

XMM-Newton catalogues & products in the years to come

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For the XMM-SSC and XMM2ATHENA

XMM-NEWTON CELEBRATES 25 YEARS IN SPACE



470 000

Active Galactic Nuclei



1 MILLION

detections of X-ray sources

1.5 BILLION

kilometres travelled

8000+
papers



57 000

X-ray binaries



83 000

stars



79 000

extended sources



6.6 MILLION

UV & visible sources



15 000
scientists



530+

PhD theses



16 800

observations
in public archive

4579

orbits around Earth

3.8t
mass

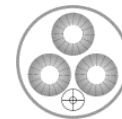
10m
length

16m
span

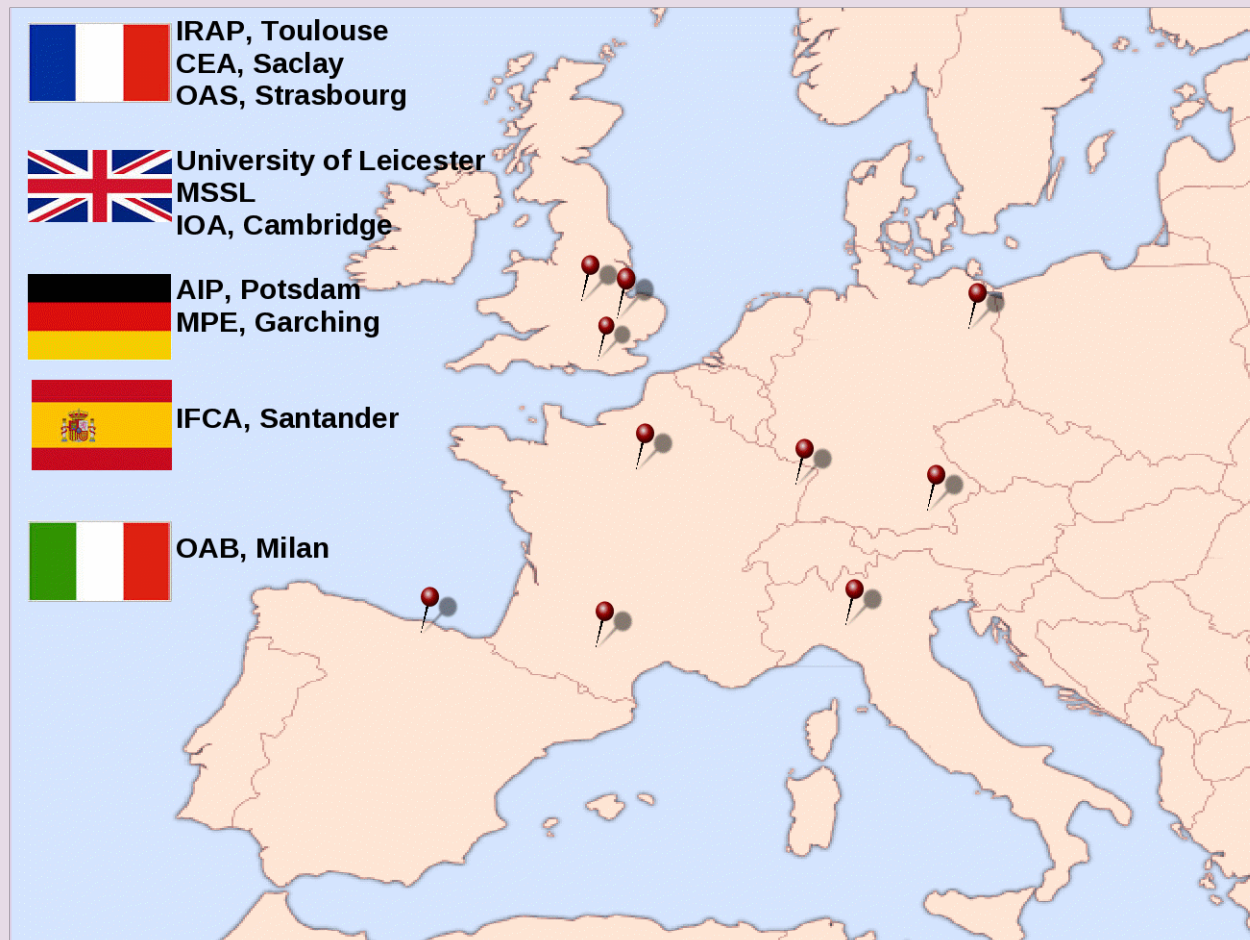
BIGGEST SCIENCE SATELLITE BUILT IN EUROPE



WHAT IS THE XMM-NEWTON SURVEY SCIENCE CENTRE & XMM2ATHENA ?



- The XMM-Newton Survey Science Centre was selected by ESA in 1995 to ensure the scientific community can exploit XMM-Newton data
- Development of science analysis system (SAS)
- Pipeline processing of XMM-Newton obs.
- Identification of XMM serendipitous sources
- Compilation of the Serendipitous Source Catalogue
- XMM2ATHENA was a Horizon 2020 project (Apr. 2021-Sep. 2024) to improve and publicise XMM catalogues & prepare for Athena



<http://xmmssc.irap.omp.eu>

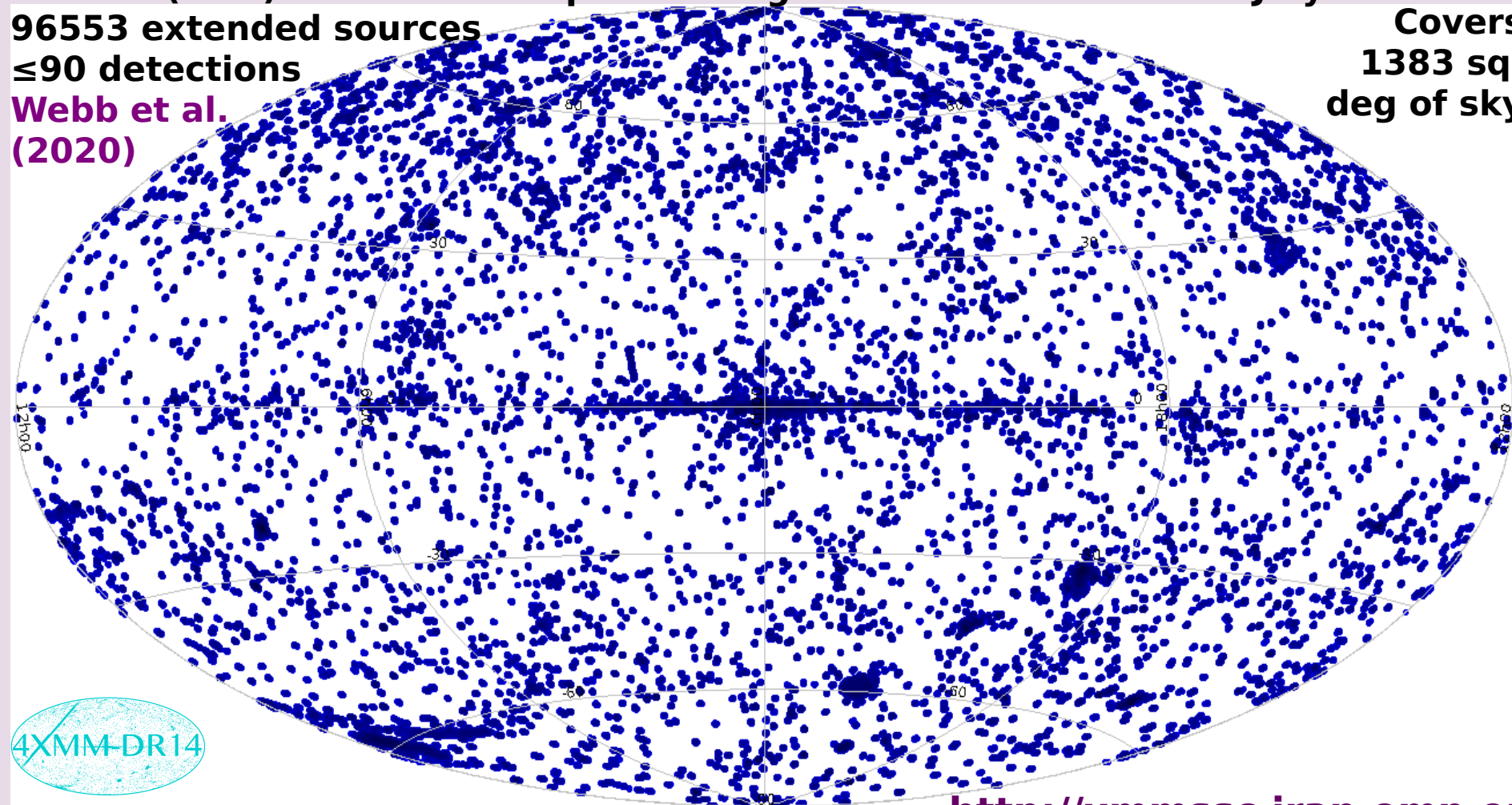
1035832 detections, 692109 unique sources
372313 (36%) sources with spectra & lightcurves

