

International X-ray Observatory High-Redshift Science Panel

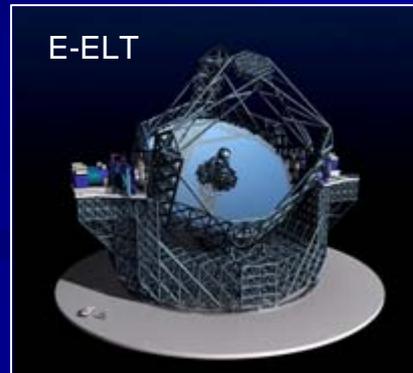
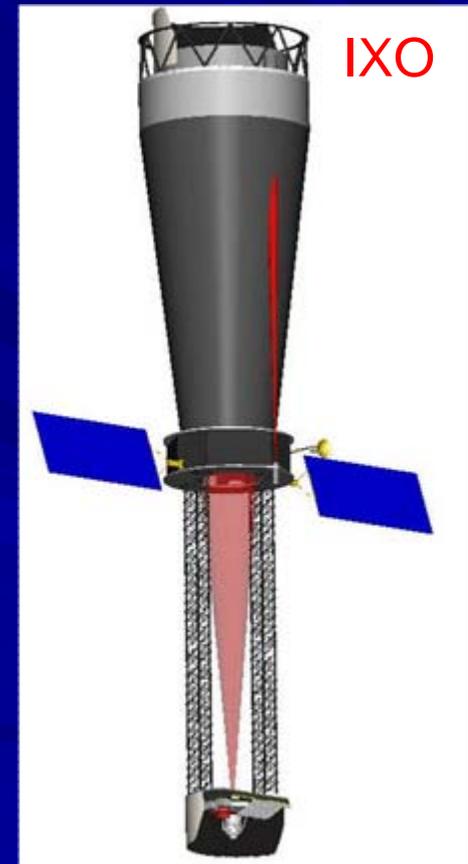
Are the first SMBHs to form in the Universe feeding and growing in the same way as local ones?

How do these first SMBHs influence the first galaxies?

