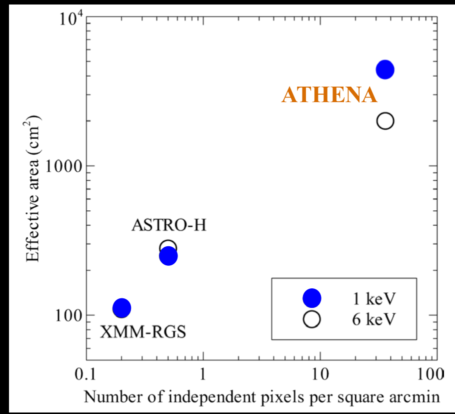
MISSION OVERVIEW

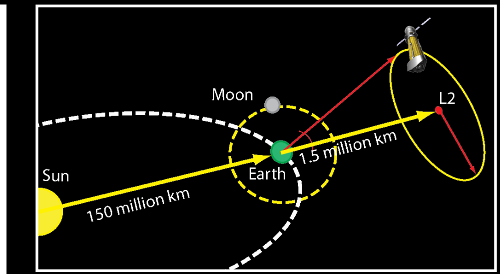
An ESA observatory-class mission, with a 5 year lifetime (10 years consumables), with all systems using proven technology, launched onto an L2 halo orbit by an Ariane V.

KEY REQUIREMENTS

Spectral Revolving Power:	3 eV for a 2 arcmin Field of View
Bandpass:	0.1 - 15 keV
Effective Area:	1.0 m² @ 1.25keV 0.5 m² @ 6 keV
Spatial Resolution:	10" HPD with a goal of 5"
Field of View:	25' arcmin with a goal of 50'
Count Rate:	1 Crab with >98% livetime



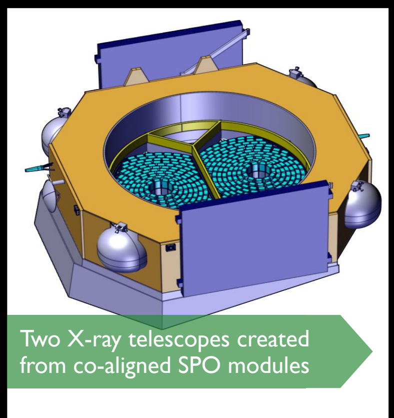
ATHENA effective area vs number of independent pixels per arcmin² compared to ASTRO-H and XMM spectrometers. This emphasizes the dramatic gain in spatially resolved high-resolution spectroscopy, which will open new territory in many fields of Astrophysics.



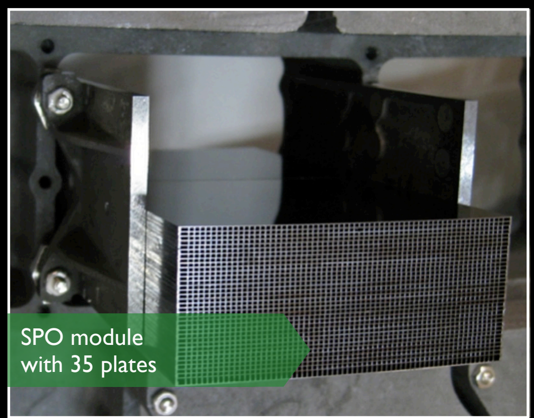
ATHENA will be launched into a zero delta-V L2 insertion orbit, ensuring high (>80%) efficiency for observations with a stable environment and no eclipse periods.

TELESCOPE CONFIGURATION

ATHENA will have two co-aligned X-ray telescopes, which make use of a novel light-weigth high performance X-ray optics technology developed in Europe under ESA auspices: Silicon Pore Optics (SPO).



