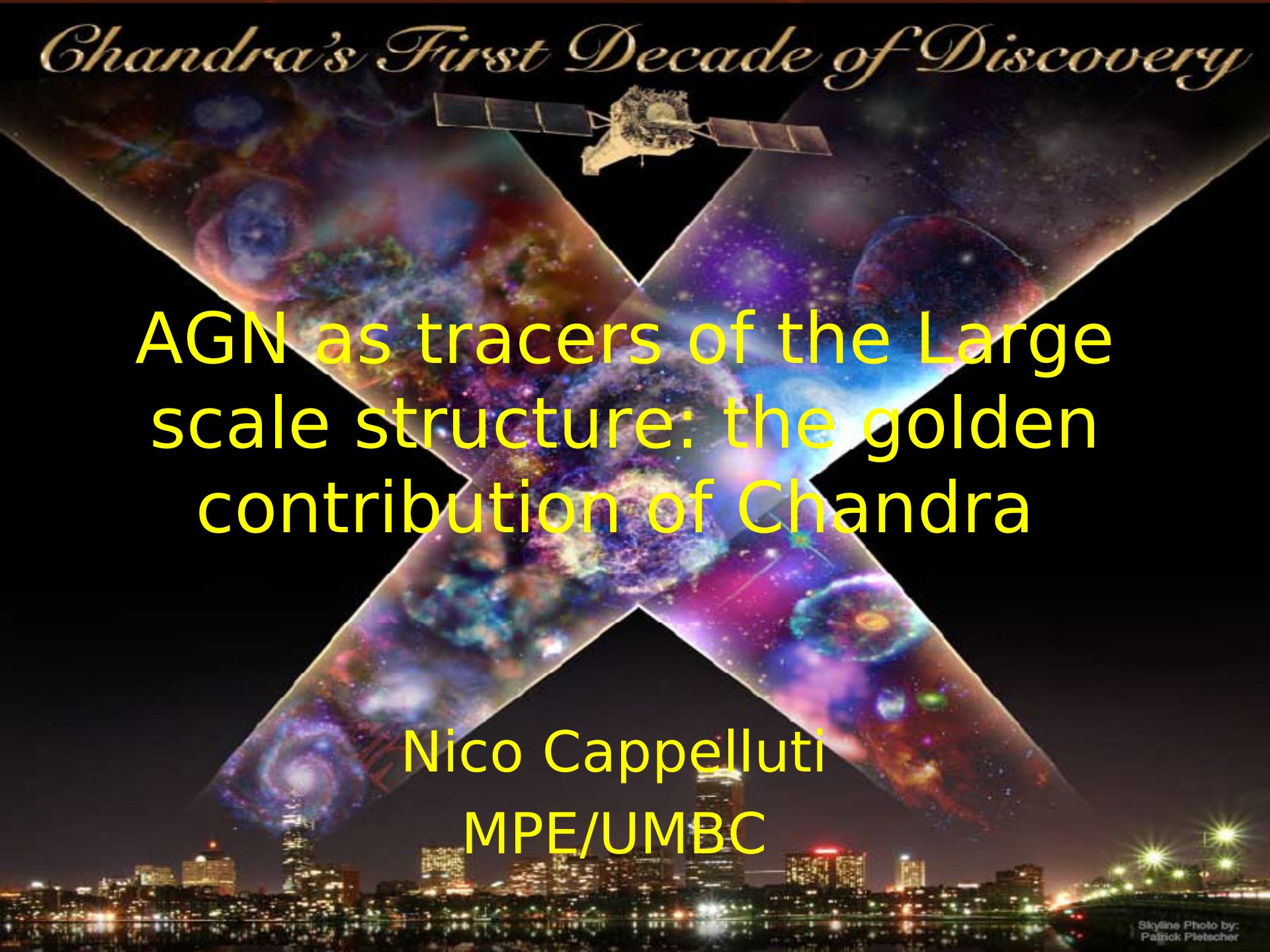


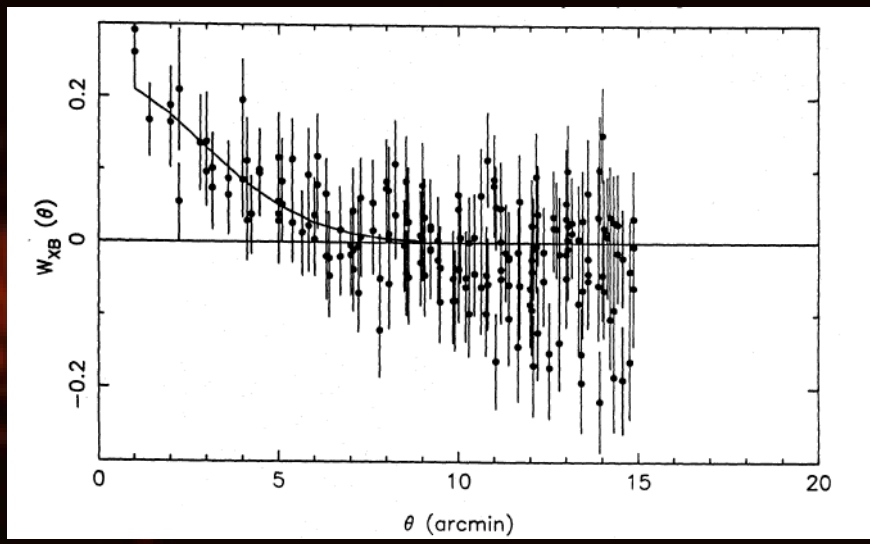
AGN as tracers of the Large scale structure: the golden contribution of Chandra

