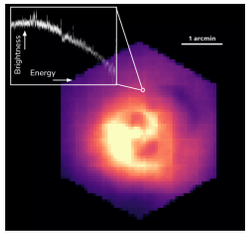
SCIENCE THEME

THE HOT AND ENERGETIC UNIVERSE

The New*Athena* observatory will pursue three main scientific objectives:

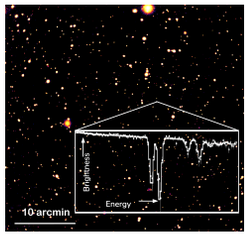
1. Determine how luminous matter assembles into the cosmic web we see today and how supernovae and supermassive black holes impact galaxy formation.



A NewAthena/X-IFU simulation of Perseus cluster with the Simulation of X-ray Telescopes (SIXTE) software: image of the core of the cluster and one single pixel spectrum (inset).

Credit: A. Simionescu.

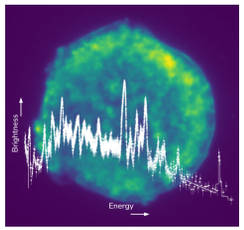
2. Understand the physics of accretion onto supermassive black holes, the launch of powerful outflows and their impact on the evolution of the surrounding environment, to establish how and when black holes form and grow together with their host galaxies.



Deep images, such as this NewAthena/WFI simulation, will reveal growing supermassive black holes out to the epoch of reionization. Inset: an example of a NewAthena/X-IFU spectrum of an Ultra Fast Outflow in an Active Galactic Nucleus at redshift 2.

Credit: WFI Team and F.J. Carrera.

3. Provide world-class observing capabilities to advance high-energy astrophysics in the coming decades, exploring high-energy phenomena in all astrophysical contexts, including those yet to be discovered.



A NewAthena simulation of Tycho's supernova remnant. It combines a WFI image and an X-IFU spectrum obtained using SIXTE.

Credit: M. Lorenz and A. Decourchelle.

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MISSION

OBSERVE X-RAYS FROM COSMIC SOURCES

New*Athena* will be ESA's next flagship X-ray observatory, offering an unprecedented advance in X-ray sensitivity and spectral resolution over previous missions. It will address seminal science questions, driving advancements in X-ray astrophysics for decades. Designed to support the wider astronomical community, it will enable the study of astrophysical processes only observable in X-rays.

- Due to launch in the late 2030s with an Ariane 64 rocket.
- Halo orbit at 1st Sun-Earth Lagrangian Point.
- 5 years mission plus possible extensions.
- Proposal-driven observing program.
- Two complementary state-of-the-art instruments enabling spatially-resolved high-resolution spectroscopy and deep wide field spectral imaging.
- ~1 m² collecting area at 1 keV.

ATHENA

Athena Community Office
Instituto de Física de Cantabria (CSIC-UC)
Avda. Los Castros s/n. 39005 Santander (Spain)
aco@ifca.unican.es

ATHENA

THE ADVANCED TELESCOPE FOR HIGH ENERGY ASTROPHYSICS

www.the-athena-x-ray-observatory.eu

New*Athena* is a large-class mission in the ESA Cosmic Vision program. It is a powerful X-ray observatory with an unprecedented combination of collecting area, survey capabilities and energy resolution. It will be operated as an observatory open to the worldwide astronomical community.

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OBSERVATORY

Single X-ray Large Area Telescope with two instruments
Wide Field Imager and X-ray Integral Field Unit

MIRROR

Large-aperture grazing-incidence telescope, utilising a novel high-performance Silicon pore optics technology developed in Europe.

The 12 m focal length New*Athena* mirror will deliver unprecedented effective area with excellent spatial resolution and a large field of view, all with very light weight. The telescope changes focus between two instruments.

Technology	*Silicon Pore Optics*
Effective area at 1 keV	*1.0 m²*
Effective area at 6 keV	*0.19 m²*
Spatial Resolution (Half Energy Width < 7 keV)	*9 arcsec on axis*

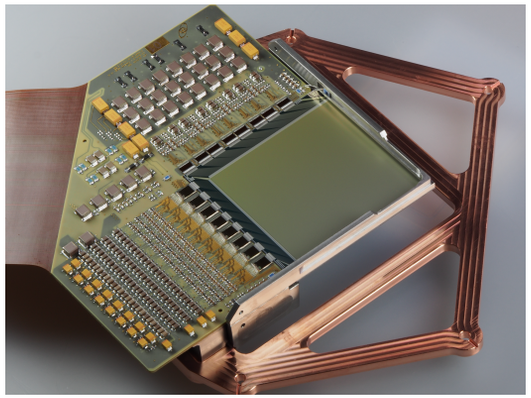
Credit: cosine.

WIDE FIELD IMAGER (WFI)

Sensitive wide field imaging and spectroscopy, and high count-rate capability with a 40'x 40' field of view.

The WFI detector is based on Silicon DEPFET Active Pixel Sensor technology. The large FoV is composed of four identical detectors. A smaller fast readout detector enables observations at high count rates.

Technology	*DEPFET Active Pixel Sensor*
Spectral resolution	*160 eV at 7 keV*
Field of View	*40 arcmin x 40 arcmin*
Pixel size	*2.2 arcsec*
Time resolution	*2 ms*



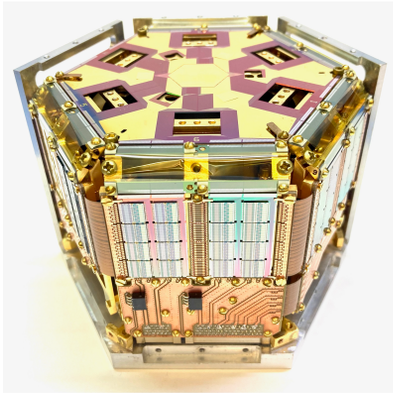
Credit: J. Müller-Seidlitz/WFI Team.

X-RAY INTEGRAL FIELD UNIT (X-IFU)

Spatially-resolved high-resolution X-ray spectroscopy over a field of view of 4' equivalent diameter.

The X-IFU is a cryogenic X-ray spectrometer, based on a large array of Transition Edge Sensors, providing both spatially-resolved high spectral resolution and high count rate capability with the optics defocussed.

Technology	*Transition Edge Sensor (TES)*
Spectral resolution	*4 eV*
Field of View	*4 arcmin equivalent diameter*
Pixel size	*~5 arcsec*
Time resolution	*10 μs*



Credit: Kazuhiro Sakai/NASA GSFC.