ATHENA

The WFI survey and the formation and growth of the earliest SMBH

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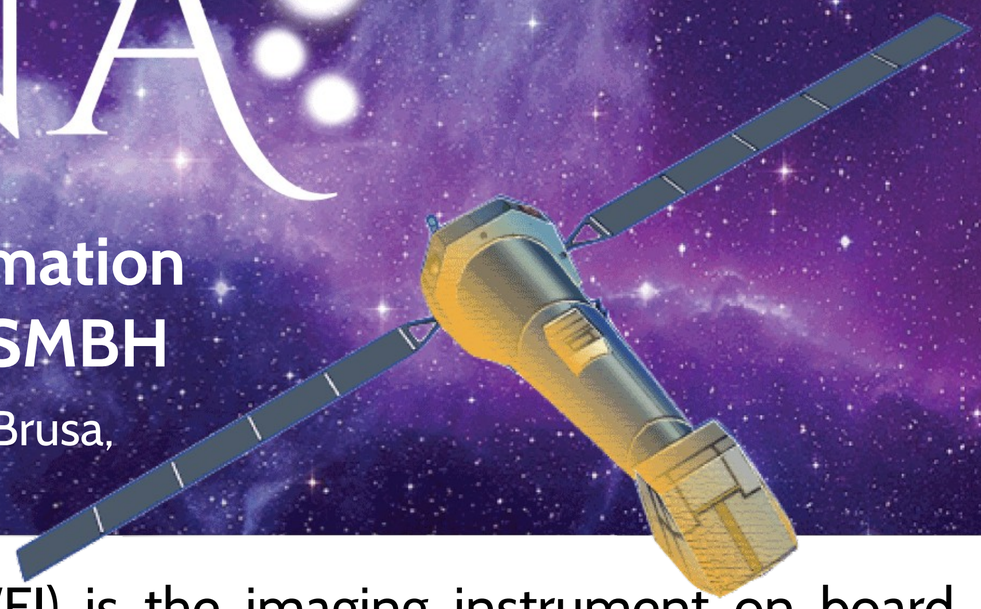
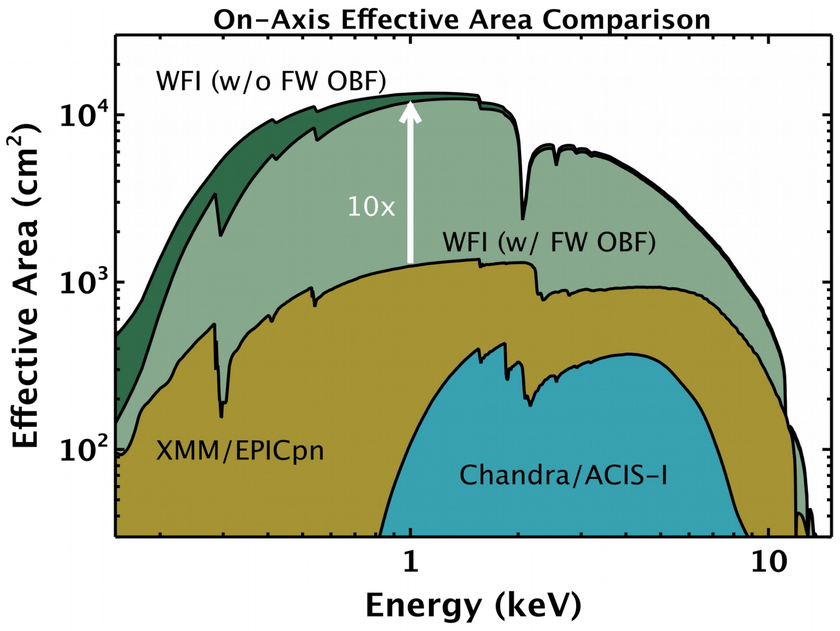
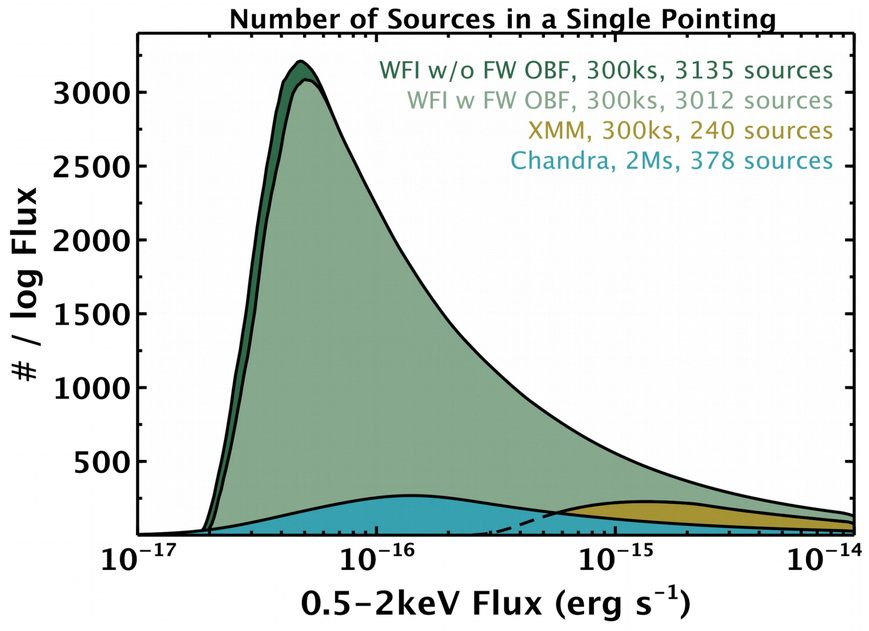


