Extragalactic Surveys

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A survey of surveys

CHANDRA

CDFN Brandt US CDFS Giacconi US E-CDFS Brandt/Hasinger US/EU US CHAMP Wilkes/Green Murray/Jones US XBootes SEXSI Harrison/Eckart US AEGIS UK Nandra SWIRE LH Wilkes US CLASXS Mushotzky/Barger US COSMOS Elvis US

XMM-NEWTON

Lockman	Hasinger	D
H2XMM	Fiore/Comastri	
XMMBSS	Della Ceca	
ELAIS-S1	Fiore/La Franca	
XMM2DF	Goergantopoulos	GR
NHS	Georgakakis	GR
XMM-LSS	Pierre	F
XMDS	Chiappetti/Marasch	ni I
AXIS	Barcons +SSC	E/UK/I
XMM-SSC/	SXDS Watson	UK/EL
COSMOS	Hasinger	D/EU
XMM 13H	McHardy/Page	UK

http://cxc.harvard.edu/xraysurveys/surveys.html November 2006 Chandra Meeting

Survey of surveys (2)





Brandt&Hasinger 2005 ARAA



WHAT HAVE WE LEARNED FROM X-RAY SURVEYS (1)?

- Few keV (< 5) XRB mostly resolved into AGN
- Unobscured and Compton Thin fairly sampled
- X-ray faint sources (starbursts) steep counts
- X-rays detect more AGN than optical
- Compton thick AGN are still missing
- Evolution: what does LDDE mean ?
 - Rapid evolution up to a Lum. Dep. redshift (z ~ 1 for Seyferts 2-3 for QSO) "downsizing"
 High z (>~3) cut-off ?

WHAT HAVE WE LEARNED (2)?

- Type 2/1 fraction decreases with L_X
 The type 2/1 fraction increases with z (?)
 Optical appearance of hard X-ray sources (Type 2 QSO; EROs; X/O; XBONG; ...)
 Host galaxies: red, massive, bulge dominated
- AGN trace the underlying LSS

Census of obscured AGN



The XRB synthesis provides an integral constraint (Gilli, AC, Hasinger 07)

Red -> unobscured

Blue -> Compton Thin

Black -> Compton Thick

The evolution is folded with the adopted XLF

AGN DOWNSIZING



Absorption distr. (L and z depen.)



Gill+07 ; La Franca+05 Hasinger+05

Elusive AGN XBONG-HighX/O-EROs...



XBONG



Search for (X-ray) Type 2 Quasars



Select R-K>5 objects (good optical/NIR data) ->high z

@ high X/O sources → high NH

> Brusa+05 Severgnini+05

Spitzer observations of hard X-ray selected EROs (Pozzi, Vignali, AC+ 07, A&A in press)





6 high X/O X-ray selected EROs AGN Early-type host morphology IRAC and MIPS detected Galaxy+AGN fit

Bolometric correction Plus local Lk vs MBH relation



 AGN hosts (mostly early type morphology) populate the red sequence and green valley

--> AGN activity persist after SF has ended Many hard sources in the red sequence Massive hosts in rich environments

Nandra+06 ; Georgagkakis+06 AEGIS









Prominent Spikes in deep fields



QUESTIONS

- High redshift (z > 2-3) XLF and evolution
- Obscured fraction at z > 1-2
- AGN census (missing Compton Thick)
- X-ray vs optical properties (Type 2 QSO)
- AGN host galaxies (dead red , SF blue, ...)
- AGN vs LSS (Luminosity, redshift, obscuration, ...)
- AGN galaxy co-evolution
- ... and all that I have missed ...