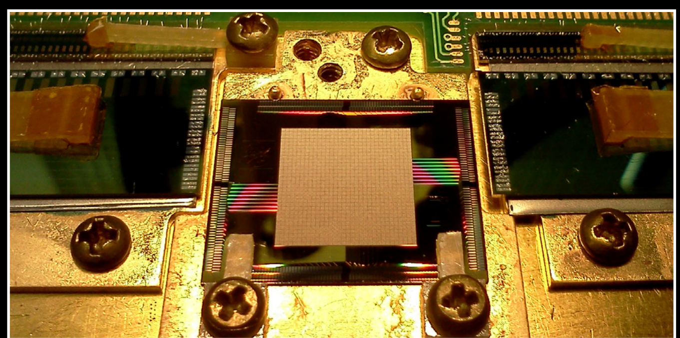
Two X-ray telescopes created from co-aligned SPO modules



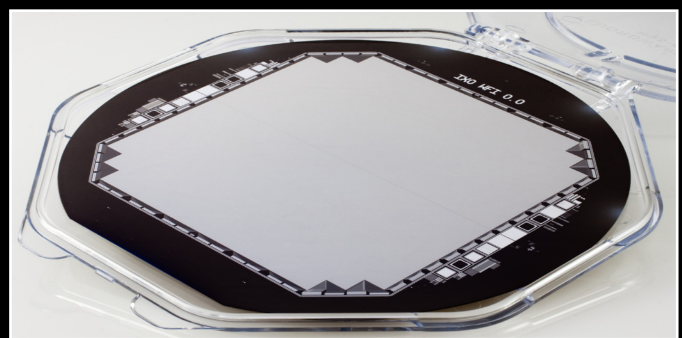
SPO module with 35 plates

ATHENA spacecraft in operations

INSTRUMENTS



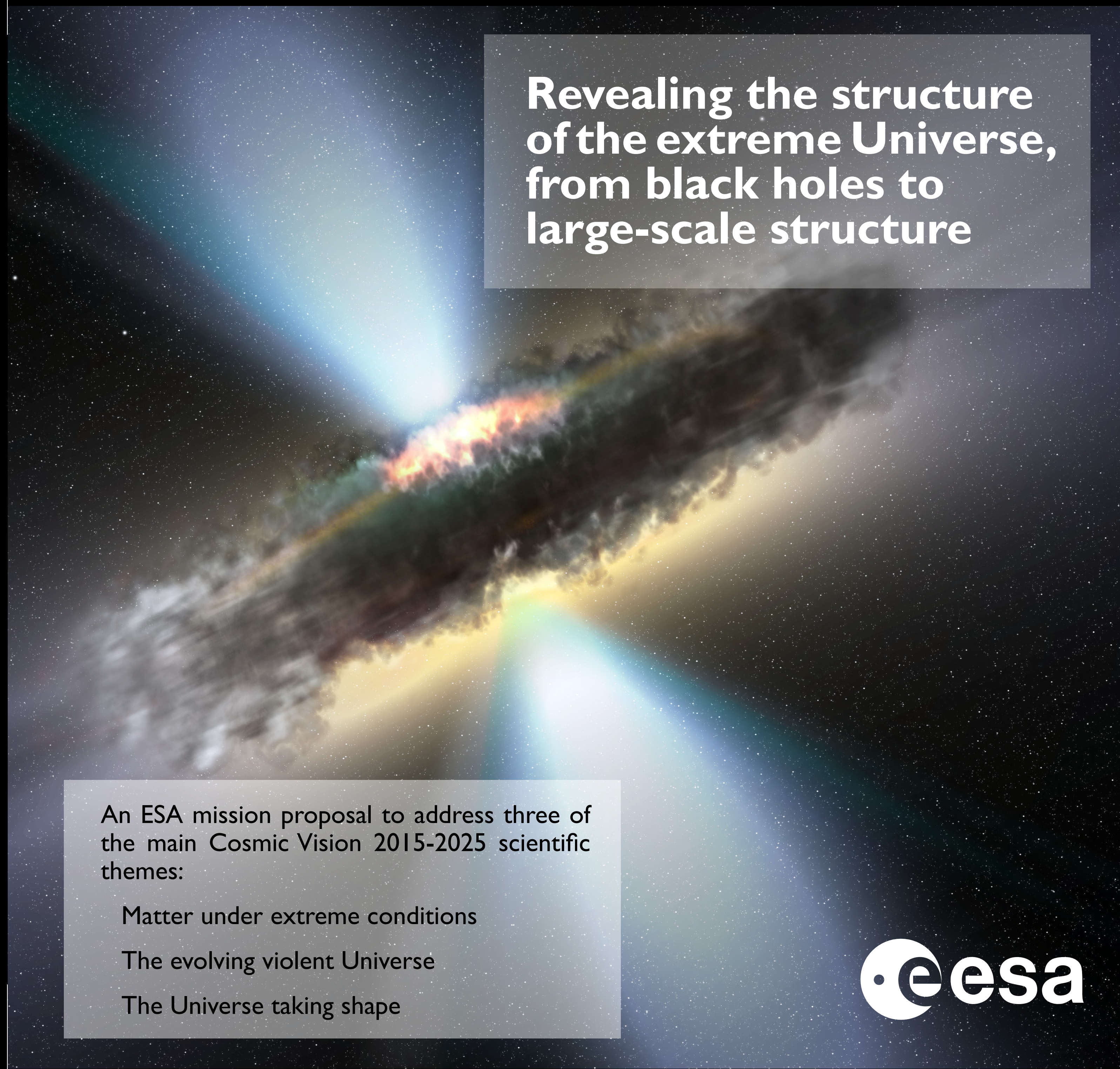
X-ray Microcalorimeter Spectrometer (XMS) provides imaging high-resolution spectroscopy (ΔE=3eV) with a closed-loop cyrocooler and no expendable cryogen. The array has size 32x32 with 300 micron pixels. The XMS is an "integral-field spectrometer in the soft X-ray band.



