SMBH growth

$$\frac{dM}{dt} = \frac{l\,(1-e)}{e}\frac{M}{t} \qquad l = \frac{L_{bol}}{L_{Edd}} = 1 \qquad t \sim \frac{Mc^2}{L_{Edd}} = 0.45 Gyr$$

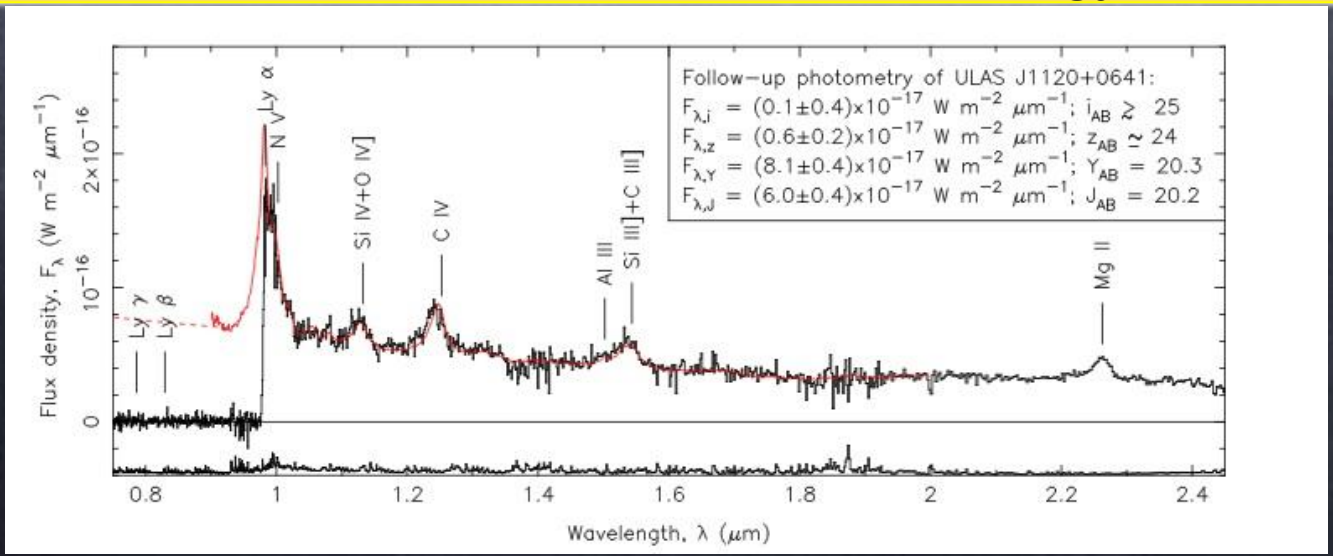
$$M(t) = M(0)\exp\left(\frac{1-e}{e}\frac{t}{t}\right)$$

L*CDM*

t=t(z=20)-t(z=6)=0.77 Gyr e=0.1 M(0)=150$M_\oplus$ $\rightarrow$ M(t)=~$10^9 M_\oplus$ ~OK