Future Observations of First Galaxies

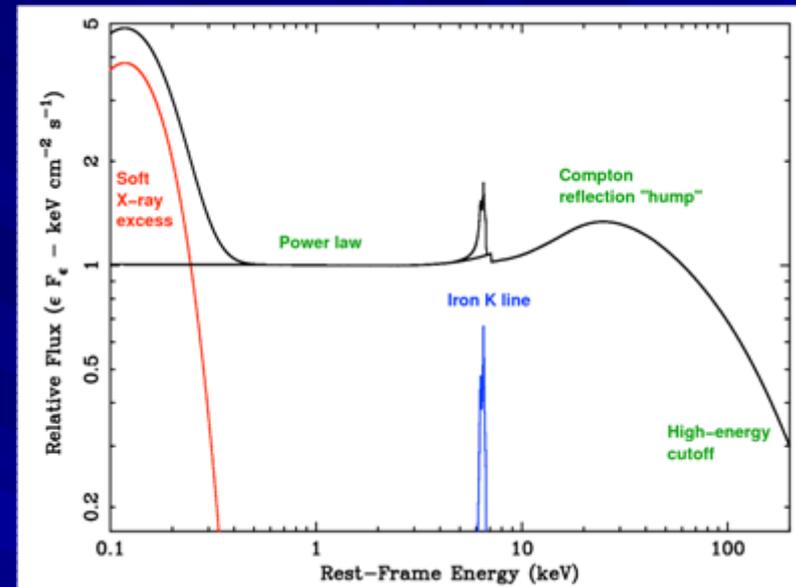
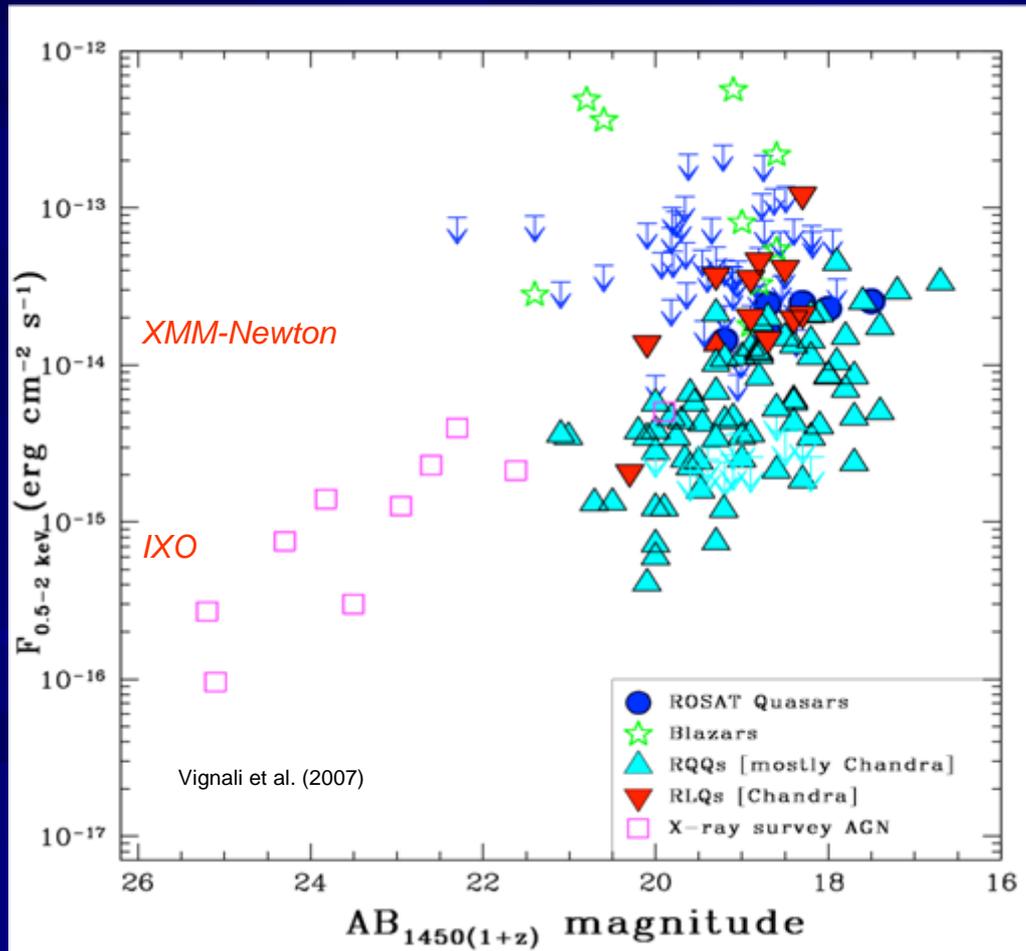
Starlight from First Galaxies

Accretion Light from First Galaxies



IXO Needed for Effective X-ray Spectroscopy of Most $z > 4$ AGNs

X-ray vs. Optical Flux for $z > 4$ AGNs

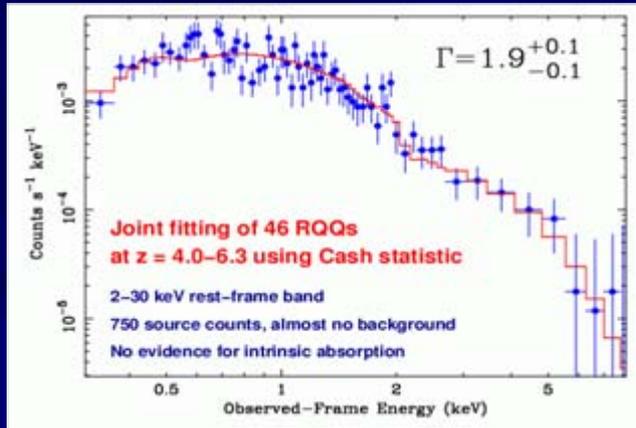


Photon starvation prevents use of spectral diagnostics.

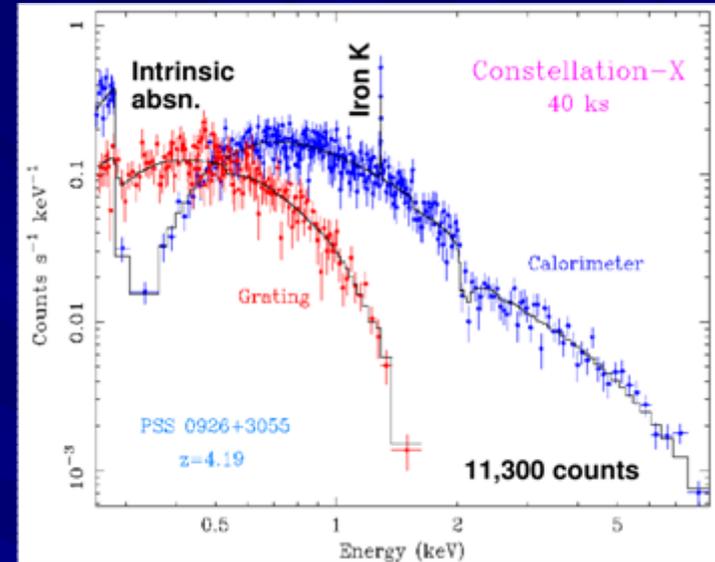
IXO can probe to $\sim 10^7 M_{\text{Sun}}$ at $z > 4$ with spectroscopy.