Wide Field Imager (WFI) provides a 25 arcmin Field of View with moderate spectroscopy (ΔE=150 eV @ 6 keV) using silicon DEPFET technology. The effective area of ATHENA in the WFI energy range is more than a factor of 5 larger than previous X-ray missions.

ATHENA

Advanced Telescope for High-ENergy Astrophysics



Revealing the structure of the extreme Universe, from black holes to large-scale structure

An ESA mission proposal to address three of the main Cosmic Vision 2015-2025 scientific themes:

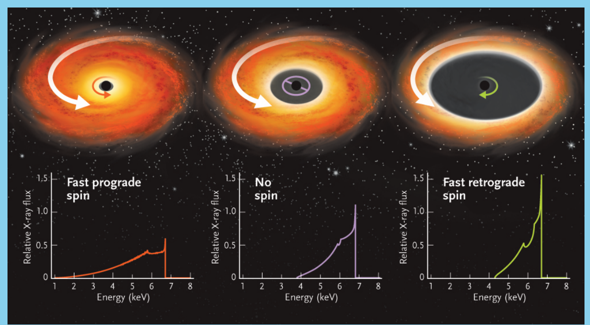
- Matter under extreme conditions
- The evolving violent Universe
- The Universe taking shape

esa

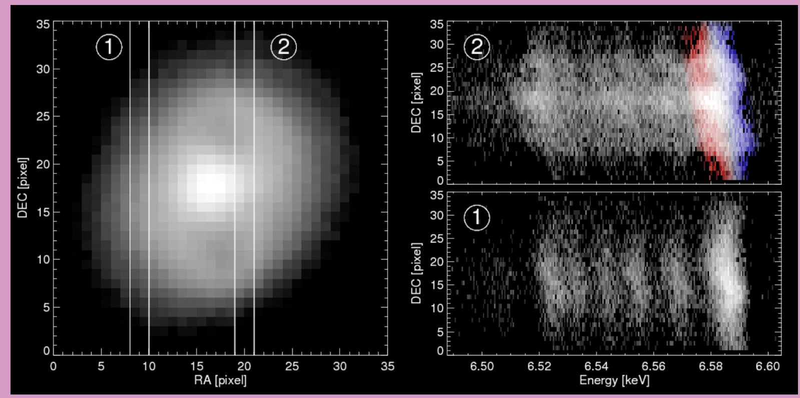
ATHENA will observe matter in the strong gravity regime within a few gravitational radii of the event horizon of black holes. Large gravitational redshifts, extreme light bending and time delay effects introduce distinctive spectral and timing signatures in the X-ray emission. These general relativistic effects will be readily measured by ATHENA.