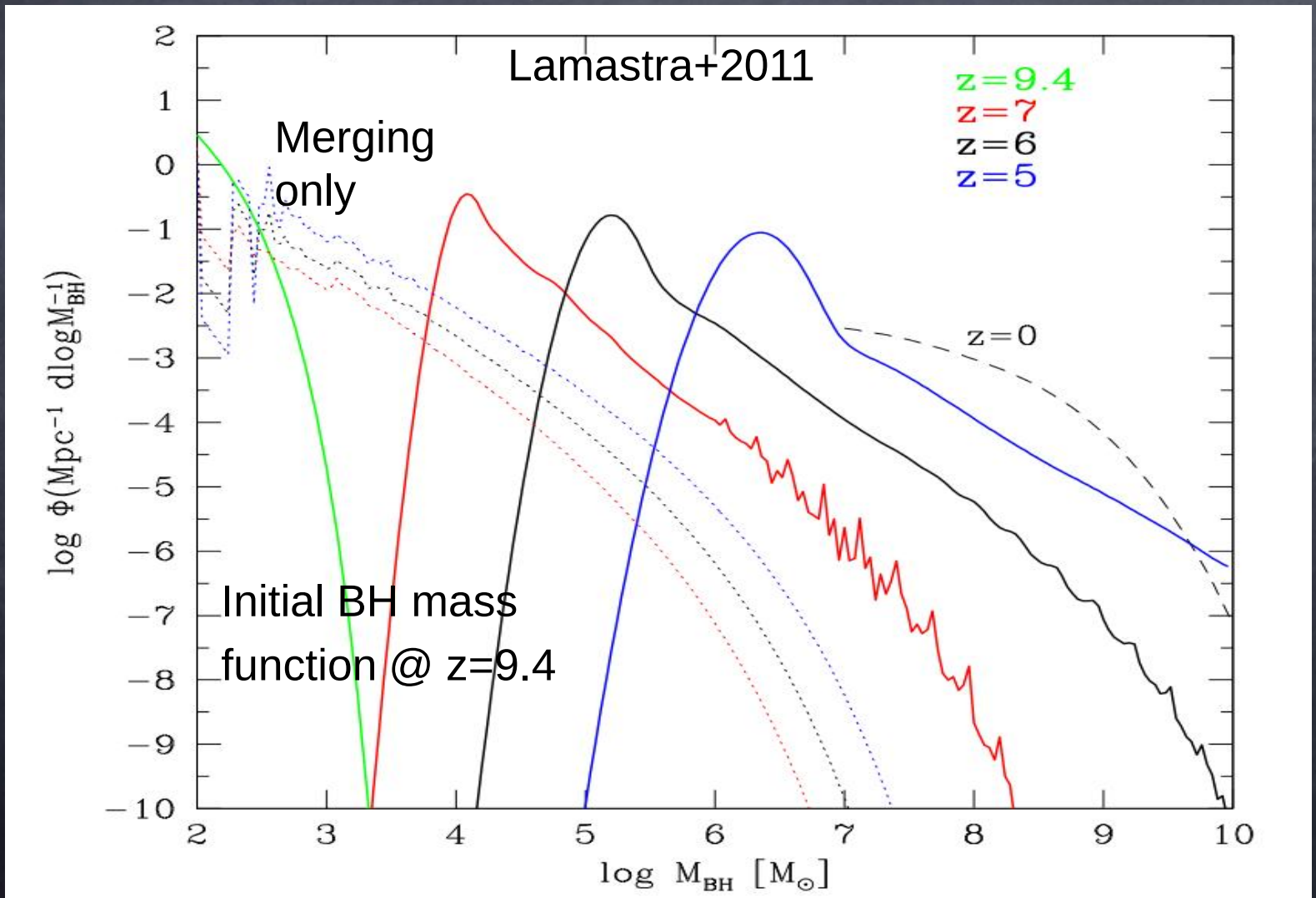
t=t(z=20)-t(z=7)=0.60 Gyr e=0.1 M(0)=150$M_\oplus$ $\rightarrow$ M(t)=~$2\times10^7 M_\oplus$ NO!