Accretion Mechanisms of First SMBHs

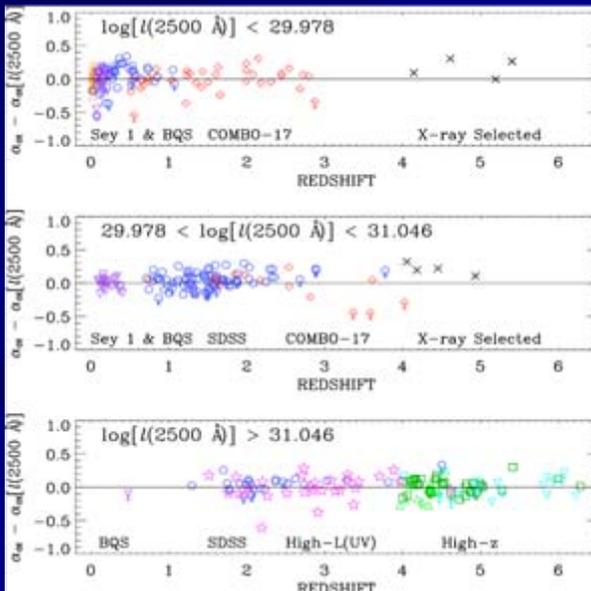
Basic Chandra Joint Fitting - Vignali et al. (2005)



High-Quality IXO Spectra – 1000-80000 counts



L_X / L_{Opt} – Steffen et al. (2005)



X-ray continuum shape – L / L_{Edd} indicator

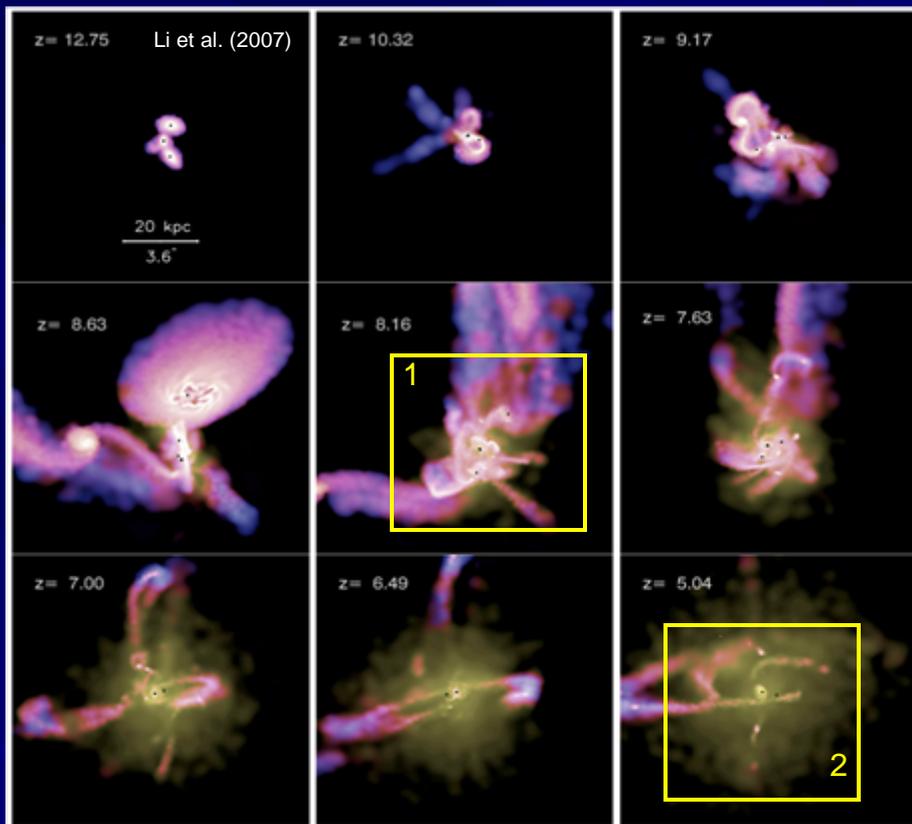
Iron K lines – Disk ionization, rotation, Baldwin effect, multiple SMBHs