ATHENA will measure the spin of astrophysical black holes through a variety of independent and complementary techniques.

ATHENA will enable multiple independent constraints to be obtained on the mass and radius of each neutron star observed, thus giving insights into the densest form of observable matter in the Universe and testing Quantum Chromodynamics.

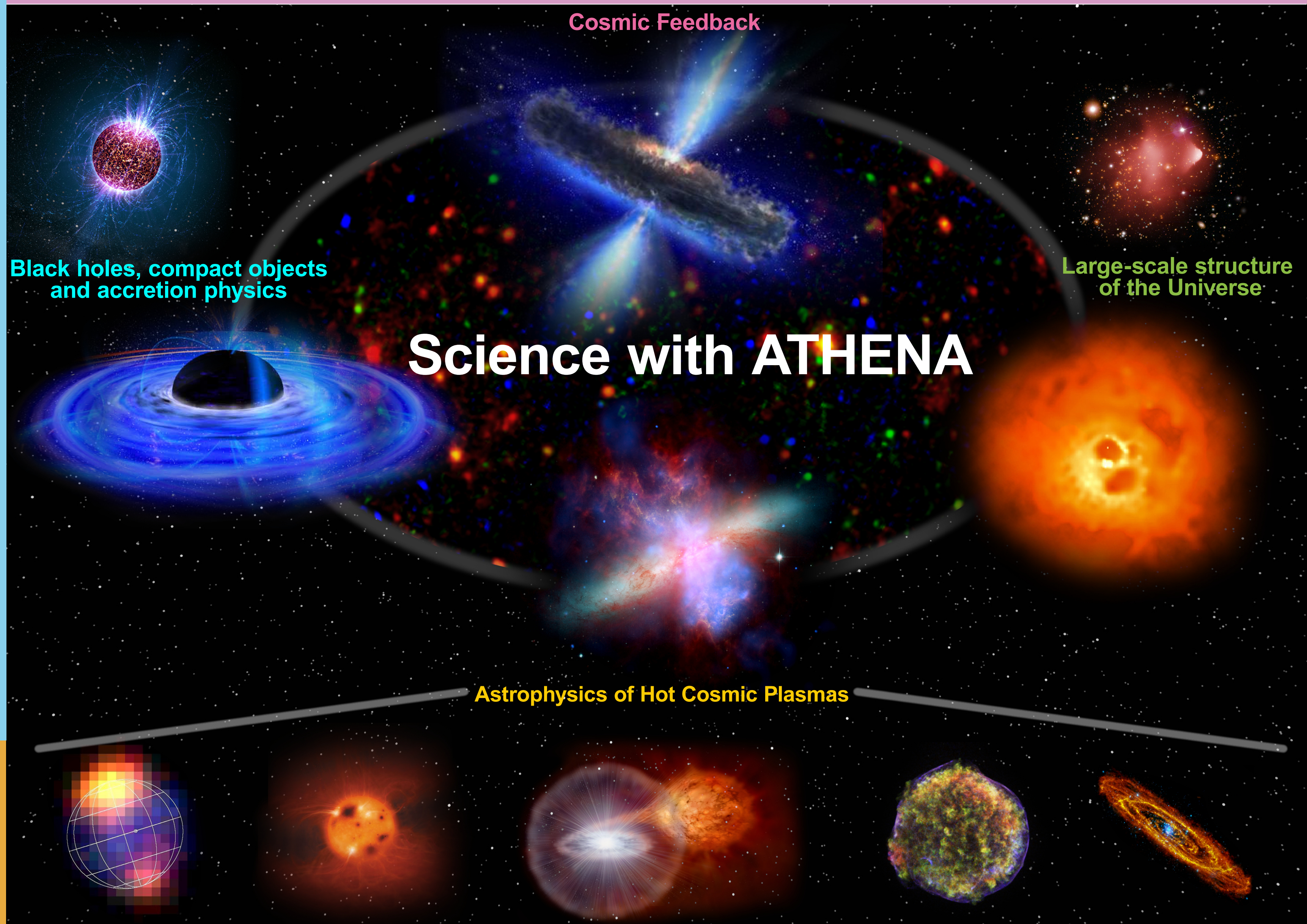


ATHENA will make a major contribution to our understanding of cosmic feedback through the measurement of the volume-filling component of both the energy outflow from supermassive black holes and of the surrounding hot medium in galaxy bulges, groups and clusters. Doppler velocity measurements will enable energetics of feedback to be determined.