Mortlock+2011 z=7.085 M_{BH}~2 10^9 M_{Sun}

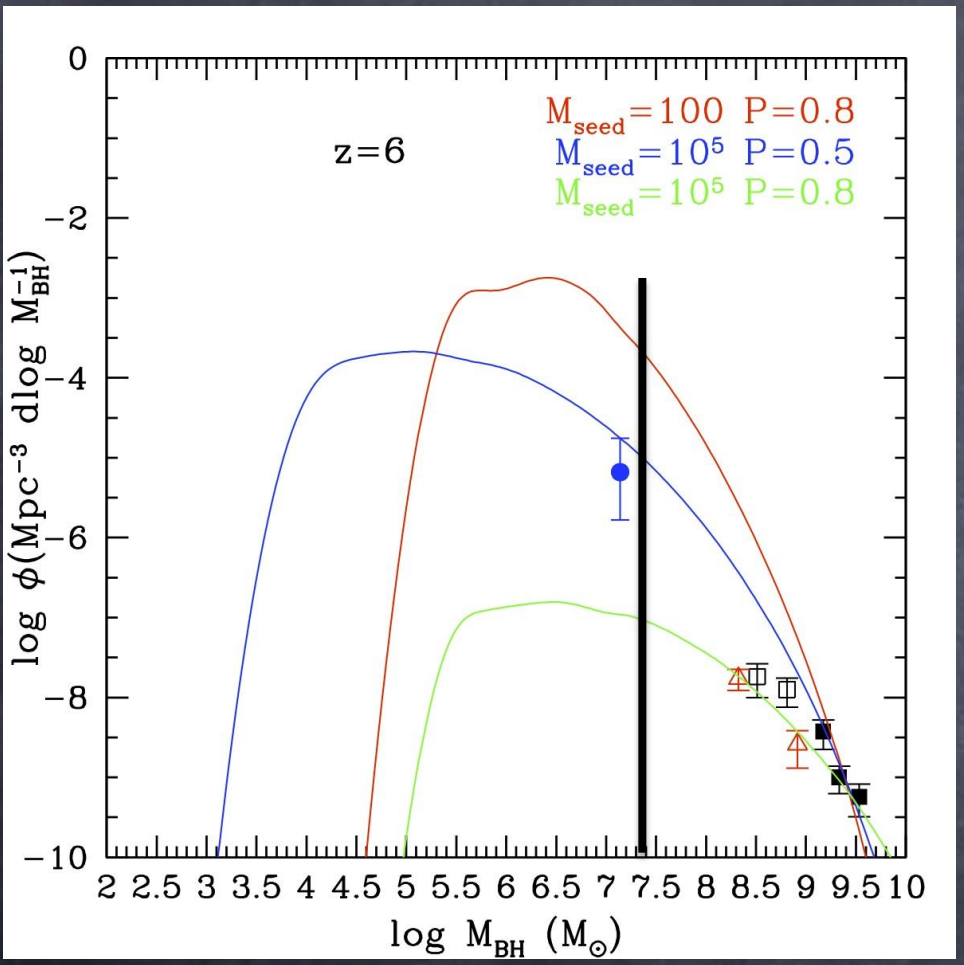


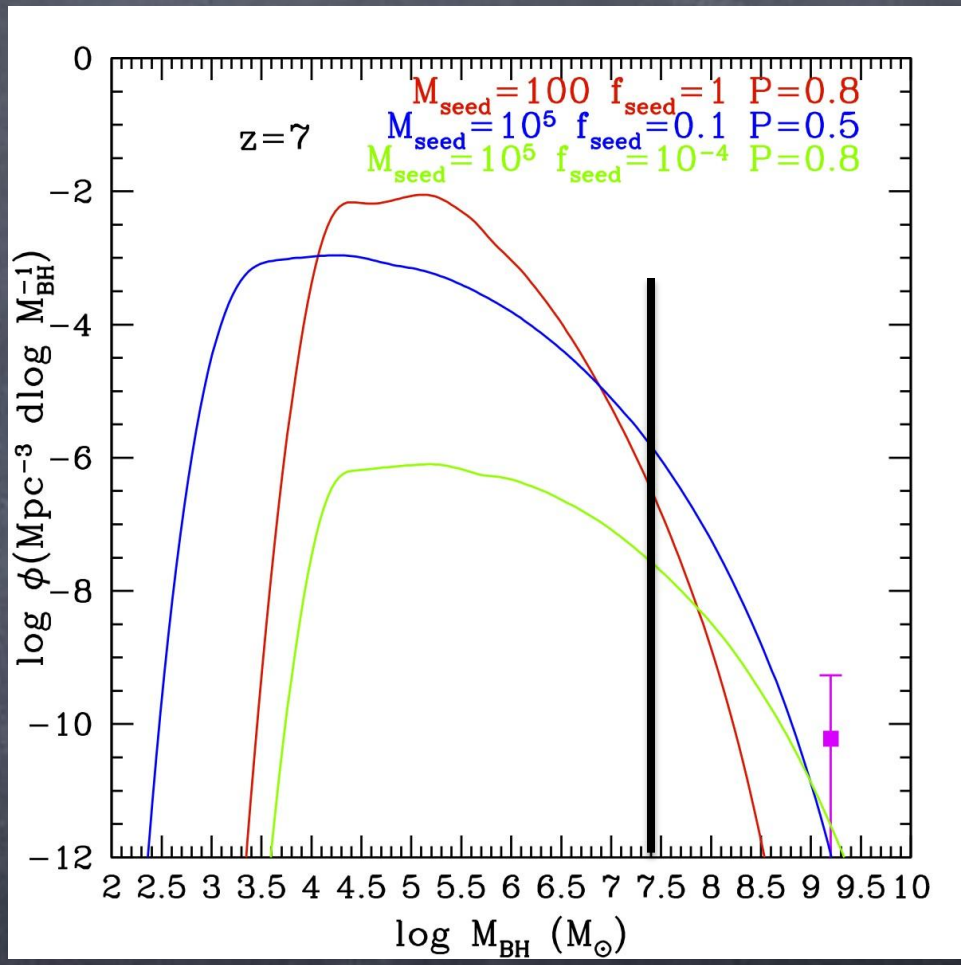
BH growth models

Initial condition: $M_{BH}=M_{halo}/10^6$ >$100M_{Sun}$. BH accretion only would rigidly shift the initial BH mass function to higher masses. ***ε=0.1 fix***