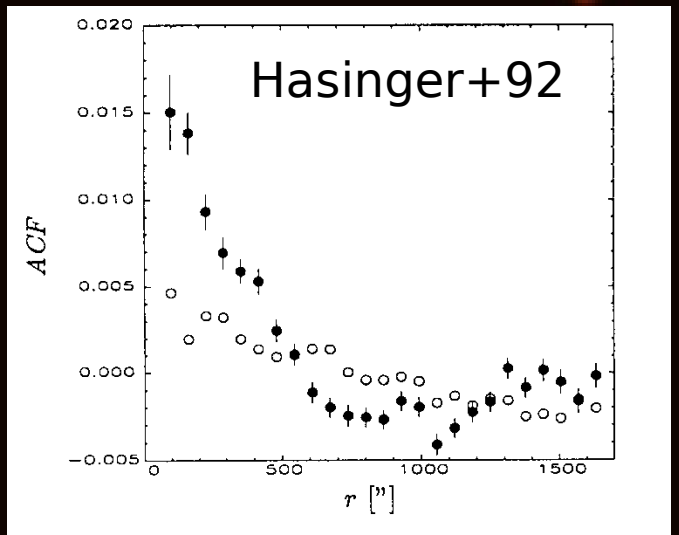
Nico Cappelluti
MPE/UMBC

The structure of the XRB Before Chandra and XMM-Newton

Discovery of small scale fluctuations of the XRB (Barcons & Fabian 89)

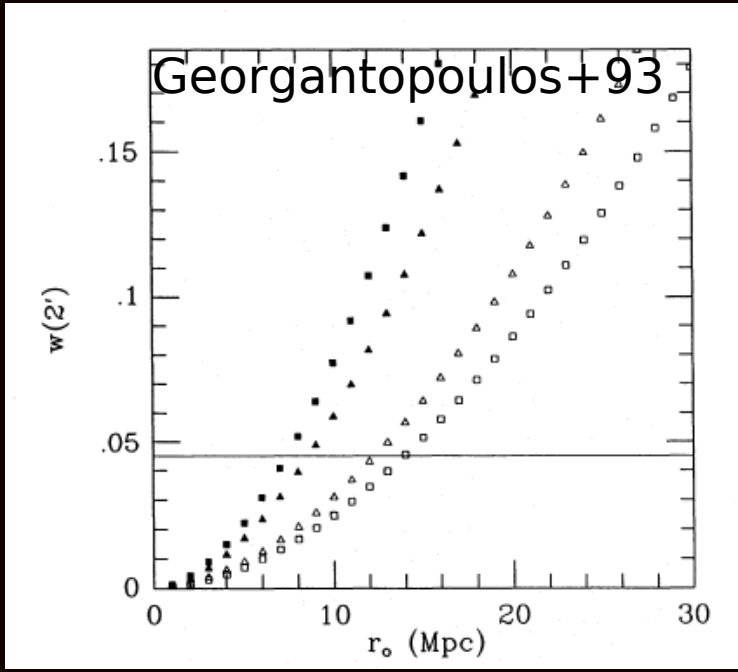
The sources of the X-ray background follow a cosmological structure.





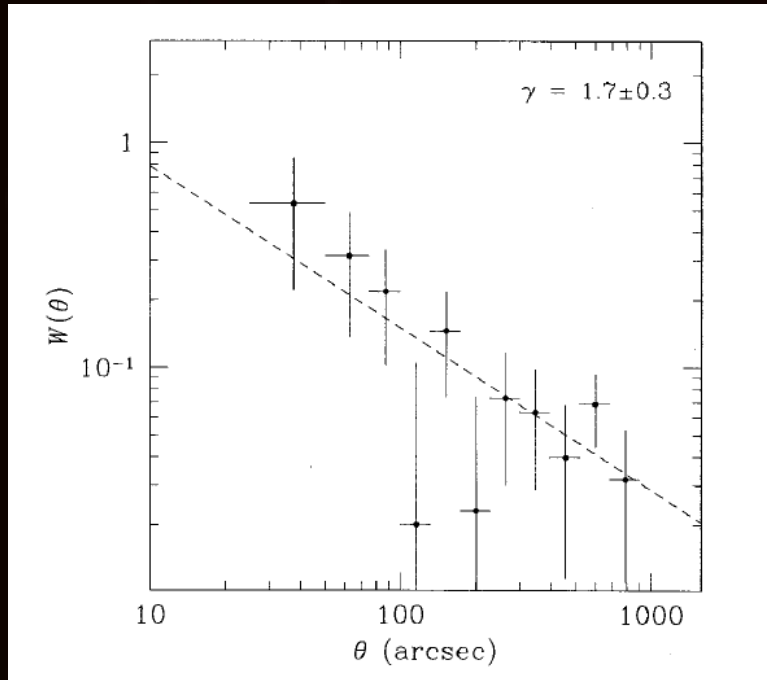
ROSAT measured clustered fluctuations of the XRB