Release: 9th July 2024

96553 extended sources
≤90 detections

Covers
1383 sq.
deg of sky

Webb et al.
(2020)

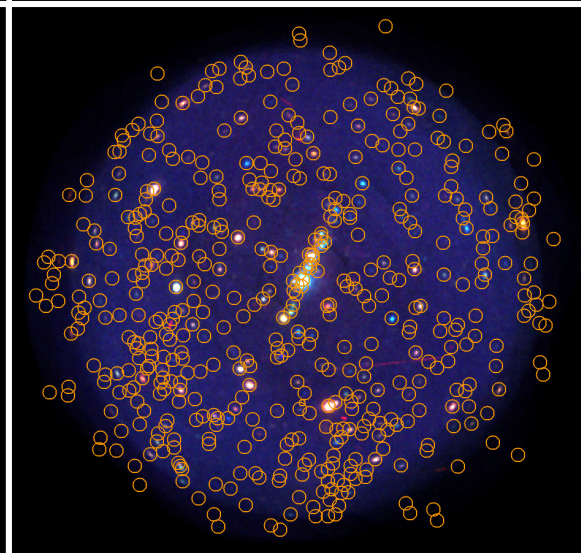
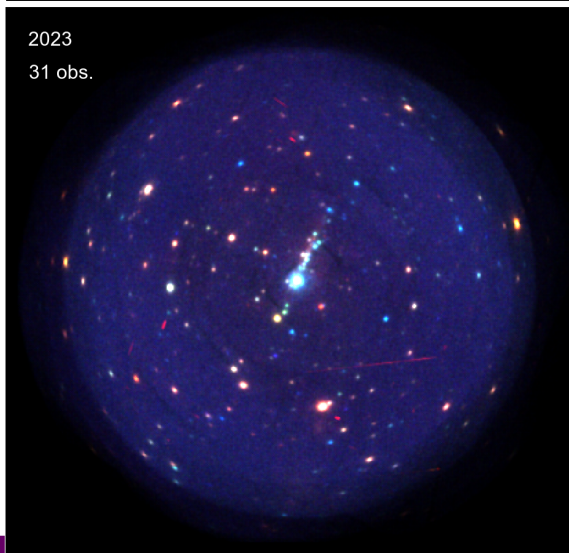
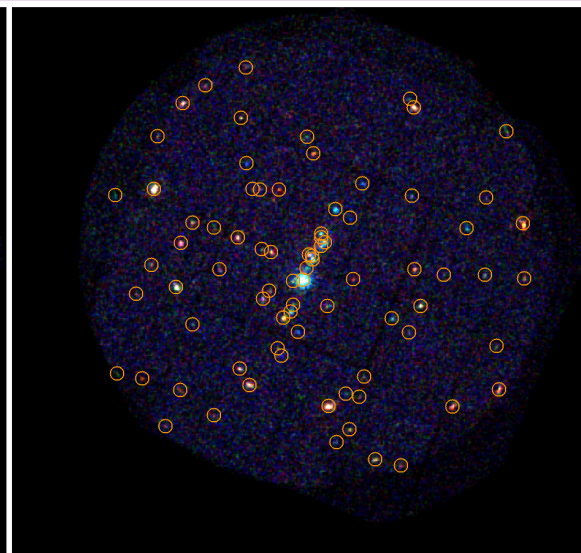
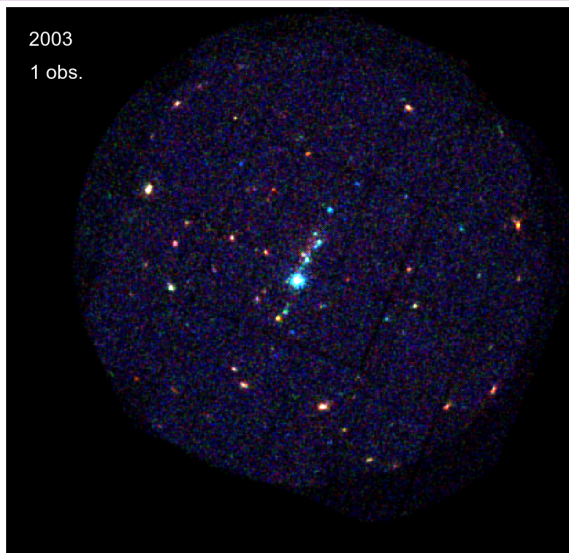


<http://xmmssc.irap.omp.eu>

- **4XMM-DR14s**
- **1751 stacks**
- **10336 observations**
- **427524 sources**
- **~20% new sources with respect to 4XMM-DR14**
- **Released 9th July 2024**
- **With both catalogues, a similar number of sources to eRosita**

Traulsen et al. (2020)

