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Astronomical Resource Cross-matching for High Energy Studies

An FP7-Space EC funded project *(Jan 2013-Sept 2015)*

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The ARCHES Consortium:

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ARCHES focuses on the 3XMM X-ray survey catalogue. New tools are developed for cross-correlation with extensive archival resources, producing well-characterised multi-wavelength data in the form of spectral energy distributions (SEDs) for large sets of objects and in the form of a catalogue of clusters of galaxies. ARCHES validates products and investigate their usability in the framework of various science cases. All ARCHES products and tools will be made available to the general community. These enhanced resources will significantly broaden the effective exploitation of the XMM-Newton data by the scientific community in the exploration of a wide range of forefront astrophysical questions.

An enhanced 3XMM catalogue

The enhanced 3XMM source catalogue created by ARCHES gathers best quality 3XMM detections i.e. with low background, offaxis < 12' , exposure times > 5 ks, bore side corrected, hot spots removed, etc...
New unique sources are derived from the cleaned detections.
Astrophysical field content, usability for test science cases, masks areas are also provided.
3XMMe (v1.0) contains 338291 detections (cf 531261 in 3XMM) from 249967 unique sources (cf 372728) in 5552 fields (cf 7427)

A best set of archival catalogues for SEDs

Selection criteria:
– Limited number (to avoid s/w complexity)
– Maximum sky coverage/overlap with 3XMMe
– Extended wavelength coverage (avoiding overlap)
– Emphasis quality (uniformity/reliability/documentation)

Result: 17 wide-angle or whole-sky catalogues organized
In sets for cross--correlation:
– Whole sky: 7 sets of 3XMMe + 6 catalogues
– Galactic Plane: 6 sets of 3XMMe + 5 catalogues

An advanced cross-correlation tool

ARCHES has developed a unique general purpose tool able to cross-correlate in a single pass an arbitrary large number of catalogues while providing probabilities for each combination of association/non association.

Probabilities are computed based on positional coincidence using elliptical errors, local source densities, and priors derived locally.

Building spectral energy distributions

We use the SVO Filter Profile Service to convert magnitude into fluxes.
SEDs wich constitute one of the main outcome of the ARCHES project will be distributed by VO compliant services and by dedicated interfaces.

An integrated cluster finder

This project develops a software tool that searches for galaxy clusters simultaneously in X-ray images obtained with XMM-Newton and in ground- and space-based multi-wavelength imaging.

The cosmological redshift is measured using the spectral energy distribution of the member galaxies and of the central dominant galaxy, supplemented by optical spectra if available.

Photo-z are derived from multi-band data assembled using the ARCHES cross-correlation and SED tools.

The validated catalogue will be disseminated into the community for fast access and scientific exploitation.

AGN test science cases

- Modelling nuclear infrared SEDs to study properties of the nuclear absorbers of AGN
- Radio selected samples to map AGN activity from the basics of accretion to its ties to the host galaxies
- Low luminosity radiatively inefficient AGN

Galactic test science cases

- What is the nature of the low to intermediate X-ray luminosity sources observed in hard X-ray surveys?
- Stellar populations across the Galaxy
- Search for circumstellar debris discs around young late type stars.

Cluster test science cases

- Galaxy evolution in densest high-z environment
- Redshift evolution of the X-ray scaling relations
- Evolution of the thermal structure of the intracluster medium