The structure of the XRB Before Chandra and XMM-Newton



The fluctuations measured by ROSAT are consistent with XRB sources clustered with a characteristic length of 6-12 Mpc/h_{50}

Vikhlinin & Forman (1995) measured with ROSAT, for the first time, clustering of X-ray selected AGN

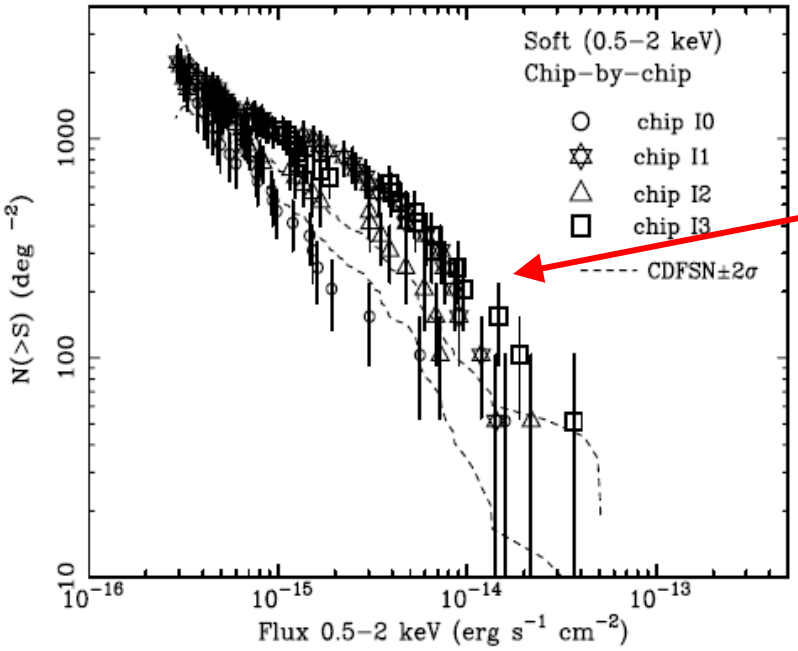


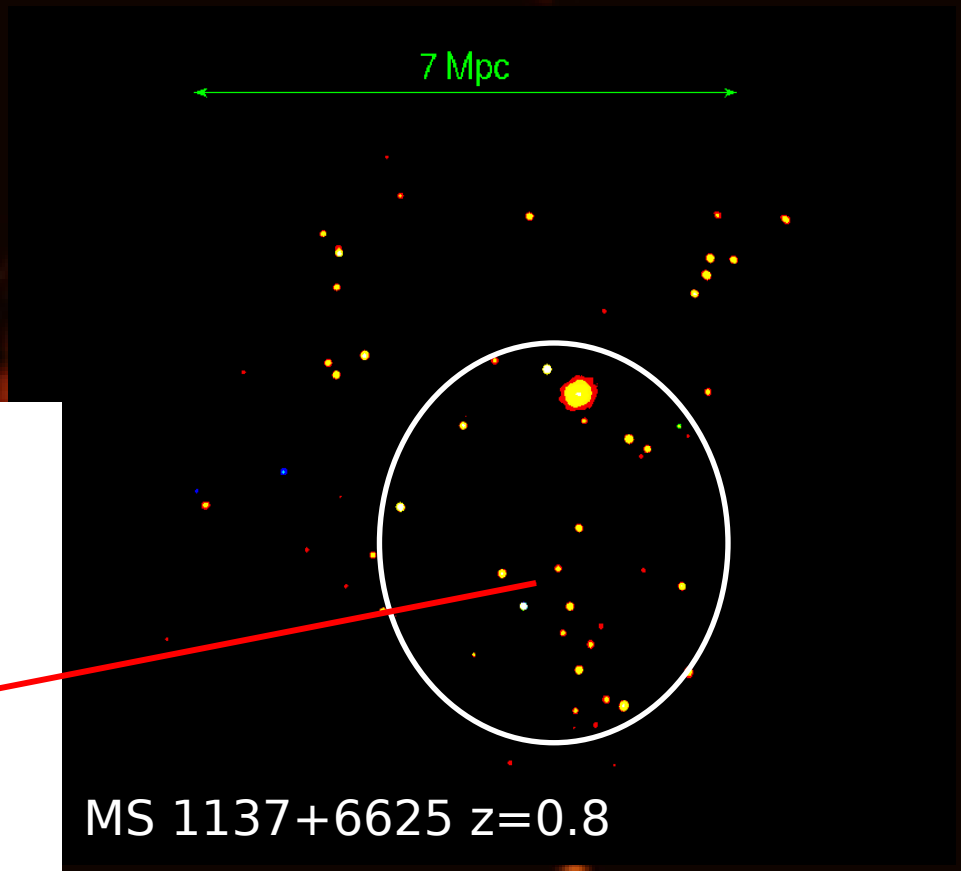
First conclusions

- r_0~6-10 Mpc, γ~1.7
- Source of the X-ray background are clustered in a way similar to optical-QSO
- No clear evidence of evolution of the clustering length → difficult to fully describe the source environment
- Results suffer from low count-statistics