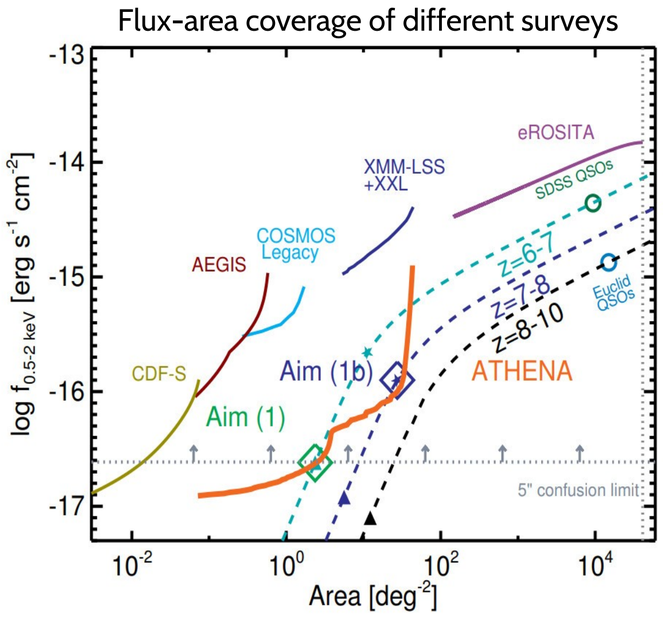
Athena (Advanced Telescope for High ENergy Astrophysics) is the next **ESA** X-ray observatory, selected in the Cosmic Vision program to address the Hot and Energetic Universe scientific theme. It has passed Mission Formulation Review in November 2019 and is due for adoption in 2021 and launch in early **2030s**. Will carry the X-ray Integral Field Unit (**X-IFU**) for high spectral resolution, and the imaging instrument **WFI**.