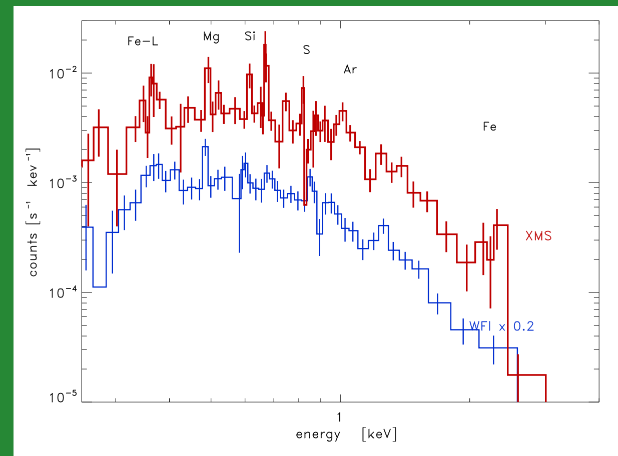
Wide area deep surveys with ATHENA will perform a census of the obscured growth of supermassive black holes in the Universe, which provide the power source driving feedback in the evolving galaxy population.

A survey of nearby AGN spins with ATHENA will probe in a unique way the growth modes of supermassive black holes (and galaxies) in the Universe, finding the relative importance of the cosmic fireworks of "brief" major mergers versus the quiet steady build-up over long times.



ATHENA's capability of performing spatially-resolved high-resolution spectroscopy will enable to discern the fate of the hot baryons within the largest bound structures in the Universe. Motions, turbulence and thermal history of cluster gas will be measured through spatially resolved spectroscopy.

ATHENA has the unique capability to measure the abundances of all elements from C to Zn in the hot cluster gas, which reveals the supernova history and initial mass function of the parent stellar populations.



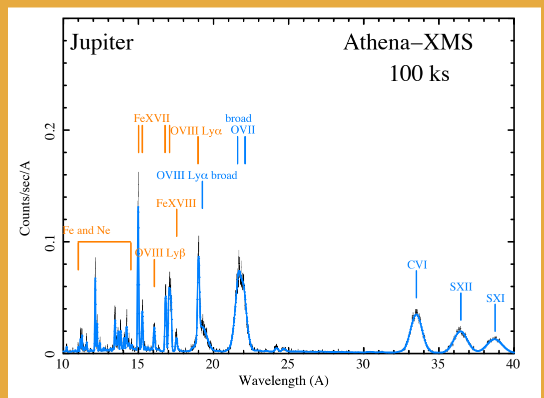
ATHENA will provide cluster mass estimates out to z ~ 2 and thence derive the dark energy density and equation of state out to that redshift. ATHENA will provide detailed parameters and astrophysical insight into clusters in the redshift range z ~ 1-2.

ATHENA will detect the Warm-Hot Intergalactic Medium both in absorption towards bright sources and in emission in filaments around clusters of galaxies, tracing regions where dark matter has accumulated.

ATHENA will diagnose hot cosmic plasmas in all astrophysical environments via X-ray imaging and high-resolution X-ray spectroscopy. In particular ATHENA will:

Measure the solar wind ionic composition and speed at varying distances and ecliptic latitudes via charge exchange X-ray emission in comets.

Conclusively show the effects of X-ray stellar emission on exo-planets and provide unique insights into the atmospheric evolution of habitable planets.



Measure mass loss and magnetic fields in single and binary hot stars.
Explore the variability of the accretion process and rotational modulation due to accretion stream shadowing in classical T-Tauri stars.
Reveal the gas and dust chemical nature of the diffuse interstellar matter in the Galaxy.
Determine the 3D structure of supernova remnants, thereby understanding shock properties and identifying the progenitor star.