And then came Chandra

X-ray source overdensities detectable by eye in the fields of galaxy clusters (Cappi +01, Cappelluti+05)

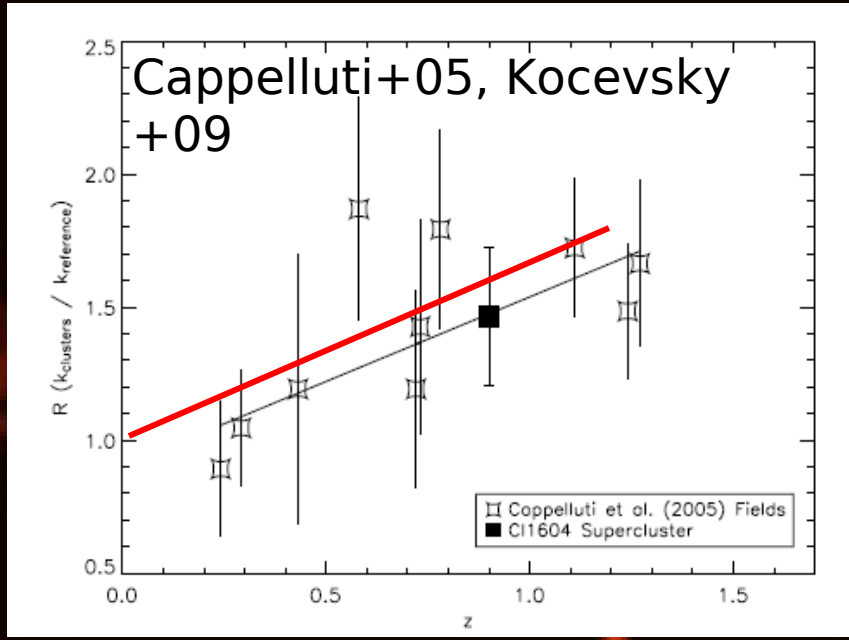




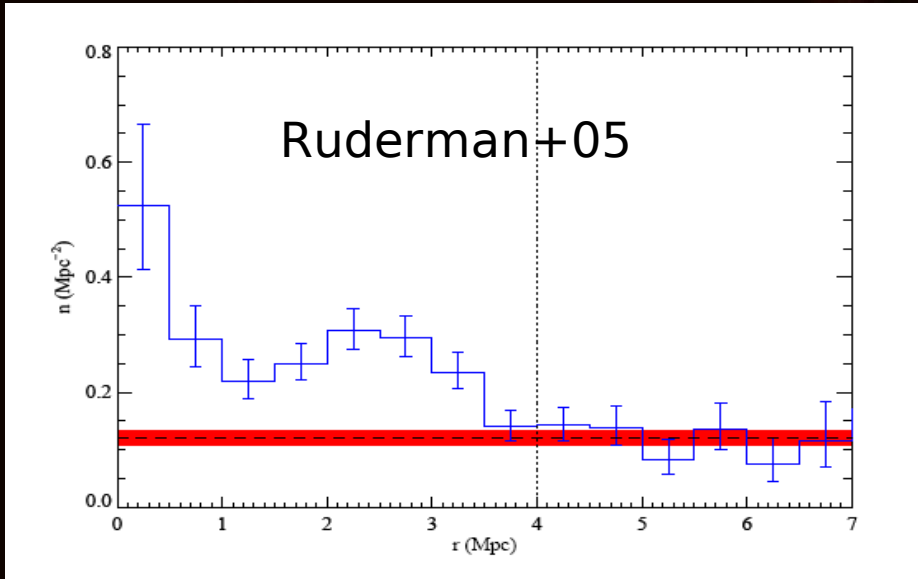
MS 1137+6625 z=0.8

Overdensities of AGN around clusters: a common phenomenon

- 40%-50% of the clusters show AGN overdensity (Cappeluti+05, +several single detections)
- Overdensity evolution