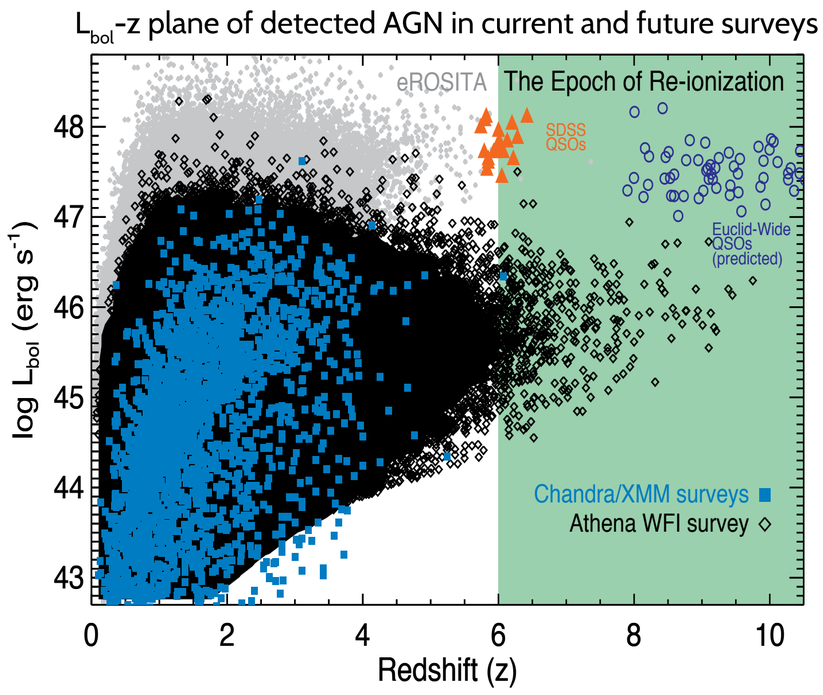
The **Wide Field Imager** (WFI) is the imaging instrument on board Athena. The large Field of View of **40'×40'**, the stable PSF of **5" HEW** across most of the FoV and the large Effective Area ensure an improvement of factor **>10** on the survey capabilities of Athena with respect to current X-ray telescopes.



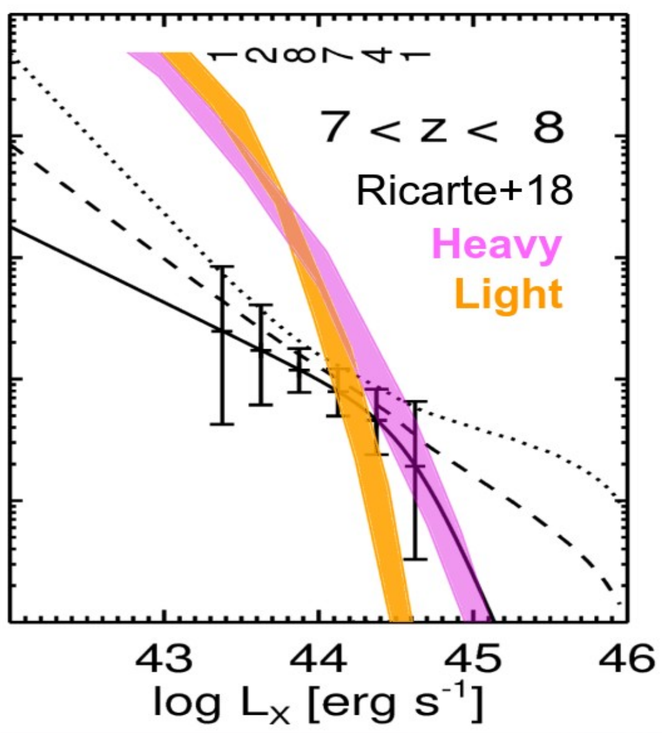


Athena will spend ~**25Ms** during its first four years, performing a two-tiers WFI survey, to detect tens of early groups forming at z>2, thousands of heavily obscured AGN at cosmic noon (z~2-3), ionized absorbers and disk winds in QSOs up to z=4, and **hundreds of z>6 AGN.**