High-z BH mass functions





P=fraction of Cosmic time with Eddington accretion

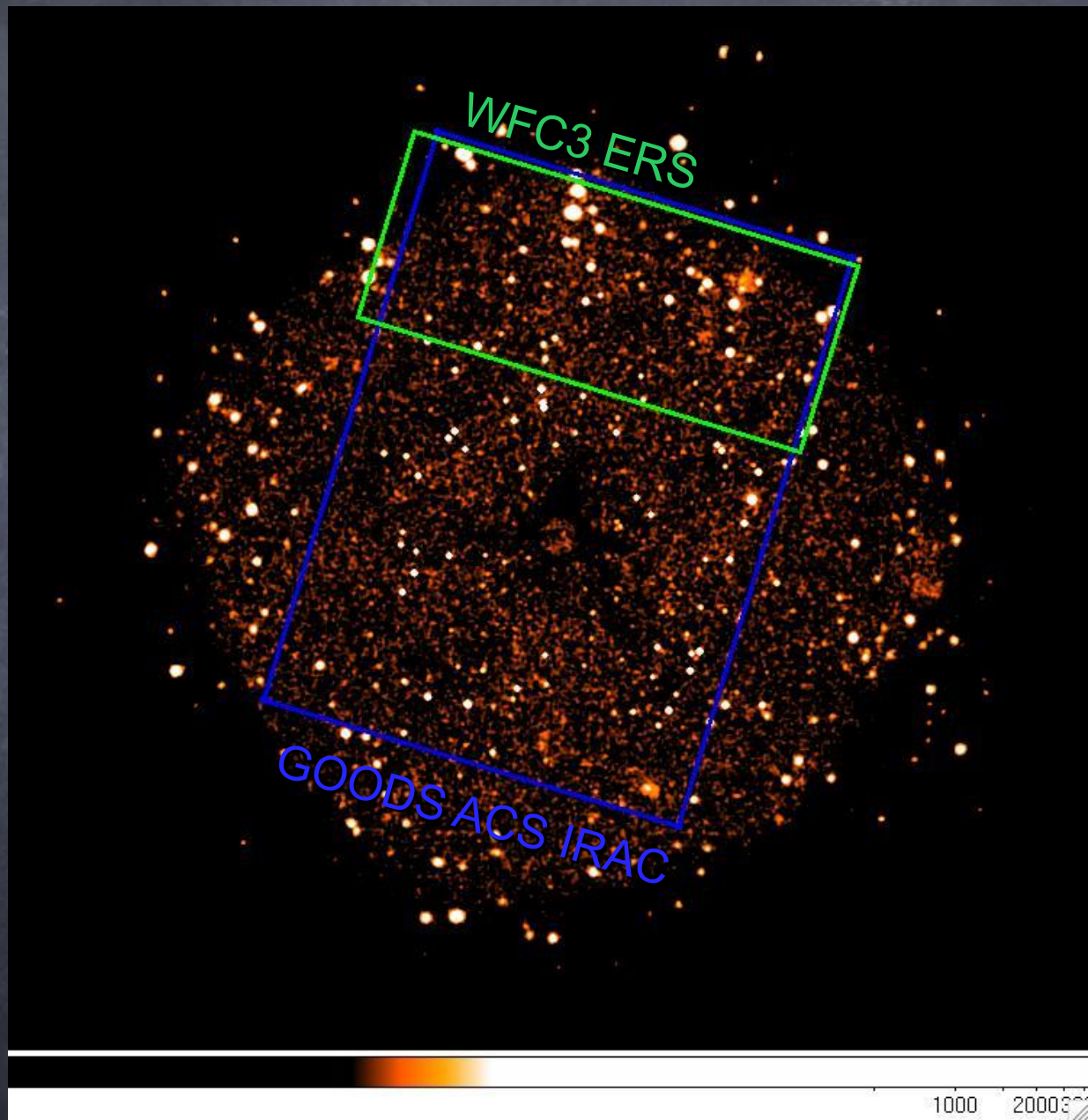
fseed=1 fseed=0.1 fseed=0.0001 fseed = fraction of halos with BH seed