<http://xmmssc.irap.omp.eu>



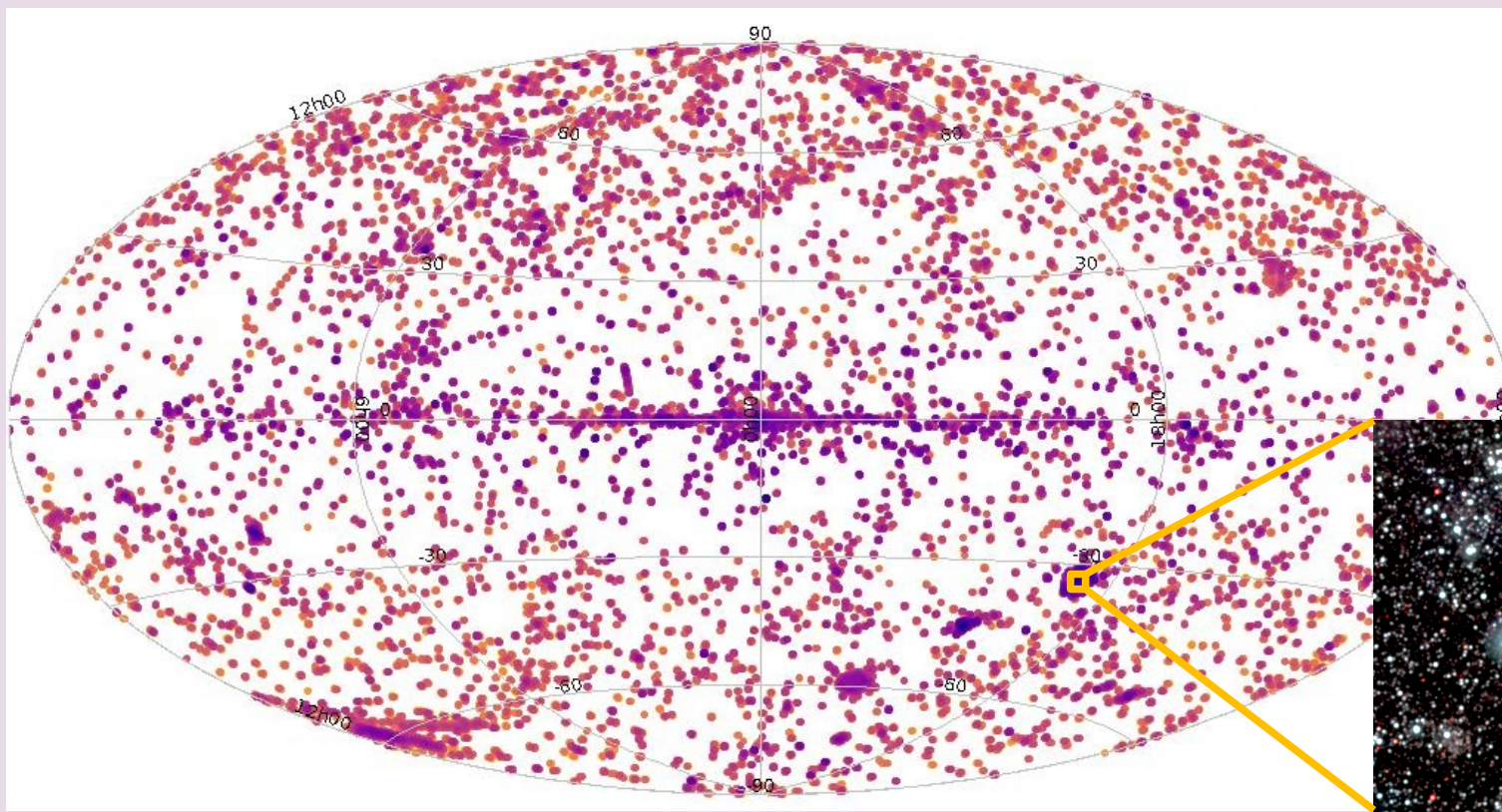


- **Period : August 2001-August 2023 - almost 10 yr extra data**
- **140735 detections (68383 new detections), 116598 unique sources**
- **Source detections up to 78 times**
- **Covers 93.7 % of sky. Median flux (0.2-12.0 keV) : 2.7×10^{-12} erg cm⁻² s⁻¹**
- **Release : 19th February 2025**
- **Minor issue with some duplicates identified**

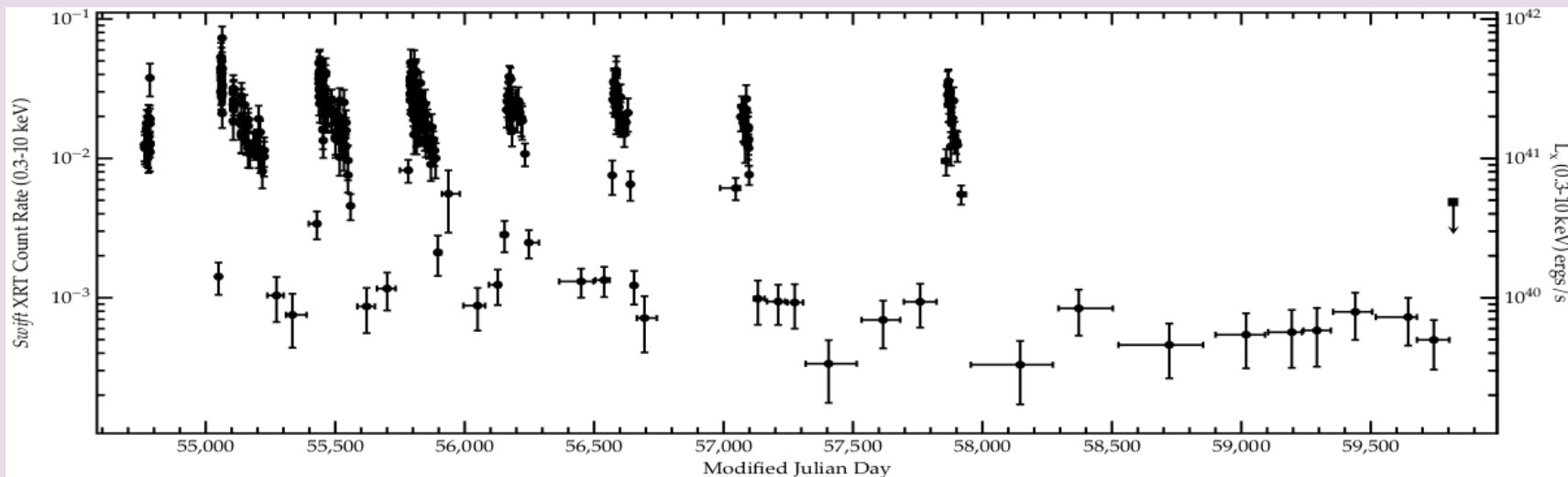


OM CATALOGUE SUSS 6.2

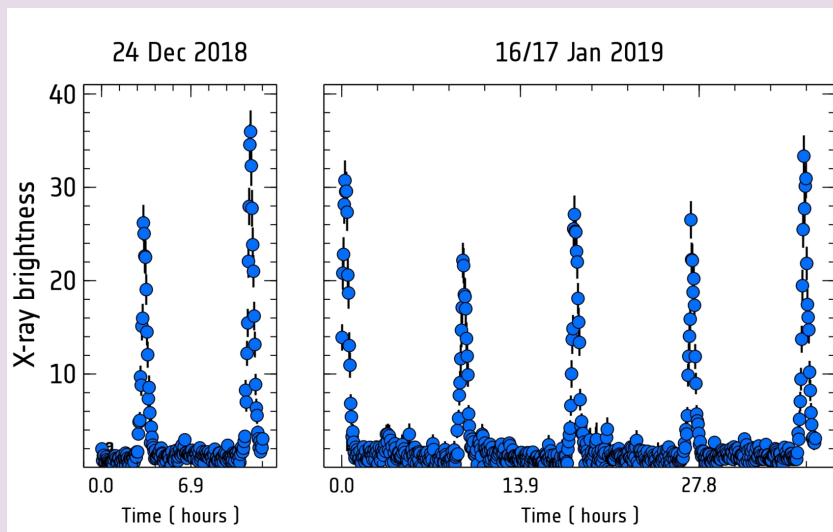
- **Period : February 2000 - November 2022**
- **9.9 million detections, 6.7 million sources, 1.2 million with multiple entries**
- **80 % sources in Gaia**
- **UVW2, UVM1, UVW1, U, B, V (down to ~23rd magnitude)**



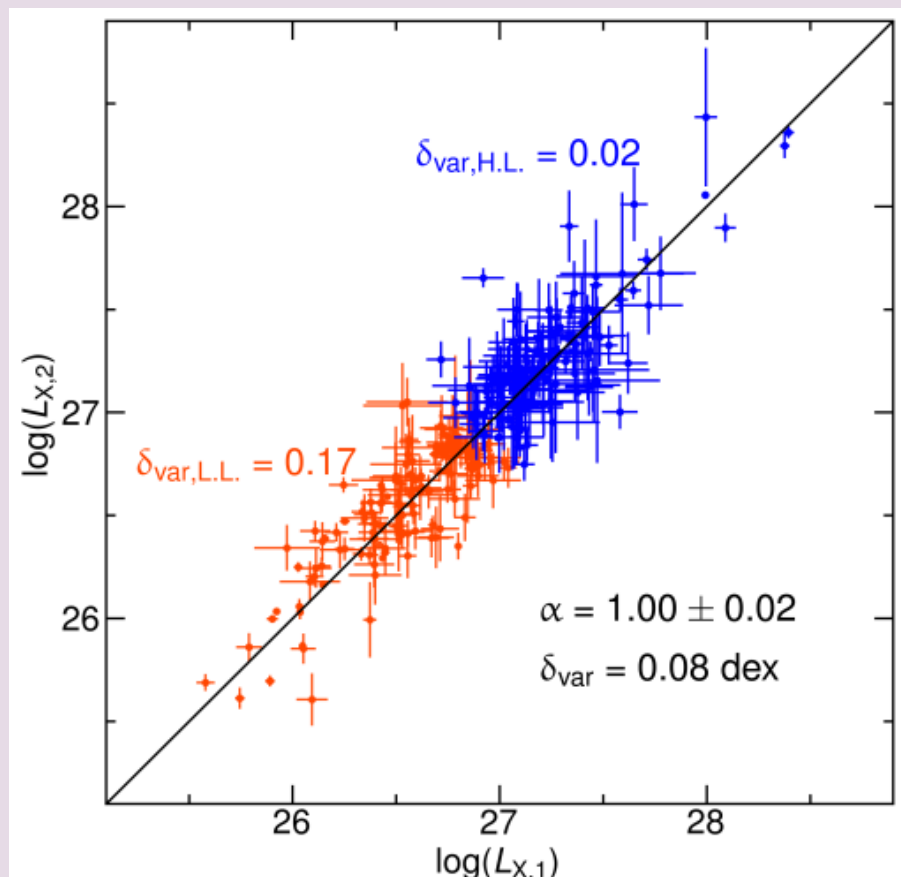
ESO 243-49 HLX-1, Partial tidal disruption event (Farrell, Webb et al. 2009)