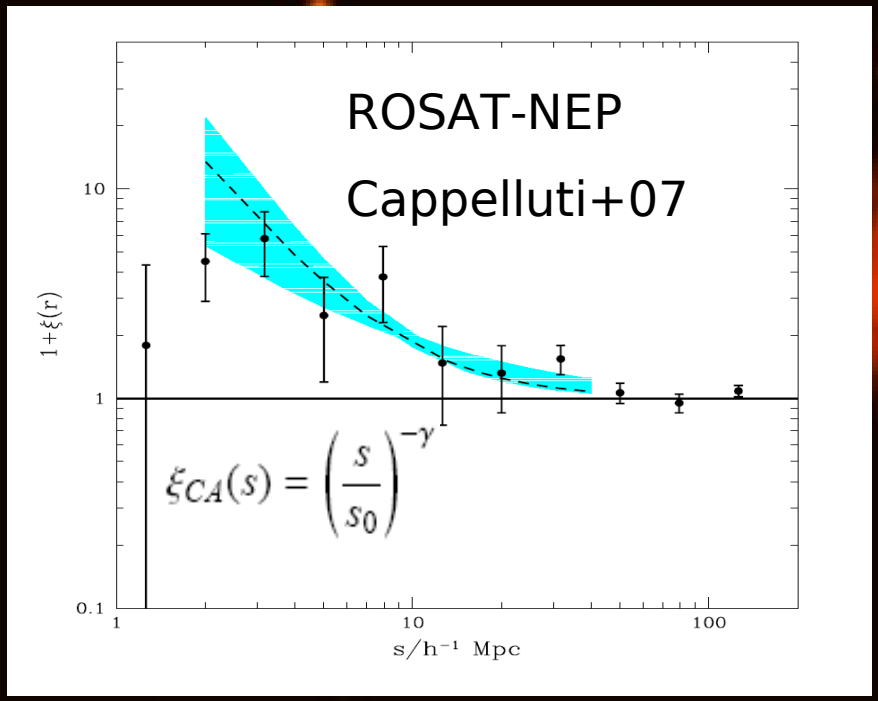


Evolution from Hasinger +05



Overdensity profile (apparently) with features, but no redshifts

Cluster-AGN Cross-Correlation function in wide field surveys

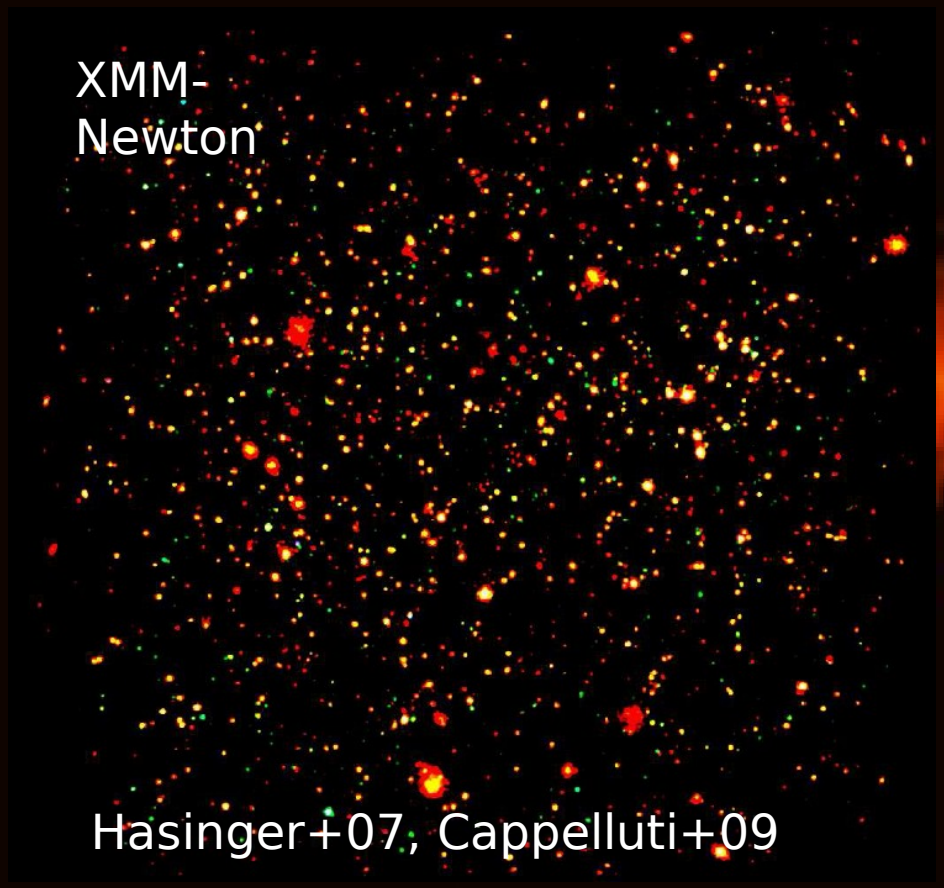


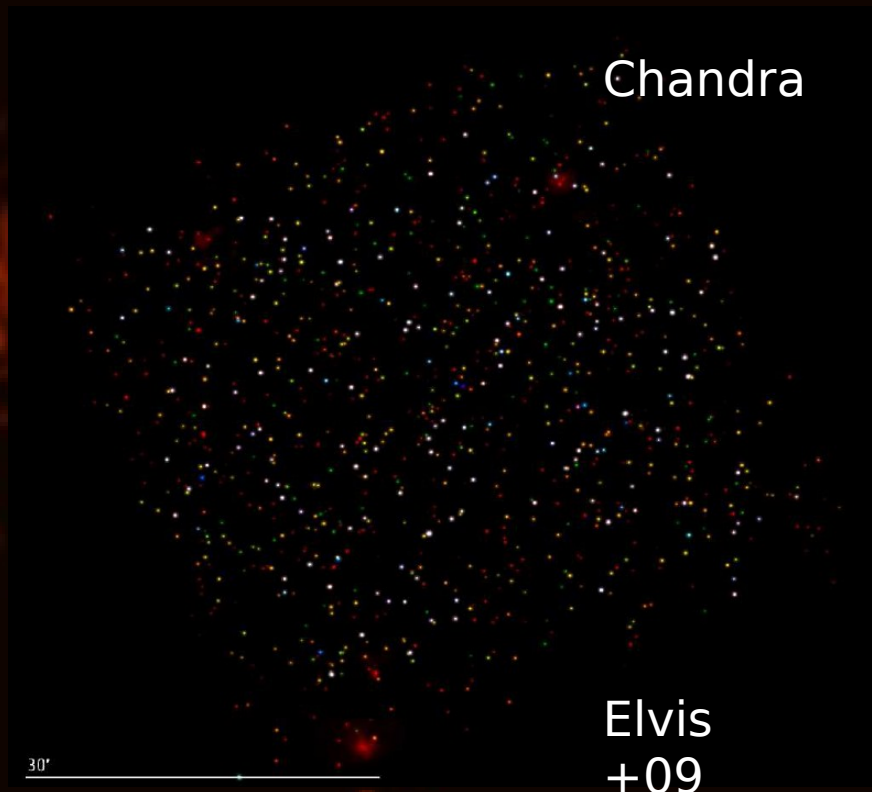
AGN overdensity is a physical property of clusters, at least in the outer regions

