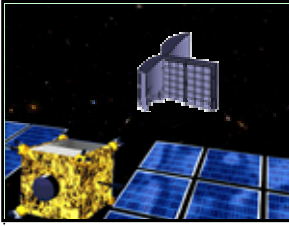




X-Ray Evolving Universe Spectrometer (XEUS)



There are two big science themes for a for a new large X-ray telescope XEUS (also addressed as “NGXT”) which is going to be part of the ESA cosmic vision programme (2015-2025): the **quest for the first massive Black Holes** and the **evolution of the cosmic web in connection with the life cycle of matter**.

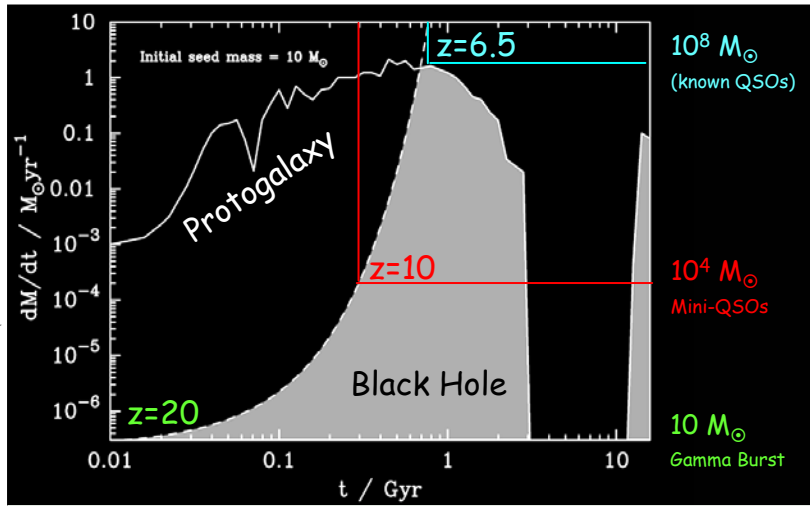
The first Black Hole:

Before the first star can form, the Universe has to cool down to ~100 K to allow molecular hydrogen cooling.

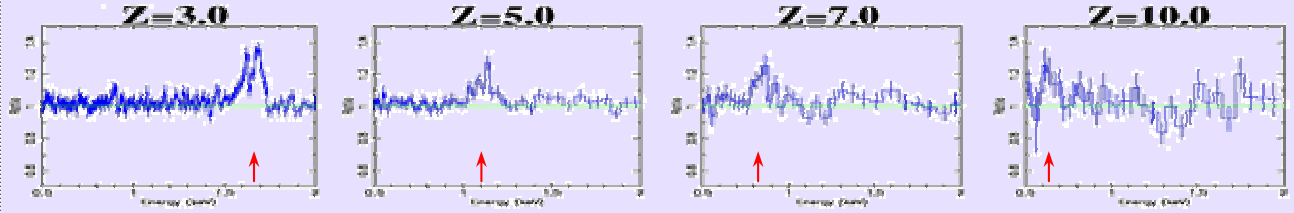
The first star is expected to be massive (~300 M_⊙), shines for ~1 Million years, sterilizes its cosmic environment, explodes in a GRB hypernova, pollutes its environment with heavy elements and leaves a seed Black Hole.

While the galaxy forms, the BH continues to grow exponentially, quickly producing a powerful quasar, if enough fuel can be provided.

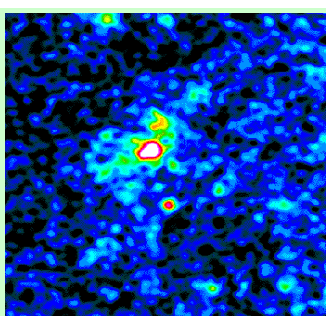
Sensitive X-ray observations can study the first GRB explosions and can detect mini-QSOs with 10⁴ M_⊙



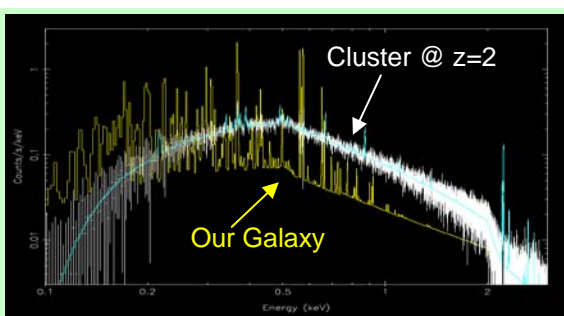
Need New Generation X-ray Telescope to detect and study BH in conjunction with forming galaxy ($S_{\min} \sim 10^{-18} \text{ erg cm}^{-2} \text{ s}^{-1}$).
10⁴ M_⊙ @ redshift 10 detectable.



XEUS view of relativistic Fe line: We get this or better quality for many objects in each field



Enrichment of elements in early clusters XEUS:
Simulation of a 5 keV cluster at z=2
Element abundances of O, Ne, Mg, S, Si, Fe, ...



Scientific Requirements:		Technology development required:	
Sensitivity:	10-18 erg cm ⁻² s ⁻¹ → > 10 m ² area @1 keV	- Factor ~10 lighter mirrors, high precision optics	
Energy band:	0.1 to ~100 keV	- Formation flying, 1 mm ³ accuracy over ~50 m	
Angular resolution:	2-5 arcsec	- Imaging calorimeter, better than 2 eV	
Spectral resolution:	1-2 eV	- Large, fast active pixel detector with μs timing	