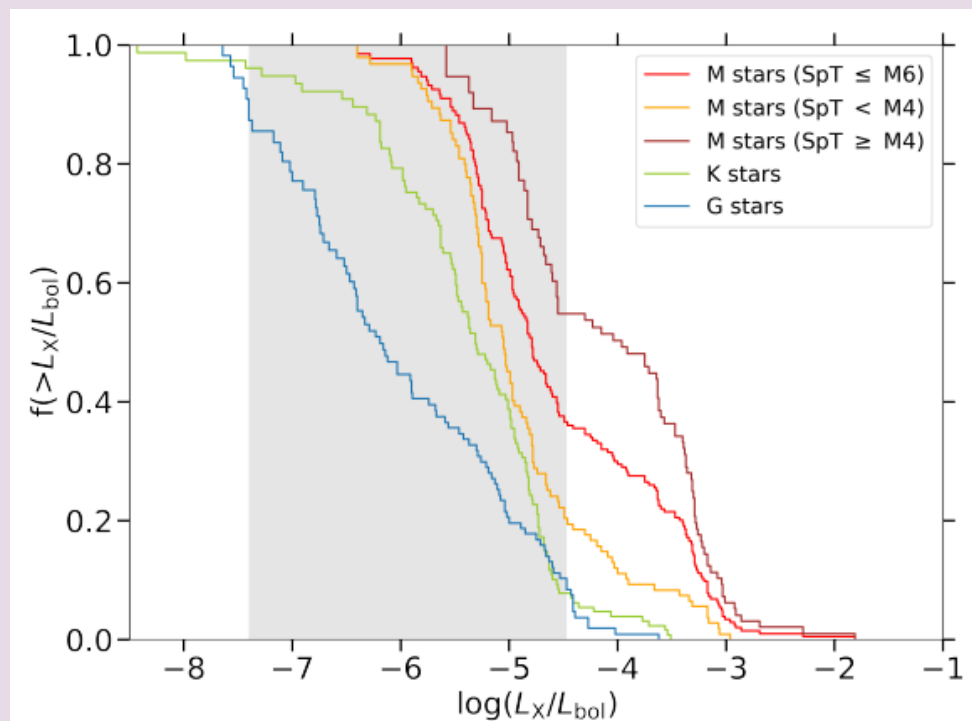
GSN 069 Quasi Periodic Eruptions (Miniutti et al. 2019)

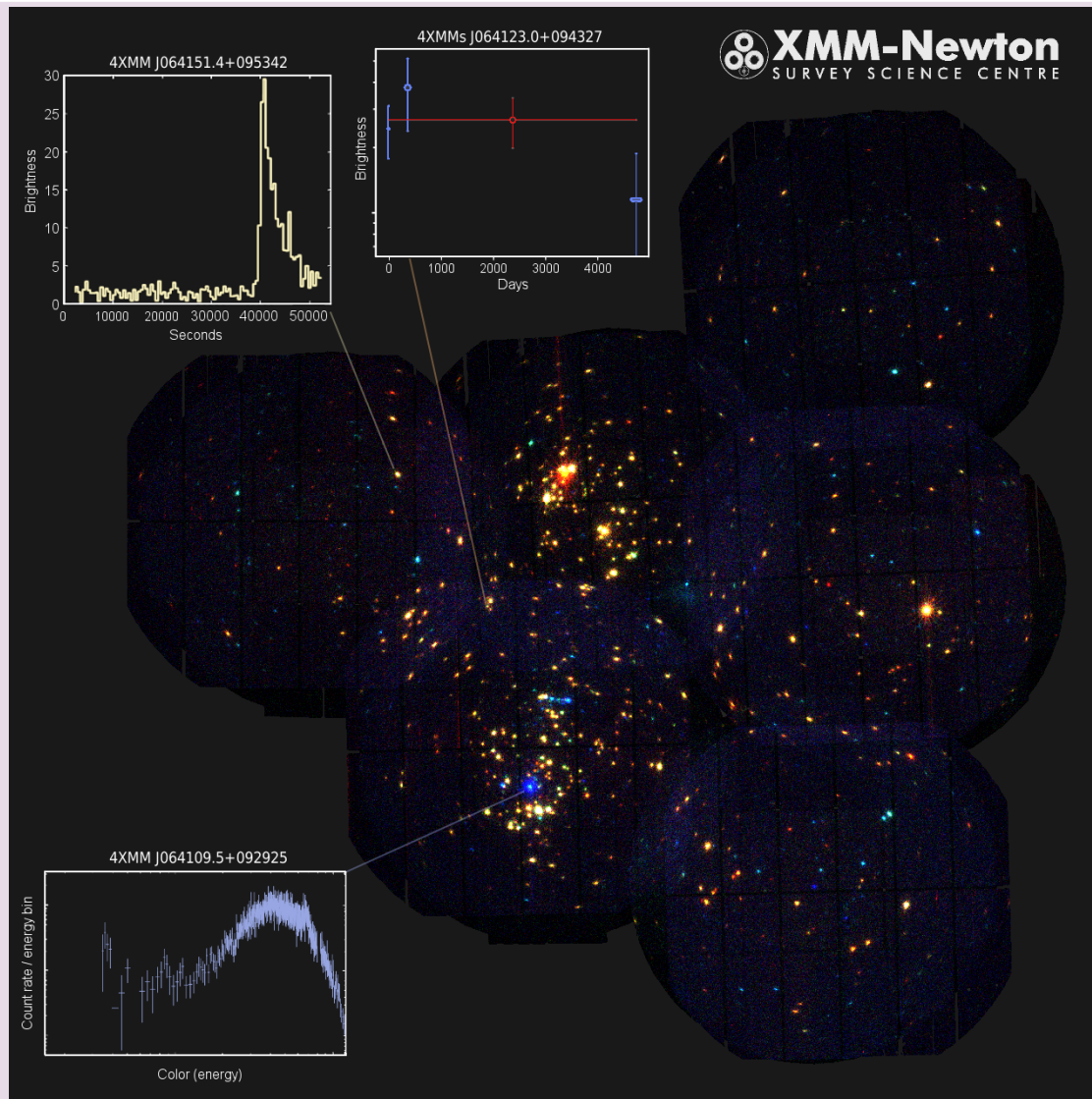


Using quasars as standard candles (Signorini et al. 2024)