What kind of structure do AGN trace

$\gamma \sim 1.8$, $s_0 = 8.7$ Mpc

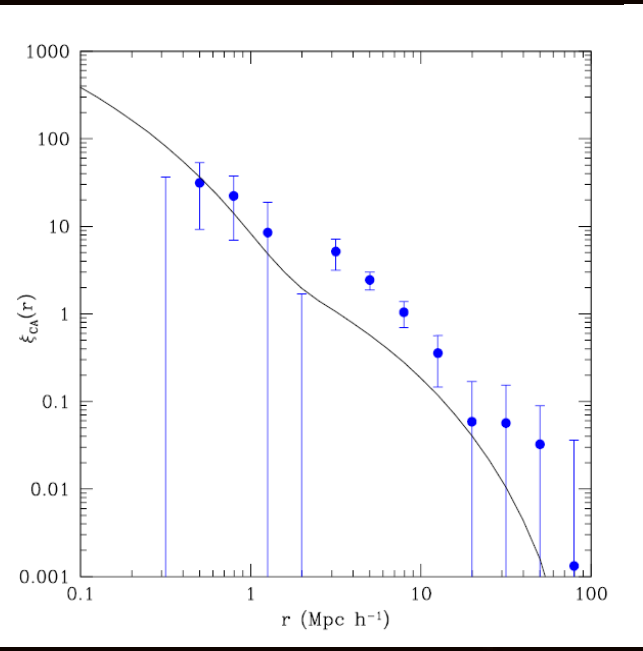
Then it came COSMOS



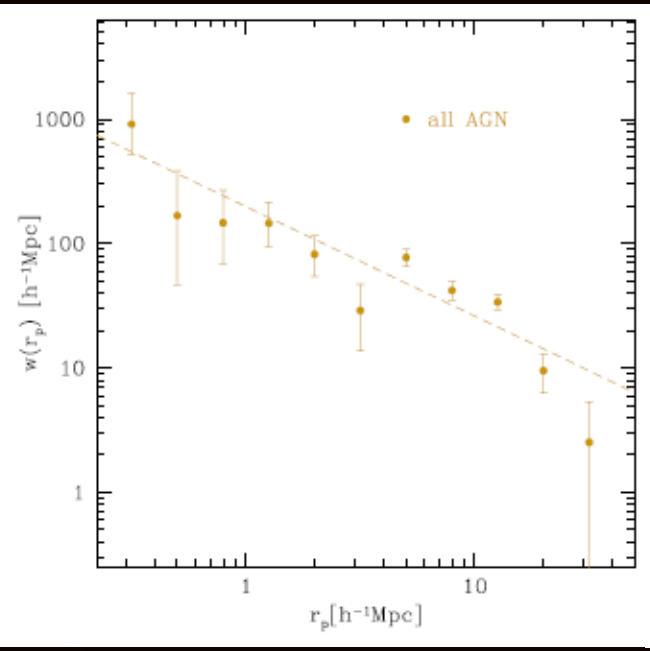


See M. Elvis talk

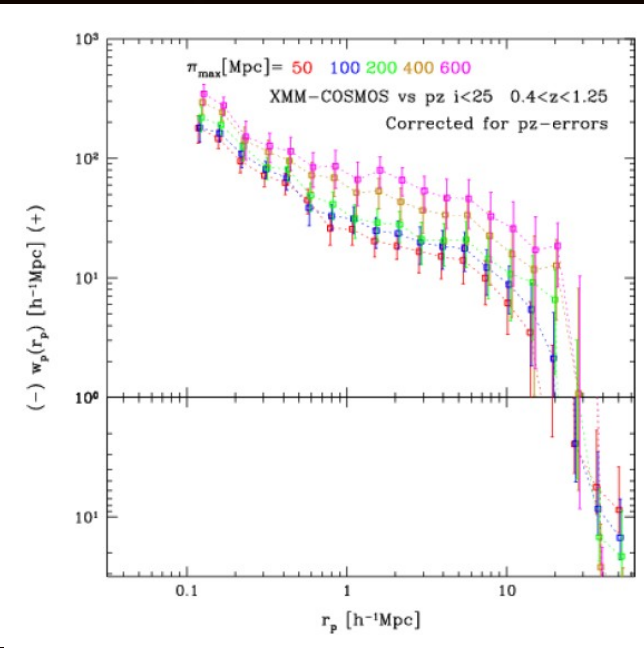
Comprehensive picture arising from XMM-Chandra/COSMOS