Sy-like AGN at z=6 and QSO-like AGN at z=7 can distinguish between models

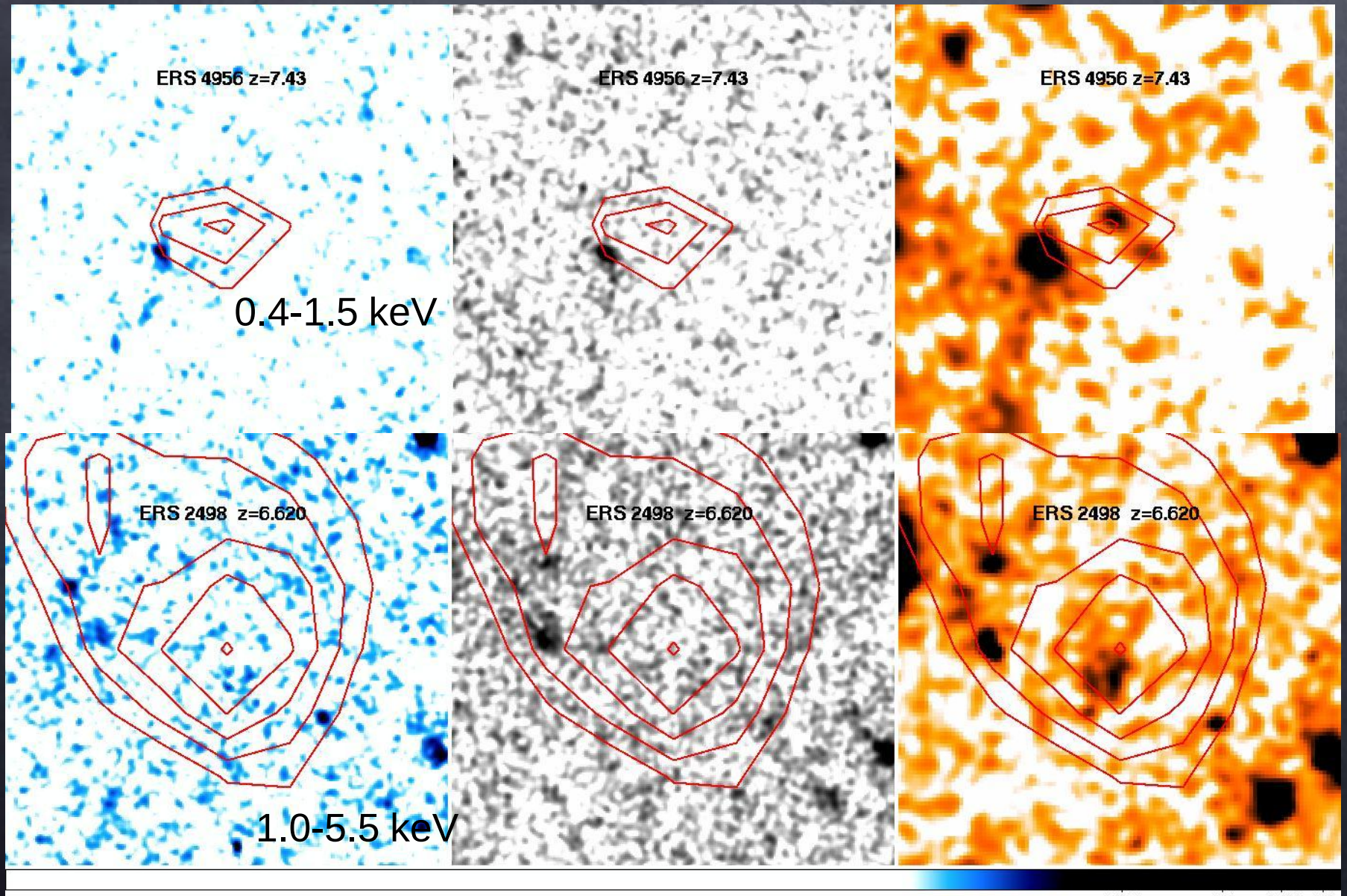
High-z AGN in the CDFS 4Msec field

Pilot program on the CDFS4Msec:

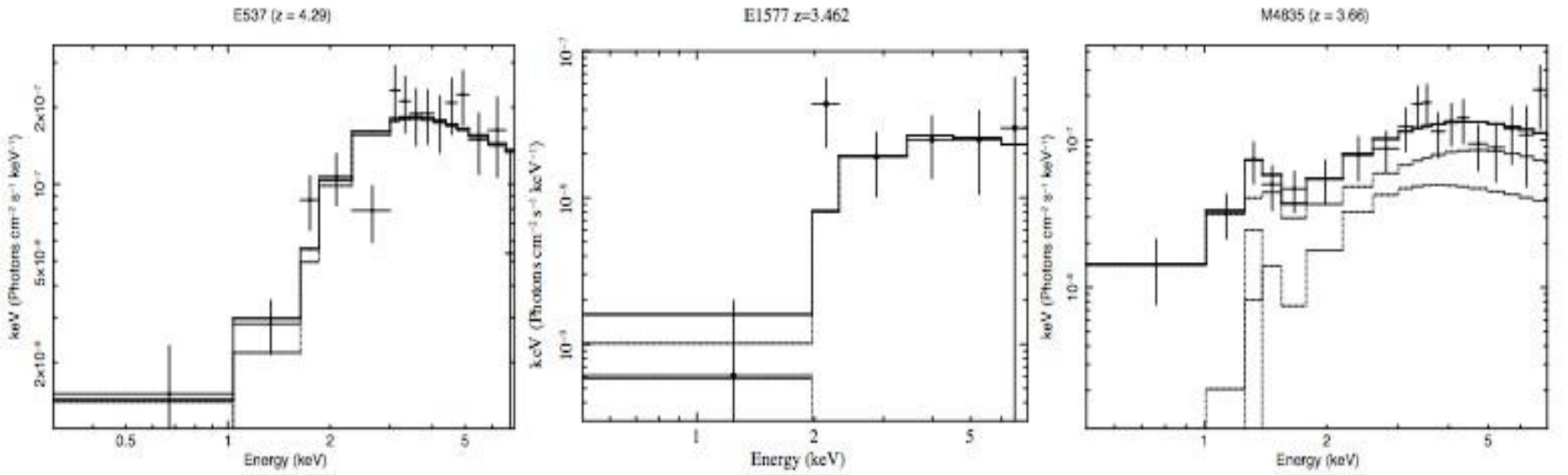
- Use ERS and GOODS-MUSIC galaxy catalogs and photo-z
- search the X-ray band that maximize the number of detected counts. ***ephot***, first step toward multi-dimensional source detection