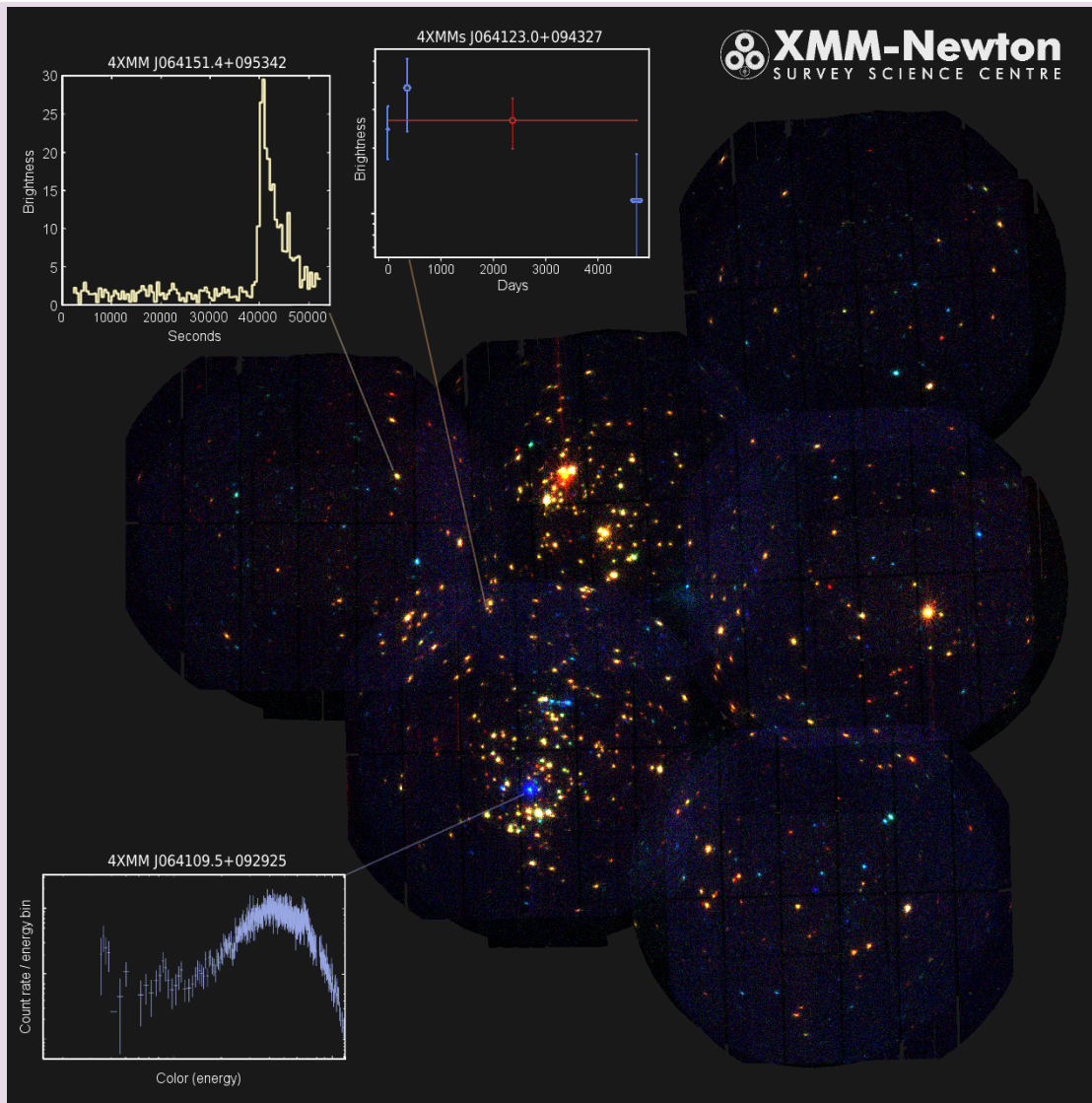


Evaluating stellar activity to determine exoplanet habitability (Zhu & Preibisch 2025)

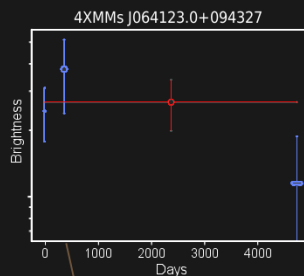
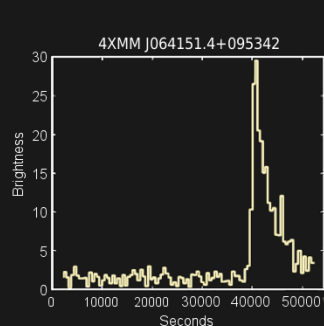




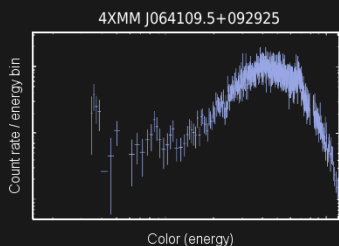
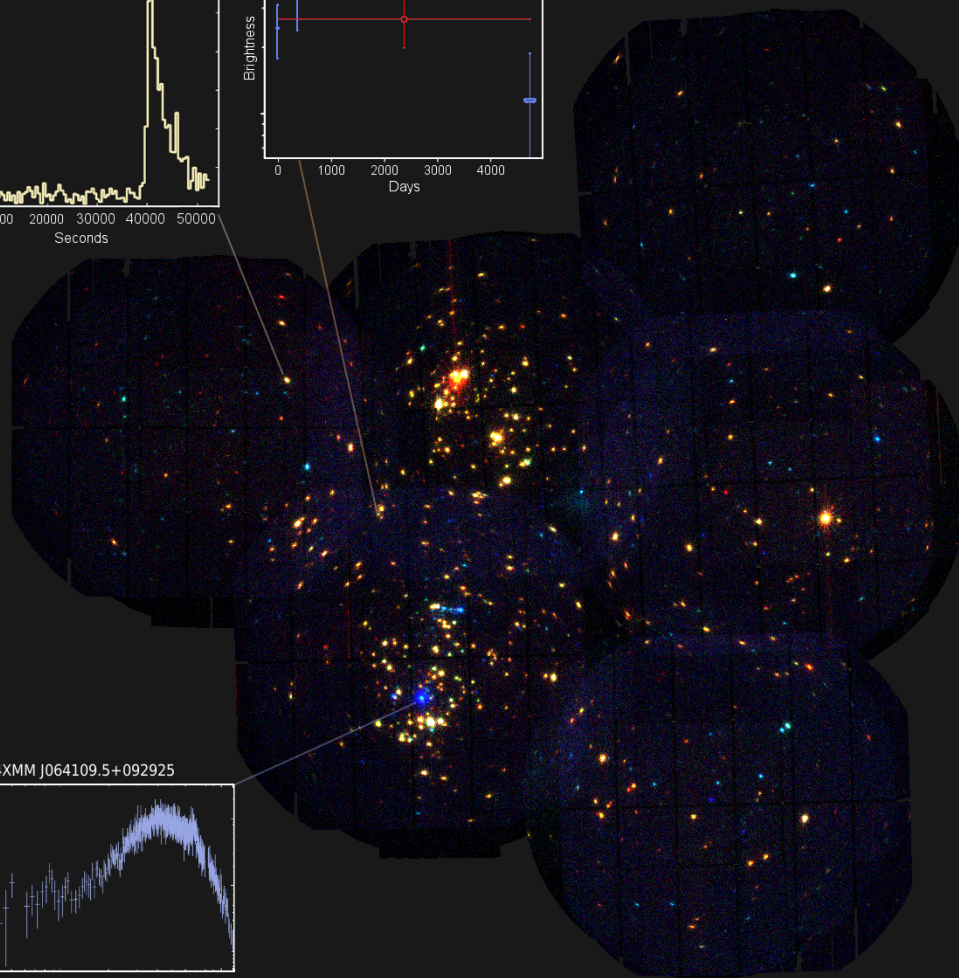
What is this source ?



What is this source ?

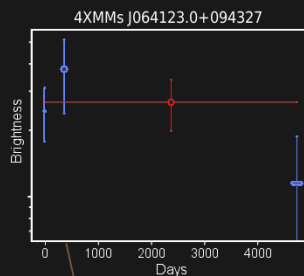
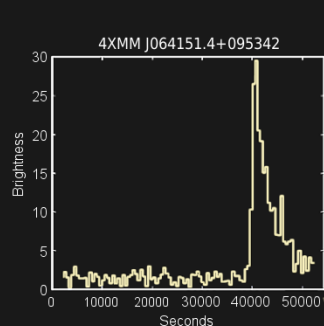