Cluster-AGN ccf

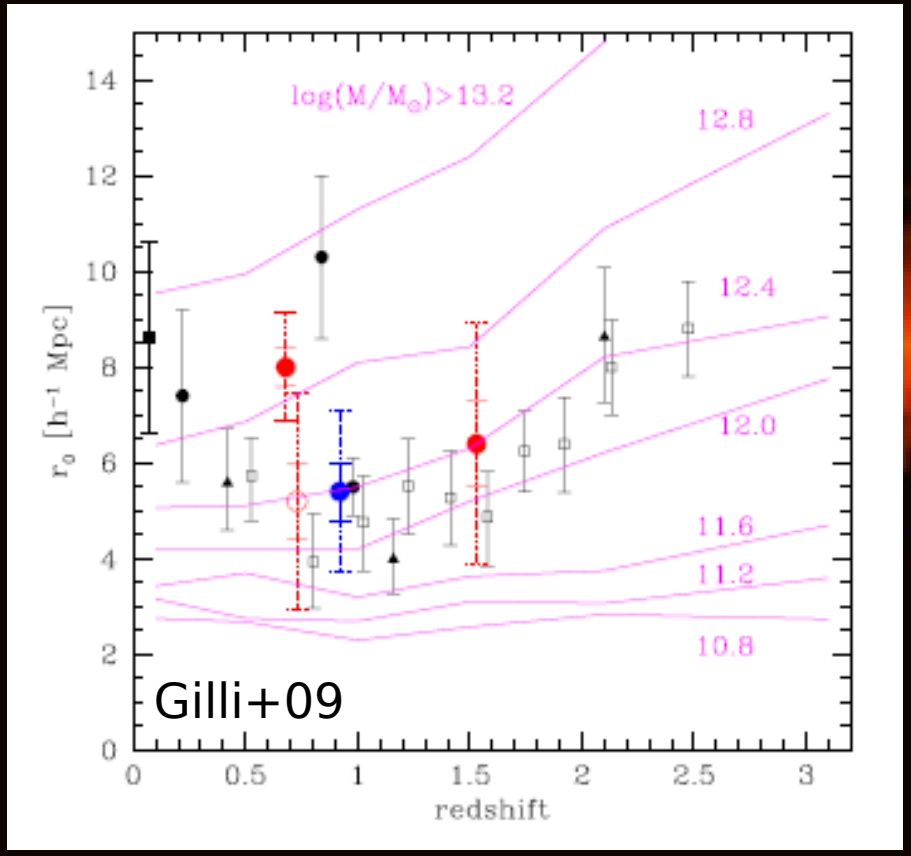


3D auto-correlation



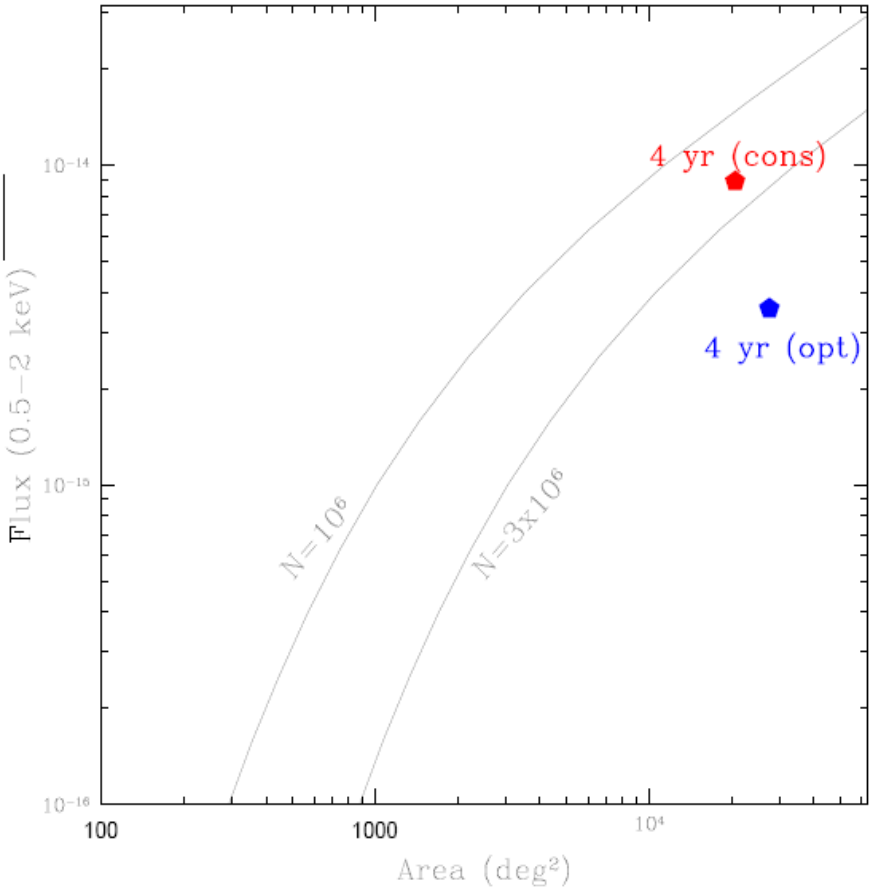
3D AGN-galaxies ccf
~3000 objects with photo-z (still problematic)

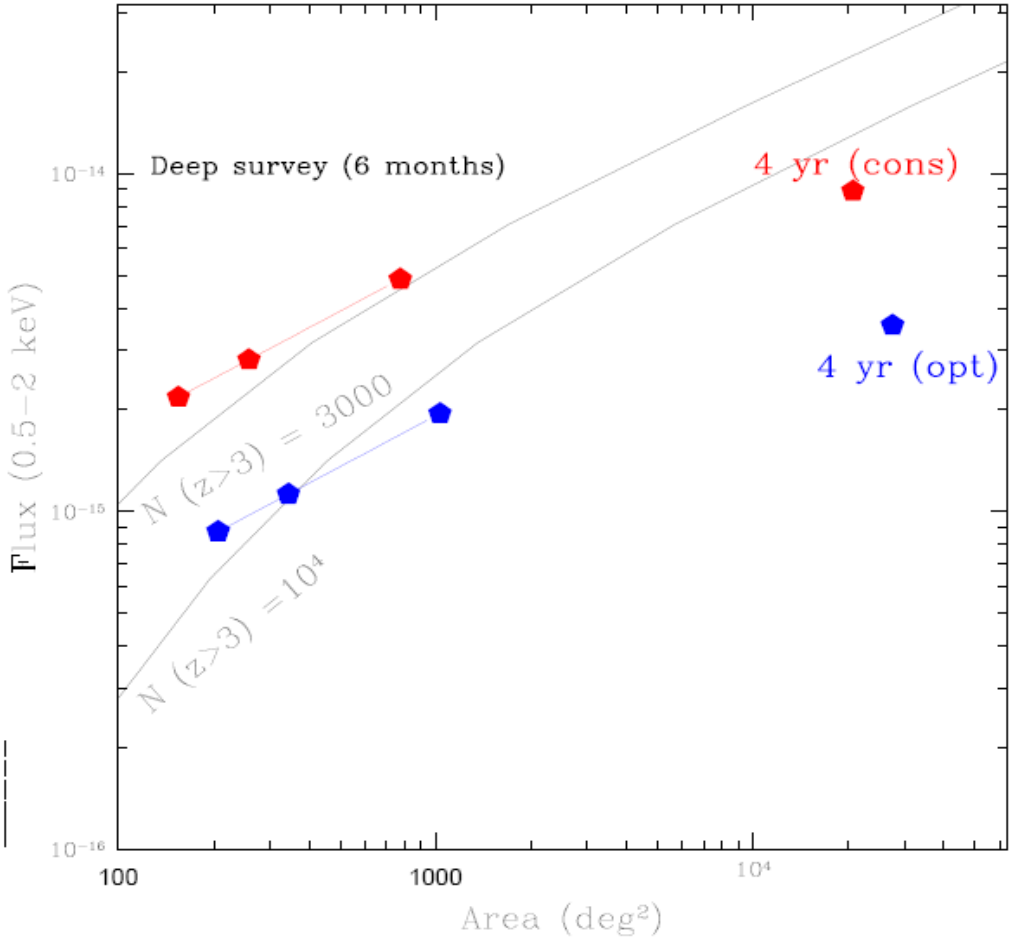
The environment of AGN



- AGN live in DM halos with log(M)~12.5 M$_\odot$
- They cluster like massive late type galaxy
- Consistent with the triggering of AGN via merging
- Work in progress for HOD modeling of AGN
- Better statistics required and high-z coverage

But we won't stop here!





Conclusions

- Chandra (and XMM) give a clear view of the LSS traced by AGN
- AGN cluster like massive galaxies
- Wide field surveys are fundamental for studying the environment of AGN
- New Missions like eROSITA or WFXT will provide a best view of the LSS at high-z