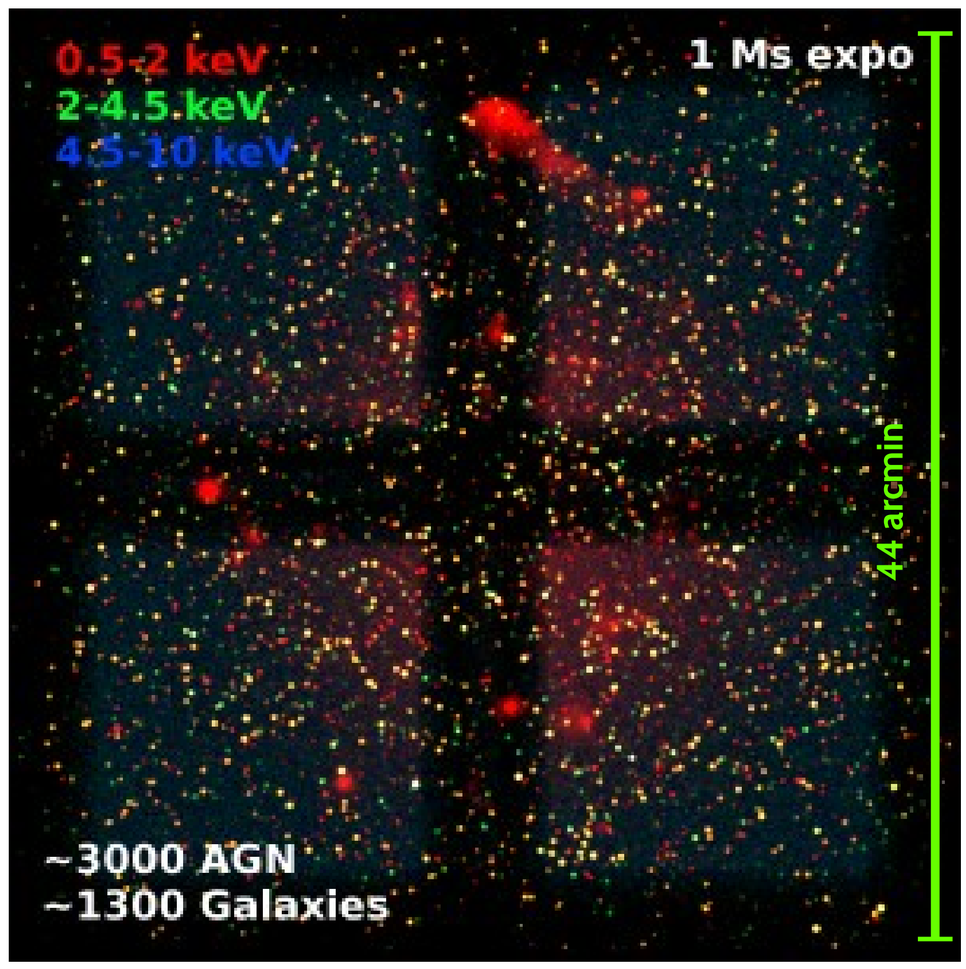


The sources at z>6 detected in the simulated fields will allow us to test **SMBH seed** models, that now provide widely different predictions at these redshifts. On the right, the reconstructed LF at 7<z<8 compared with predictions from one SMBH seed model (Ricarte et al. 2018) with two different seeding mechanisms (**heavy** for direct collapse BH and **light** for PopIII remnants).



We are developing end-to-end simulations with **SIXTE**[1] to test the WFI survey performances. We are testing different state-of-the-art Luminosity Functions and spectral prescriptions. One deep exposure will return a number of AGN and galaxies comparable to those collected so far by Chandra and XMM-Newton with 10s of Ms in several fields.

False color image of a simulated 1Ms deep field with Athena-WFI



1 https://www.sternwarte.uni-erlangen.de/research/sixte/