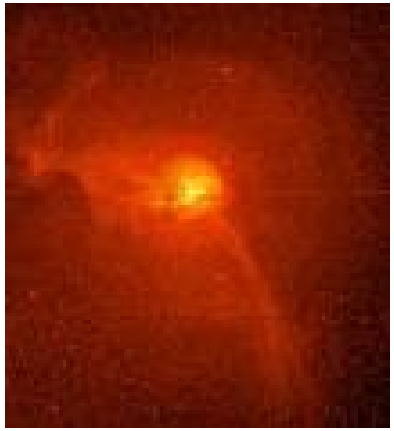

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