XMM-Newton
SURVEY SCIENCE CENTRE

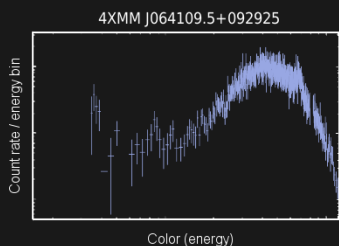
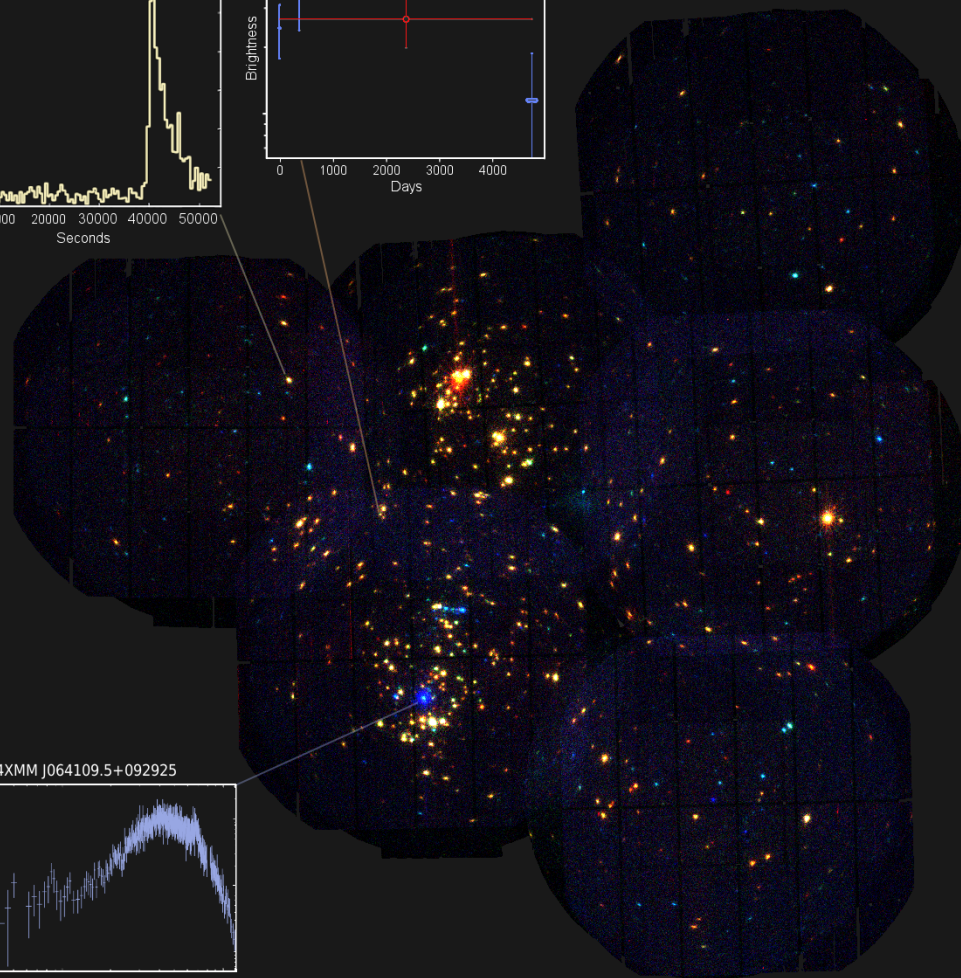


What does it look like at other wavelengths ?

What is this source ?



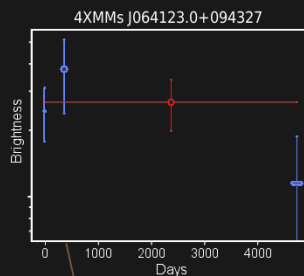
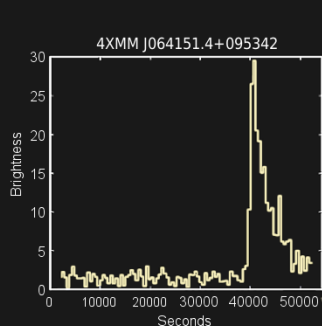
XMM-Newton
SURVEY SCIENCE CENTRE



What does it look like at other wavelengths ?

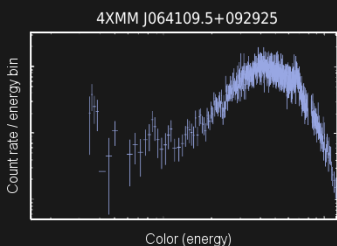
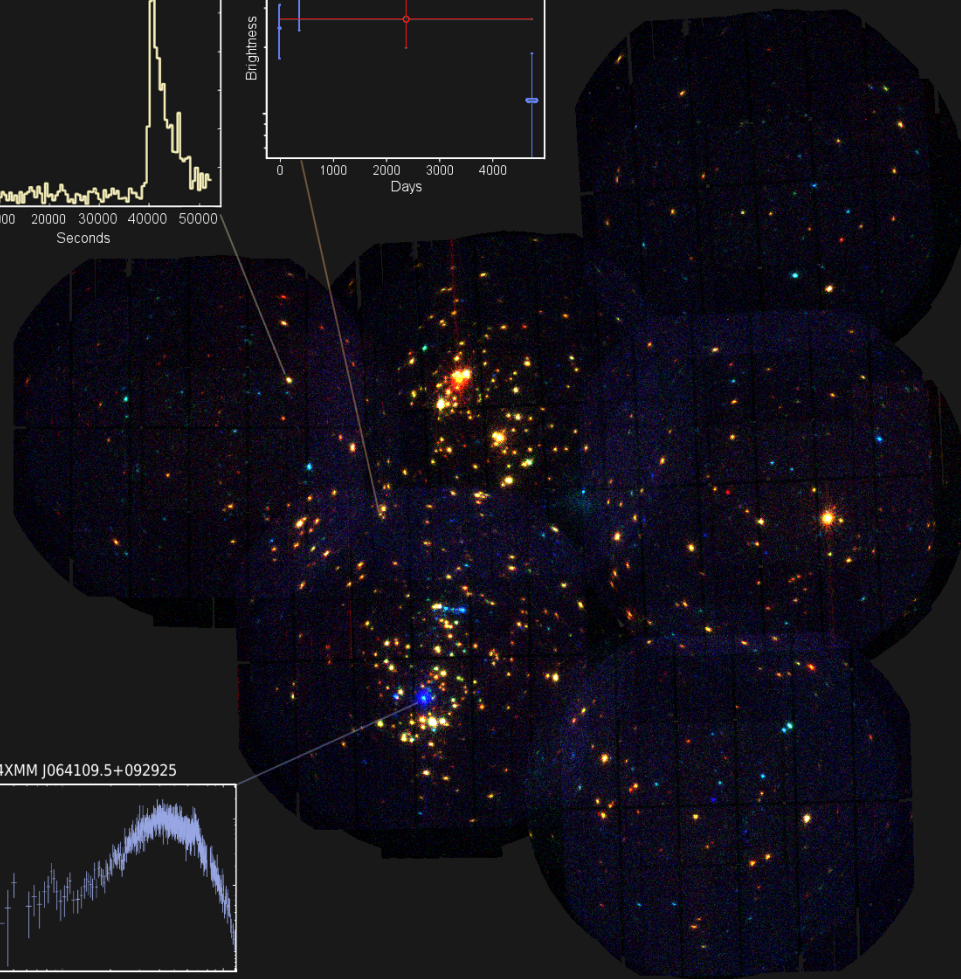
Has it always looked this way or does it change ?

What is this source ?



XMM-Newton
SURVEY SCIENCE CENTRE

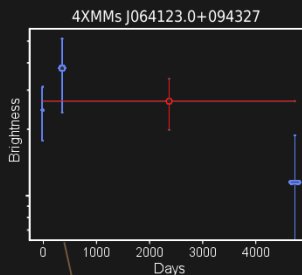
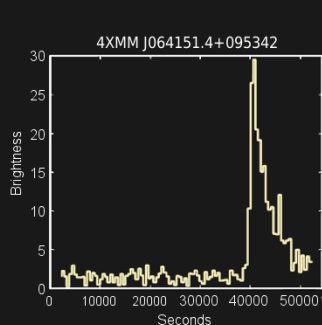
What does the X-ray spectrum look like ?



What does it look like at other wavelengths ?

Has it always looked this way or does it change ?

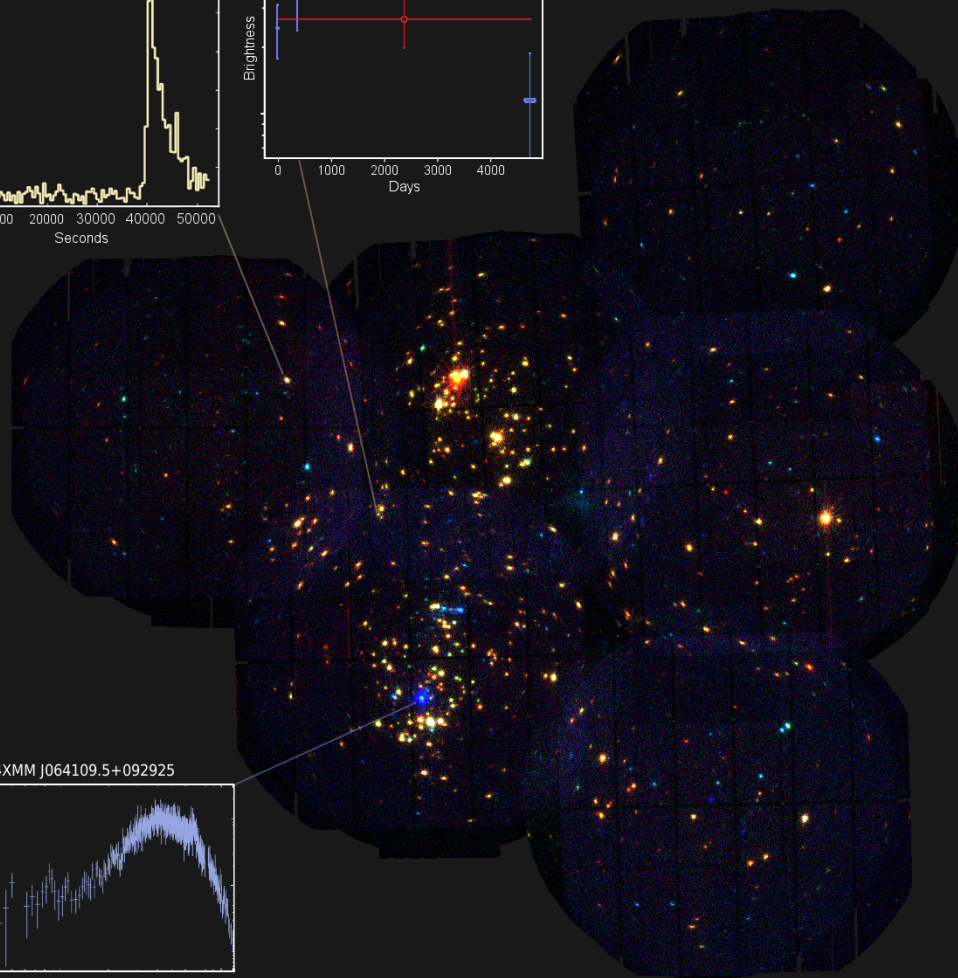
What is this source ?