Compton-reflection continuum – Disk ionization

Variability – Relations to SMBH mass and L / L_{Edd}

Environments and Effects on First Galaxies

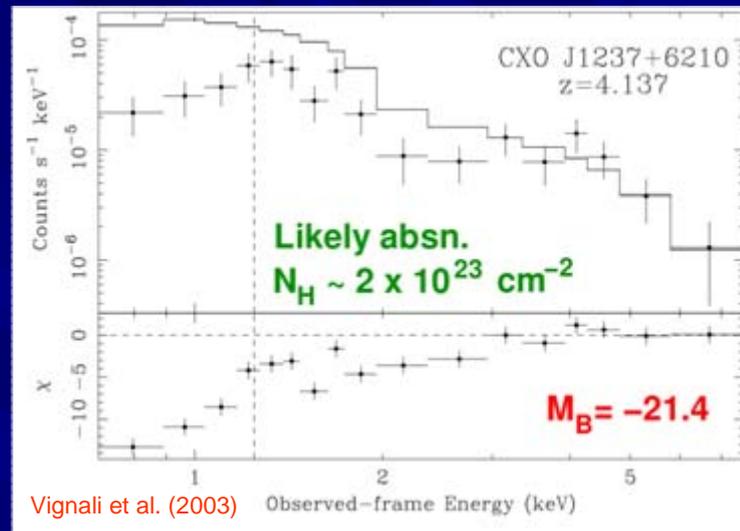
Gas density and temperature for high-redshift quasar host



Gas-rich mergers common in most massive halos.

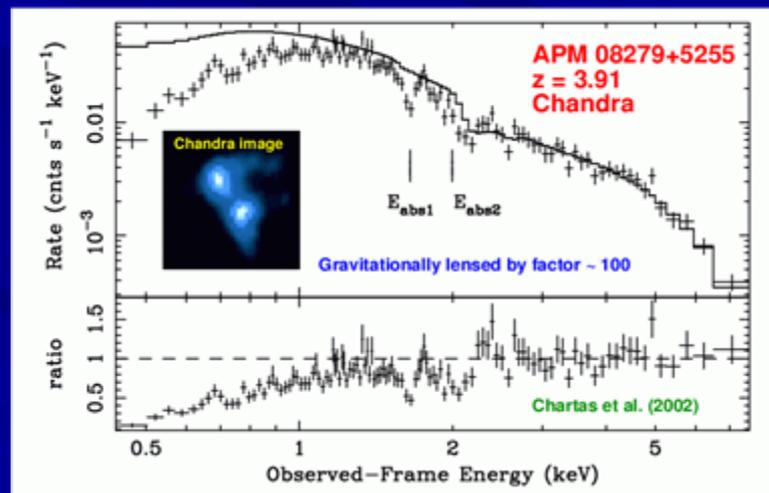
Strong circumnuclear obscuration that is ultimately removed by SMBH-driven outflow.

1. An Obscured Protoquasar?

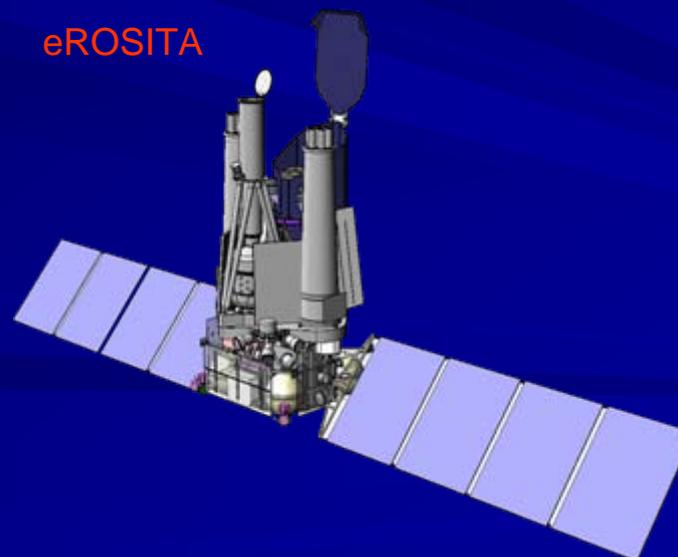


Vignali et al. (2003)