Remember that each science driver defines its own requirement in area vs. depth

MISST (Chandra symposium)

- Impact of environment on galaxies
- Are AGN created by mergers?
- History of accretion
- Physics geometry and evolution of absorption
- Physics and evolution of groups ad clusters
- Effect of AGN feedback on galaxy hosts, groups and clusters
- Cluster mass function at high z and growth of structure



Ongoing projects and namely AEGIS/COSMOS/ECDFS and Chandra ultradeep (if approved) will surely provide a step forward (especially when combined with deep HST, Spitzer, radio and multicolor coverage) not forget that for some science Chandra is better than XMM (i.e. high z XLF; merger triggered AGN activity; starburst galaxies)

ISSUES

- Optical identifications and spectroscopic redshifts or highly reliable photo-z
- X-ray incompleteness; X-ray spectral quality
- Better analysis of existing data is possible (and needed)



Brusa+07 COSMOS survey

LBG at z=3 with HR=-1 actually has N_{H} =1.5E23

Nandra (Chandra meeting)

2

SSA22a-D13 z=3.353

5

BEFORE MOVING ON

- Lessons from the past -- i.e. Type 2 QSO predicted by AGN UM turned out to be different from what expected ... not the high luminous cousins of Sey 2
- It may be the same for CT ... the sources of the > 5 keV
 XRB might not be as we expect them to be ...
- Fully exploit the multi-wavelength power of present X-ray surveys (now Spitzer ... Herschel & ALMA coming soon)

Selection of type-2 AGN at high z with MIPS/IRAC (Lacy+04; Martinez-Sansigre+05; Alonso-Herrero+06)



S(24 micron) > 300 muJy →sample QSO with L>0.2L* at z=2

S(3.6 micron) < 45 muJy →remove naked type 1 AGN and low-z type-2

350 muJy < S(1.4GHz) < 2 mJy →ensure candidates being radio-quiet QSO rather than SB and filter out radio-loud objects

21 candidates

10 spectroscopically confirmed at z=1.4-4.2, with no BL! The remaining are blank spectra (ellipticals??)

WHAT's NEXT?

... more X-ray observations might be justified... so what observations do we need?

Infinite depth or infinite (4π) area or some clever trade-off ?

"Infinite" AREA



5-20 ksec exposures to reach 10⁻¹⁴ cgs

6 XMM pointings for 1 sq degree

several tens to 100 square degrees 3-12 Megasec

A few tens (up to 100) z > 4Quasars depending from the high z XLF

First Look Spitzer SWIRE SDSS eq strip

••••

"Infinite" AREA

Advantages : pick up a fraction of mildly obscured AGN presumably missed by SDSS

Disadvantages : Optical spectroscopic follow-up might be time consuming

LBC survey 10 square degrees 2 hours exposure U ~ 28 (AB) S/N = 2 U(Vega) ~ 27 More than enough to identify U dropouts (Similar figure for B dropouts at $z \sim 4$)

Optical to near IR deep photometry for z > 6 CFHTLS Wide Survey ~100 deg2 (u,g,r,i,z) AB~25-26 VISTA (Y,J,H,K) AB~22-23

If contiguous clustering at high z

"Infinite" depth ?



Resolved fraction :

~50 % - 70%

Swift-BAT consistent With INTEGRAL BeppoSAX and close To the HEAO1 value



Model predicted Hard (5-10 keV) logN-logS for CT AGN is steep @ and below The present limits Factor ~4 deeper exp. Factor ~2 fainter fluxes Factor ~3 Number of CT (~15 in CDFS; Tozzi+06; Georgantopoulos+06) Good X-ray spectra Stiil above the confusion Limit in the 5-10 keV

Francisco Carrera talk



"Infinite" depth in the E-CDFS?



Excellent deep , multi- λ coverage

Compton Thick absorption Beyond the local Universe

Host galaxies of heavily obscured AGN

Iron lines intensity and profiles at high - z (individual and stack)

ALMA & Herschel photometry

Pathfinder for XEUS deep fields

SUMMARY

Ongoing and planned/proposed Chandra/XMM deep/large X-ray surveys should help us to better focus the scientific drivers for either a ultra-large or ultra-deep XMM survey or even both ...

Now I would go for Ultra - Deep

> 3 Megasec