XMM-Newton
SURVEY SCIENCE CENTRE

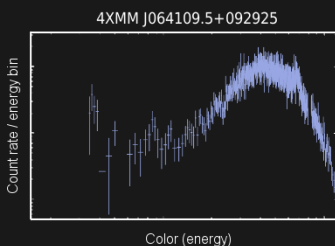
What does the X-ray spectrum look like ?

What does it look like at other wavelengths ?

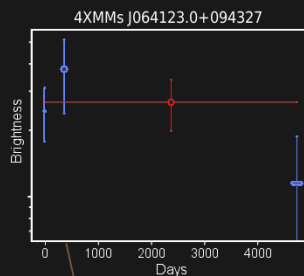
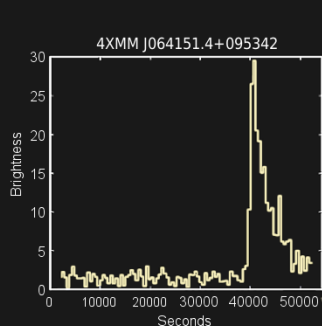


How far away is it ?

Has it always looked this way or does it change ?



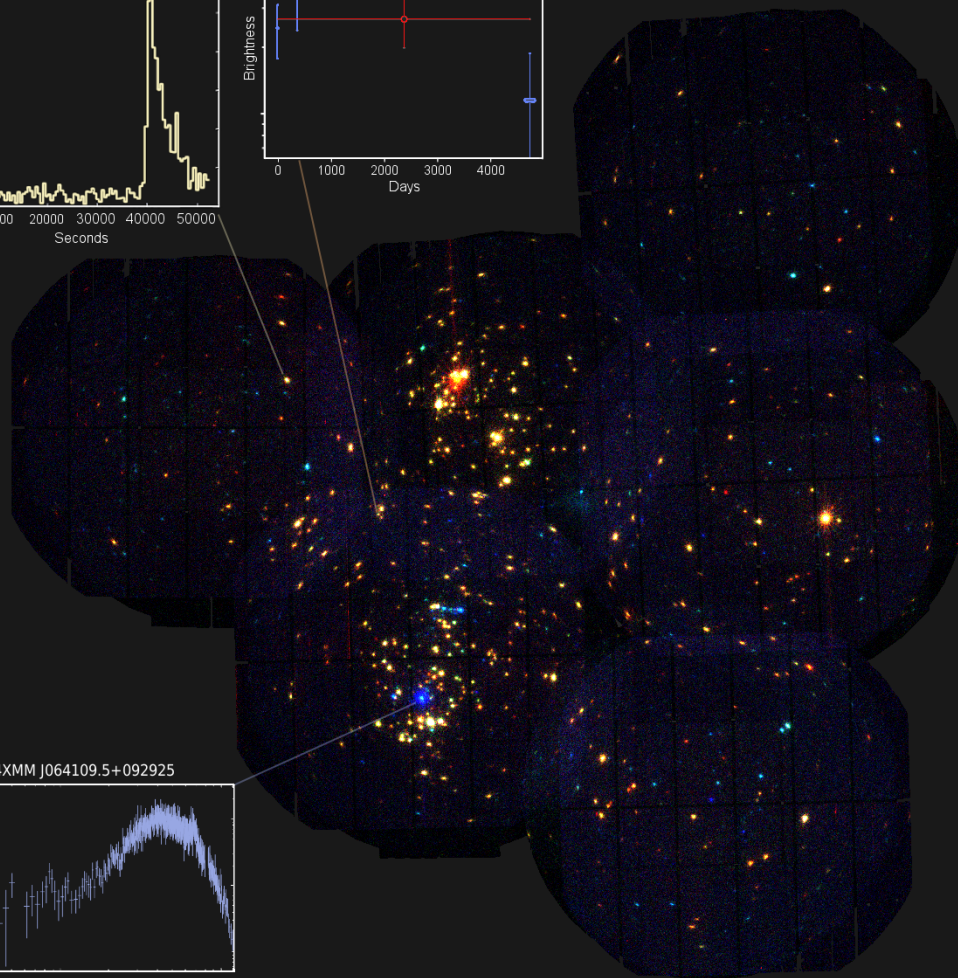
What is this source ?



XMM-Newton
SURVEY SCIENCE CENTRE

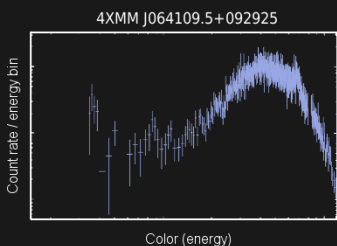
What does the X-ray spectrum look like ?

What does it look like at other wavelengths ?



How far away is it ?

Has it always looked this way or does it change ?



Can we detect new fainter sources ?

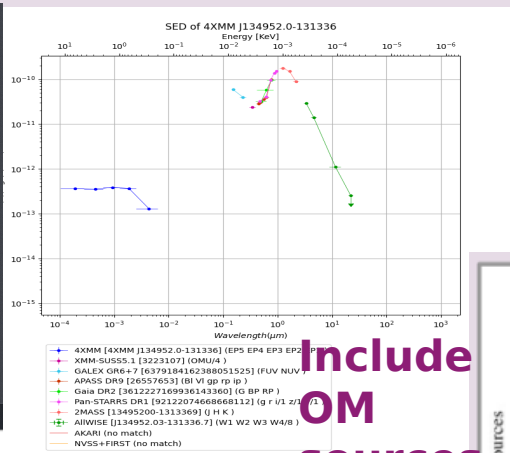
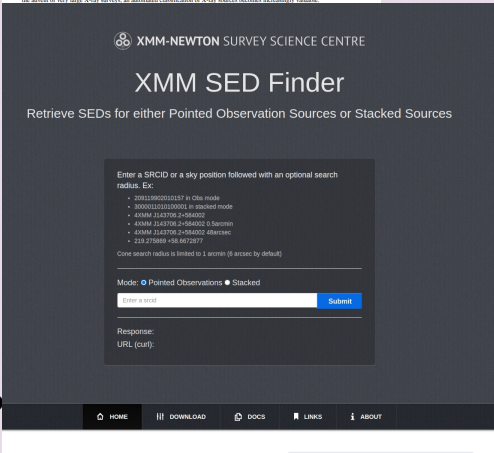
What is this source ?
Classification (Tranin et al. 2022)

What does it look like at other wavelengths ?

Has it always looked this way or does it change ?