2. X-ray BALs showing high-redshift feedback in action?



Abundant High-Redshift Targets for IXO



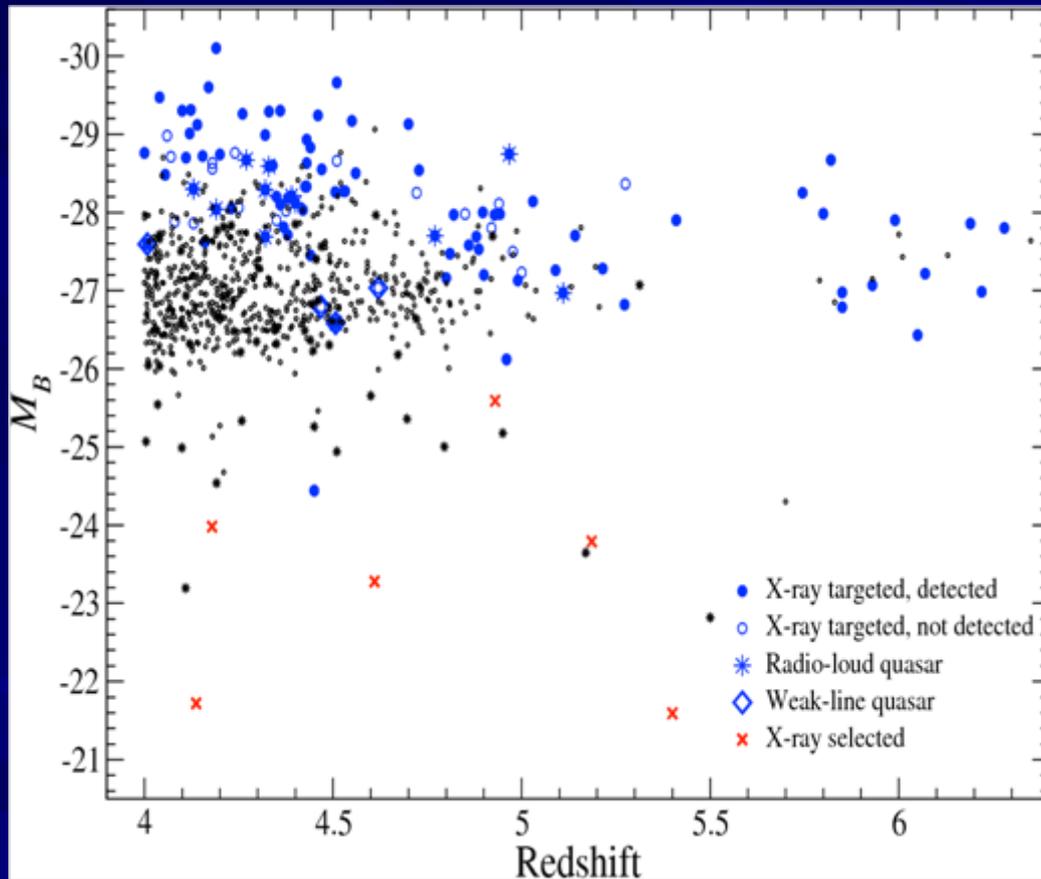
Expect ~ 30000+ AGNs at $z > 4$ by time of IXO

