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[Summer Project]

Understanding the Performance of the New X-ray Telescope Concept AXTS

Are you ready to make your mark on space exploration? As Principal Investigator, I am leading AXTS—an innovative X-ray telescope mission concept designed to revolutionise how we monitor cosmic explosions. We are looking for a motivated undergraduate student for a hands-on summer research project to build simulation pipelines and evaluate the instrumental performance of our upcoming pathfinder mission.

You will work directly with mission data simulations, test system capabilities, and optimise how we capture high-energy transient events. If you love coding and space hardware simulations, this is your chance to help build a space mission from the ground up.

Prerequisites

- Strong familiarity with Unix/Linux environments (macOS or Linux).
- Comfort with a 1st grade in PX159 (or equivalent background, if you are in your 1st year) and enthusiasm for learning new scientific packages.
- A passion for web development, e.g., building a custom website to host your Python tools would be a huge plus!

[Summer Project]

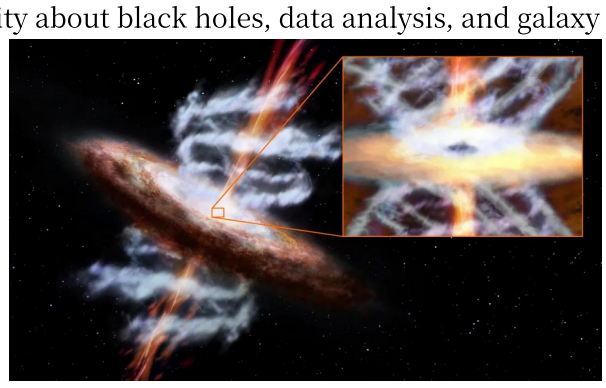
The Fate of Materials Fleeing Black Holes

At the heart of massive galaxies, supermassive black holes drive fierce winds known as Ultrafast Outflows (UFOs)—gaseous streams travelling at a significant fraction of the speed of light. But what happens to these extreme nuclear winds once they escape the black hole's gravitational pull? How do they impact the sprawling host galaxy, choke off star formation, or shape galactic evolution?

You will work with a unique sample of Active Galactic Nuclei with known X-ray UFOs. By analysing optical spectra using advanced Python-based fitting techniques, your goal will be to bridge high-energy astrophysics and optical spectroscopy to track these runaway materials.

Prerequisites

- Strong Python programming skills.
- Comfort with an upper 2:1 grade in PX159 (or equivalent background, if you are in your 1st year).
- Curiosity about black holes, data analysis, and galaxy evolution.



Artist’s impression of UFOs from black holes Credit: ESA/AOES Medialab

[MSc Project]

Studying the Accretion Discs of Stellar-Mass Black Holes Using Insight-HXMT Data

How do stellar-mass black holes accrete matter and grow, and how does this chaotic process dictate their high-energy X-ray emission? This project explores accretion physics through the lens of Cygnus X-1, one of the most famous black hole binary systems in our galaxy.

Using data from China’s Insight-HXMT satellite, you will construct hardness- and luminosity-resolved X-ray spectra. You'll perform detailed spectral fitting to decode the inner workings of black hole accretion discs and examine how geometry and radiation change across different spectral states.

Prerequisites

- Minimum 2:1 grade or equivalent (requirements by Doctoral College)
- Strong familiarity with Unix systems and working comfortably with terminal commands.



Insight-HXMT Credit: CAS

[MSc Project]

Spectrally Resolving AGN and Their Host Galaxies Using XMM-Newton

This project focuses on AGN feedback—the critical interplay between supermassive black holes and their surrounding host galaxies. Using high-resolution X-ray spectra from XMM-Newton, you will investigate the physical properties of the circumnuclear gas.

Your analysis will shed light on how energy injected from the active nucleus influences the surrounding gas and helps constrain the properties of the host galaxy. This project offers hands-on experience with premier space telescope data and advanced spectral analysis tools.

Prerequisites

- Minimum 2:1 grade or equivalent.
- Strong familiarity with Unix systems and working comfortably with terminal commands.



XMM-Newton Credit: ESA