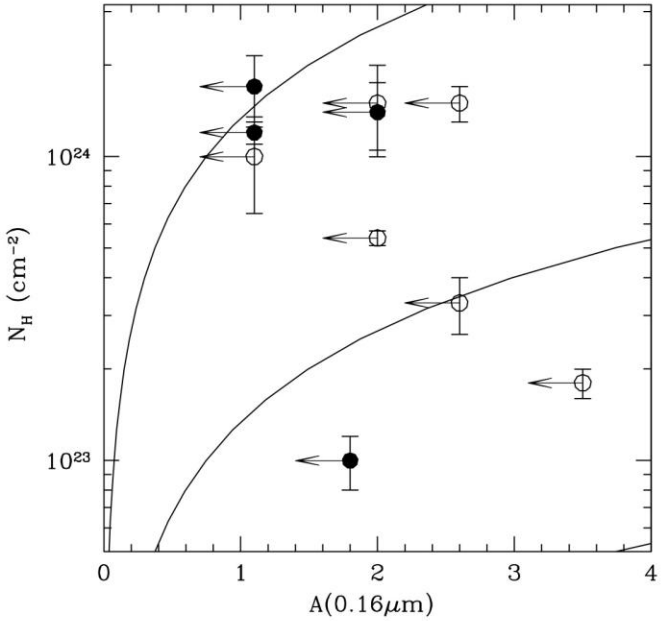
High-z AGN in the CDFS 4Msec field



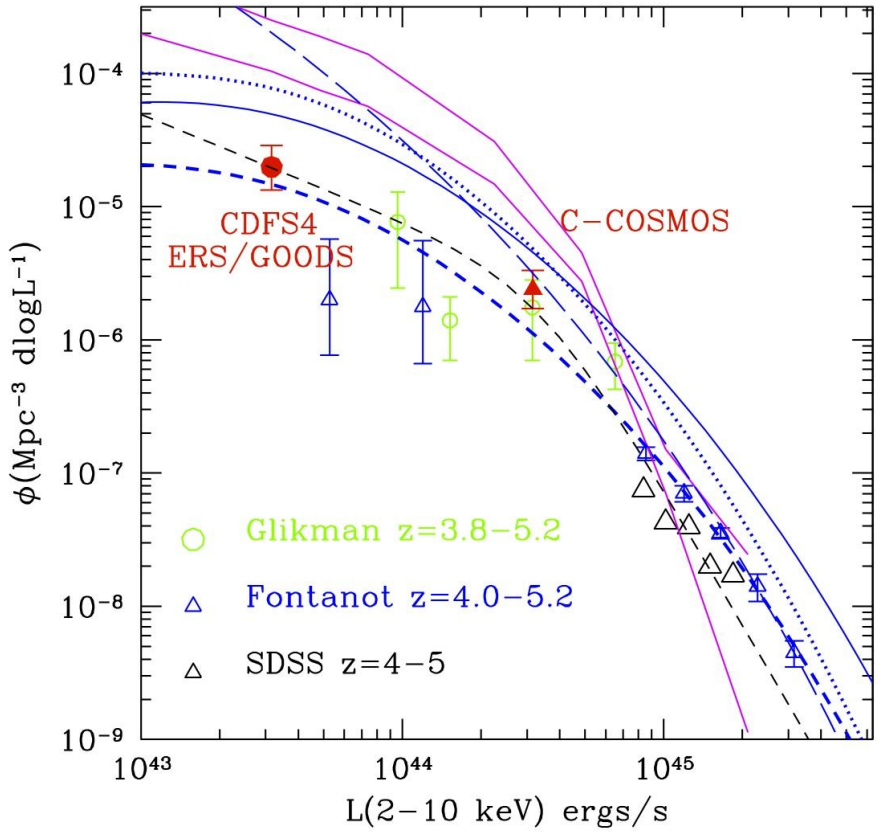
Low-mid luminosity AGN

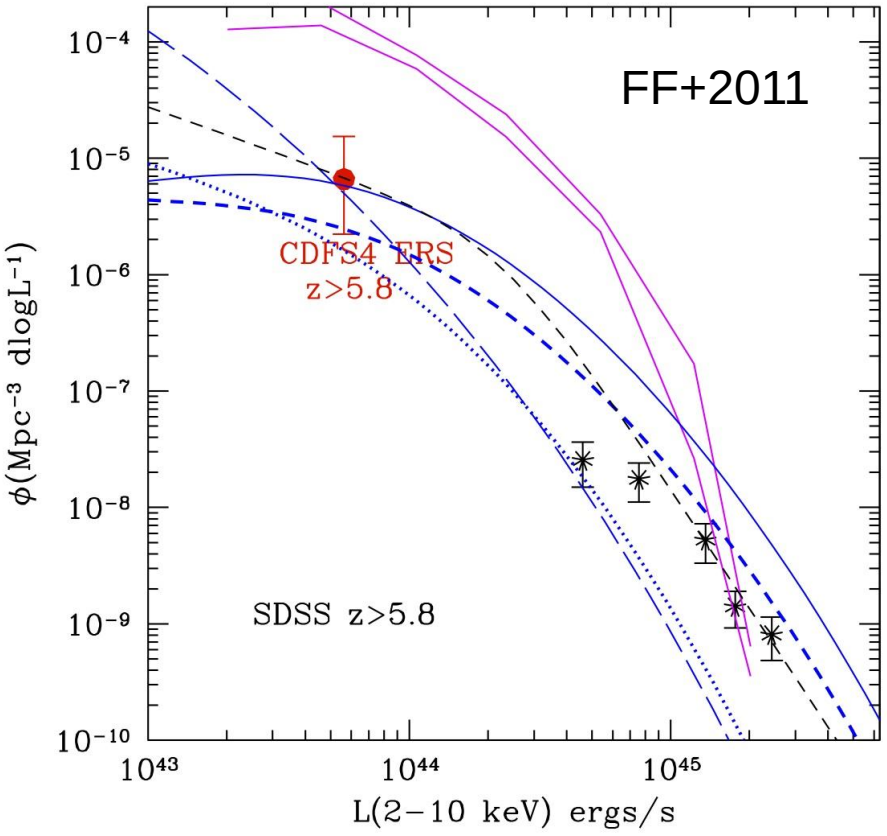


- Large fraction of X-ray obscured AGN at z>3:
  - 3/17 GOODS-ERS AGN are CT (18+17-10%)
  - 4/11 GOODS-MUSIC AGN with optical spectrocopy are CT
  - All with very low optical extinction



High-z AGN L.F. evolution





Comuving volume @ z=6-7 is $10^{6.9}$ Mpc^3/deg^2, thus 10^{-6} AGN/Mpc^3 translate in ~8 AGN/deg^2