LSST alone will deliver ~ 1100 AGNs at $z \sim 6.5-7.5$

AGN redshift frontier should be at $z > 8$ or greater

IXO High-Redshift AGN Program

Known and X-ray Observed AGNs at $z > 4$



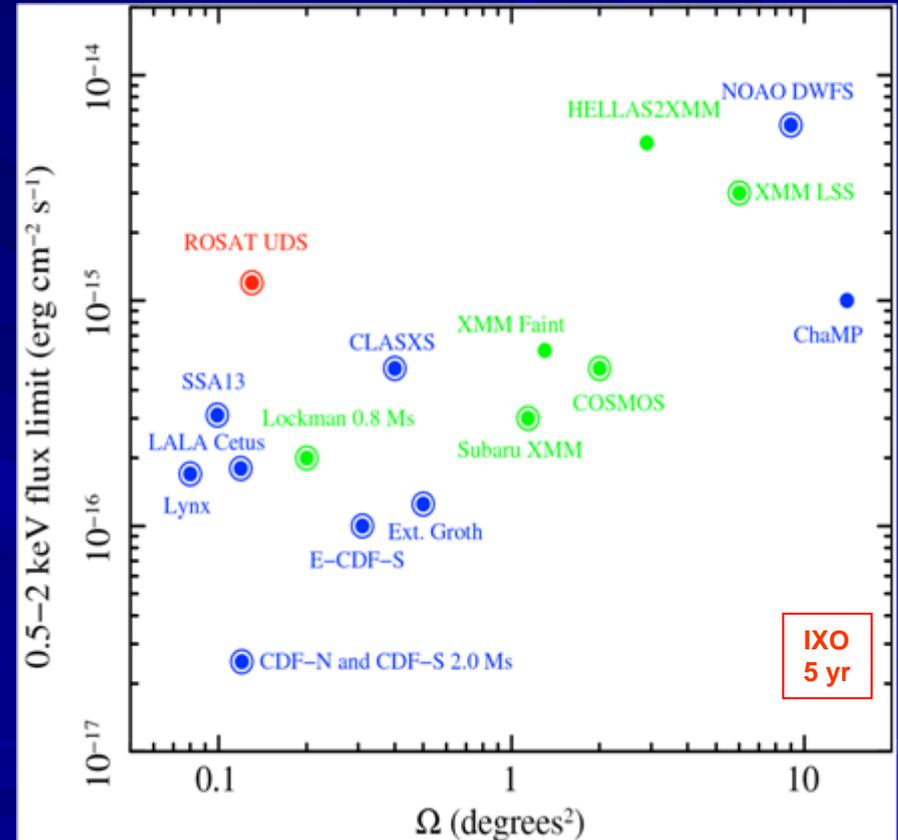
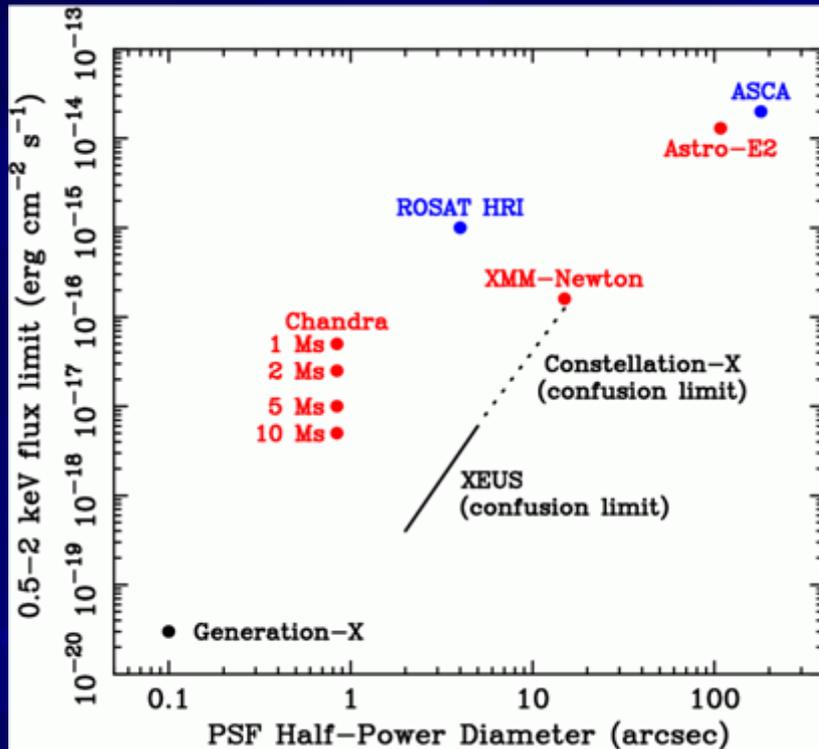
50-100 representative AGNs at $z \sim 4-8$ covering luminosity-redshift plane (2-4 Ms).

Deep exposures on ~ 10 luminous quasars at highest redshifts possible - templates for spectral understanding (2 Ms).

Remarkable $z > 4$ quasars – weak-line quasars, APM 08279+5255, blazars, etc. (2 Ms).

Serendipitous survey of obscured AGNs at highest redshifts (Free!).

Effects of Improved FOV, Angular Resolution, Collecting Area



5 year AGN yield at $z > 4$ is $\sim 2000+$

Find obscured AGNs missed by other techniques.

Science Panel Members

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