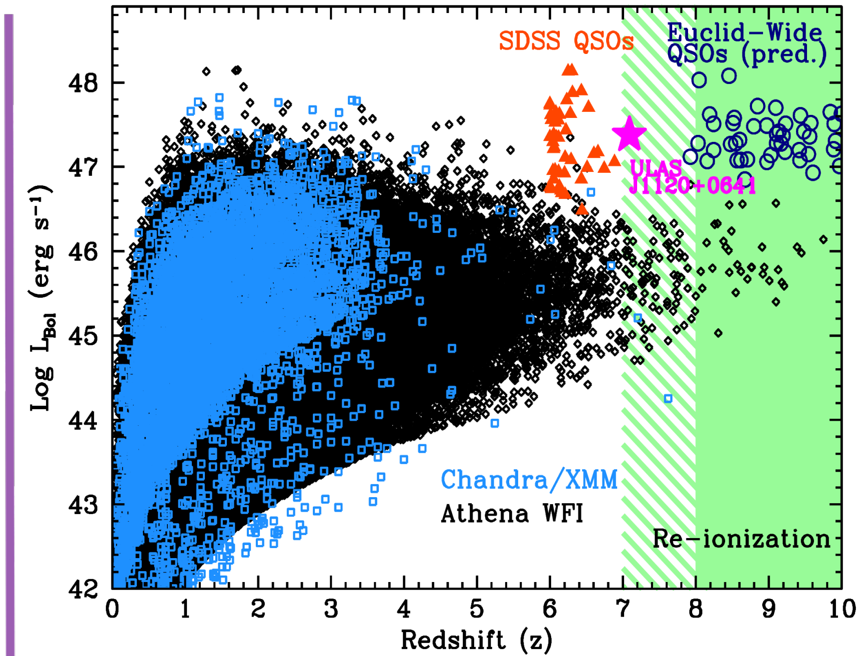
BABY BLACK HOLES AT THE COSMIC DAWN OF THE ENERGETIC UNIVERSE

Accreting black holes with masses several billions larger than that of the Sun when the age of the Universe was about one twentieth of the current one, are routinely discovered by optical surveys. This very observational fact raises several profound questions such as: How did the turbulent gas in the early Universe manage to quickly cool and form seed black holes? How did these seed black holes acquire mass at a rate exceeding the limits imposed by accretion physics?.

Even more puzzling is the relation between the mass of the central black hole and that of the host galaxy and whether it was established at the birth, or is the consequence of some unknown process at work since the early phases.
Large optical and near-IR surveys have identified massive black holes in the early Universe (z > 6), but are inevitably biased towards the most luminous Quasars. X-ray surveys can reveal more typical growing black holes, but current surveys with Chandra and XMM-Newton have yielded only a handful of X-ray selected Active Galactic Nuclei (AGN) above z=5 and almost none at z > 6.

To shed new light into the birth and early evolution of the first luminous objects in the Universe we need to uncover the bulk of the population of young accreting black holes at z > 6. They are much more difficult to detect than the big monster Quasars hosting billion solar mass black holes.
Also, they remain elusive because the majority of the accretion energy -- which can easily exceed several billion times the Sun's luminosity -- is absorbed by thick layers of dust and gas and, hence, escapes direct optical detection, but not in X-rays. Uncovering and studying the physics and the evolution of young and obscured black holes is one of the main objectives of Athena surveys.

Athena, with its unprecedented X-ray sensitivity and wide field of view will profoundly change the current picture. The Athena Wide Field Imager will push the current limits to redshifts as high as 8-10 and reveal typical, moderate-luminosity, obscured AGN, placing vital constraints on the mechanisms driving the initial formation and early growth of black holes during this key epoch. The Athena multi-tiered surveys will also probe the epoch of Re-ionization when the first light at the cosmic dawn started to break down the neutral hydrogen in the intergalactic space into protons and electrons. Energetic X-ray photons will provide deep insights on the formation of the first accreting black holes and their interplay with the rapidly evolving surroundings.



Predictions for the redshifts and luminosities of ~600,000 AGN that will be identified with a multilayered 1-year Athena WFI survey, including >400 sources at z > 6, compared to current Chandra and XMM-Newton surveys. Athena will identify AGN that are ~2 orders of magnitude fainter than current optical and near-IR surveys (e.g. SDSS) pushing the redshift limits much beyond that of the current record holder at z~7.1. Athena will discover more than 120 moderate luminosity AGN at z>7 and well within the Re-ionization epoch, which according to the most recent measurements, is found to lie in the redshift range ~7.5-9.5. The X-ray sources will provide an essential complement to the luminous Quasars that will be identified by Euclid.

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