(Quintin et al. 2024)

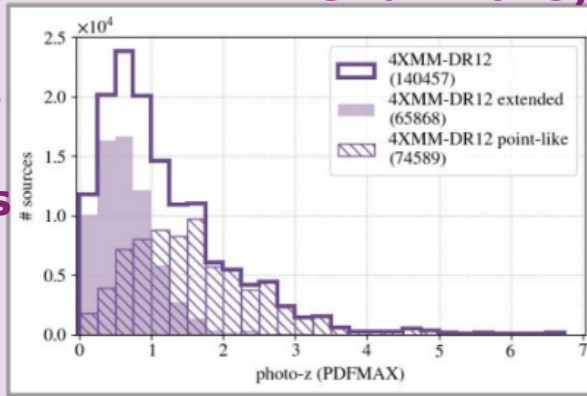
Probabilistic classification of X-ray sources applied to *Swift*-XRT and *XMM-Newton* catalogs*
Hugo Tranin^{1,2}, Olivier Gode³, Natalie Weib⁴, and Daria Primorac^{3,4}
¹ Ecole Normale Supérieure de Paris-Saclay, 41 Av. du Président Wilson, 92429 Cedex Paris, France
² IRAP, Université de Toulouse, CNRS, CNES, 9 avenue du Colonel Roche, 31028 Toulouse, France
³ Institut de Recherche en Astrophysique, Université de Toulouse, CNRS, 31000 Toulouse, France
⁴ Faculty of Electrical Engineering and Computing, University of Zagreb, 10000 Zagreb, Croatia
Received 6 May 2021 / Accepted 9 October 2021
ABSTRACT
Context. Some galaxies have proven to be an efficient way to find new objects, for example tidal disruption events, changing look active galactic nuclei (AGN), binary systems, ultraluminous X-ray sources, and intermediate mass black holes. With the advent of very large X-ray surveys, an automated classification of X-ray sources becomes increasingly valuable.



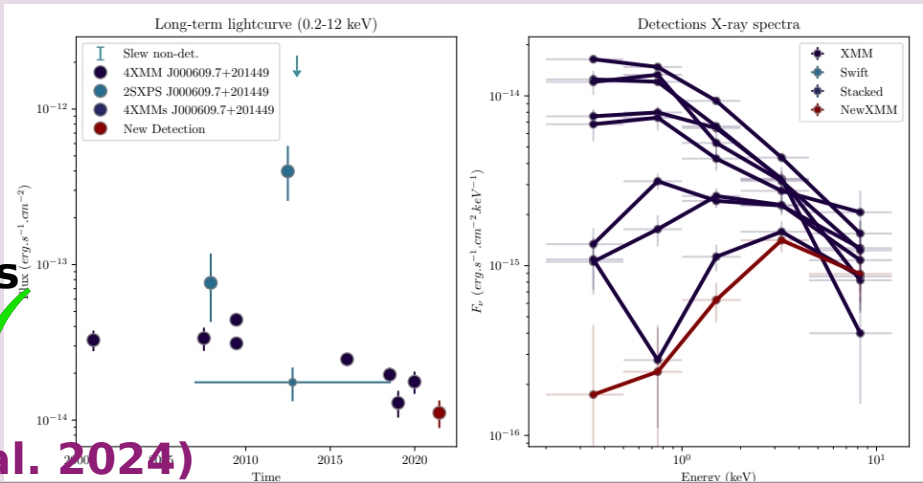
What does the X-ray spectrum look like ?
Spectral fitting (Mountrichas et al. 2022)

How far away is it ?
(Pouliasis et al. 2025)

Include OM sources



Can we detect new fainter sources ?
Improved stacking (Pires et al. 2024) & search for faint bursts (Khan et al. 2025)





XMM-NEWTON SURVEY SCIENCE CENTRE

Serendipitous alerts

ABOUT

Welcome to the XMM-Newton serendipitously detected X-ray transient alerts page. You will find the latest transients to be detected by chance in the EPIC field of view, and for which the PI has given prior accord for this information to be made public. Please feel free to follow-up on any of these sources.

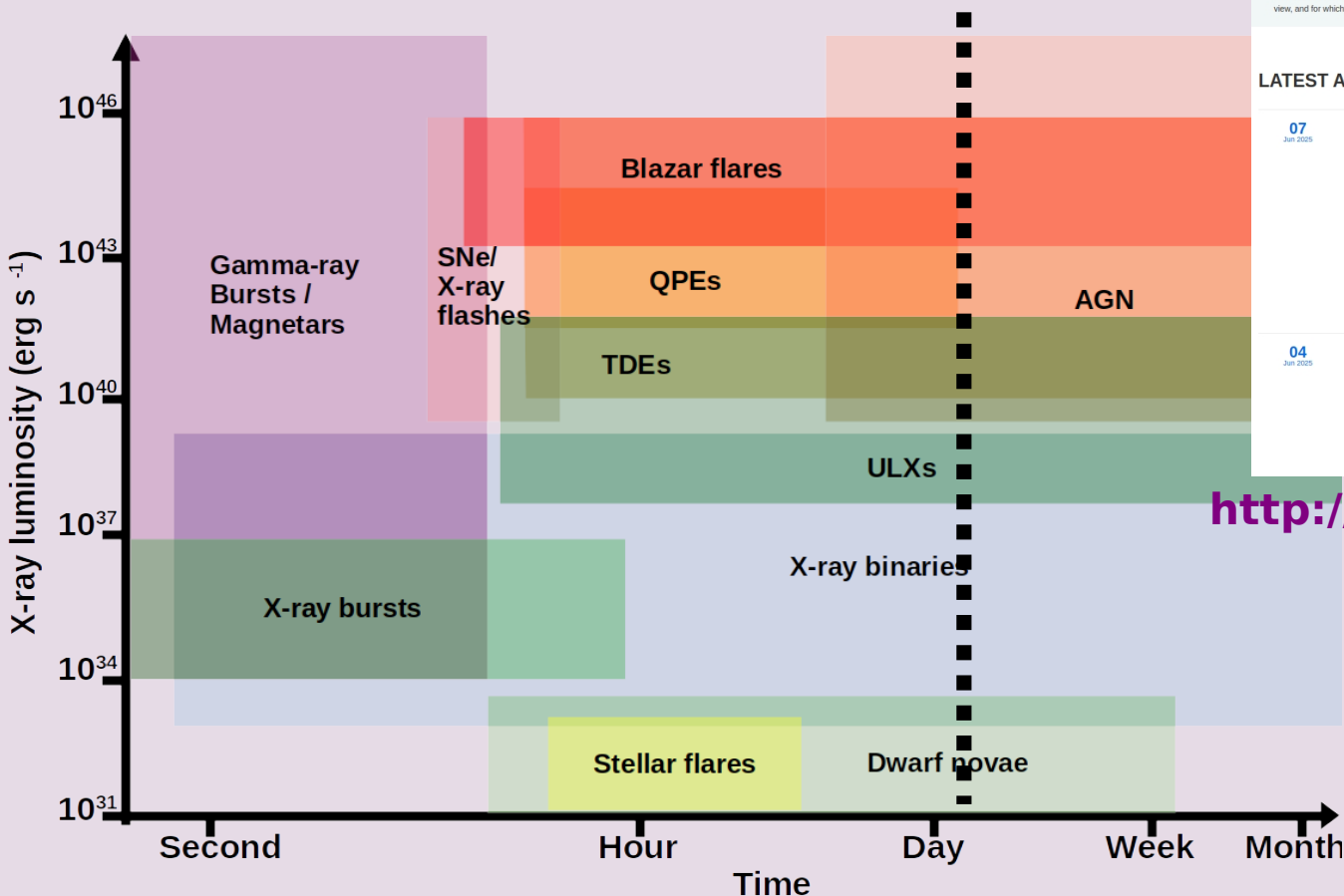
LATEST ALERTS

07
Jun 2025

Coordinates: 11:03:49.6 +38:23:09.9
Time: 01:40:43
Exposure time: 12393 s
Position Error: 1.66"
Flux: $1.5e-13 \pm 6.5e-14 \text{ erg cm}^{-2} \text{ s}^{-1}$
EPIC detection maximum likelihood: 23.4
Hardness ratio: 0.84
Long term variability: 6.7
Simbad: Unknown (XMM J110349.7+382308)
Spectral warning: True
Alert type: Past Variability

04
Jun 2025

Coordinates: 12:28:10.8 +44:03:38.9
Time: 15:55:18
Exposure time: 60814 s
Position Error: 0.19"
Flux: $4.4e-14 \pm 1.5e-15 \text{ erg cm}^{-2} \text{ s}^{-1}$
EPIC detection maximum likelihood: 4941.0
Hardness ratio: -0.99
Long term variability: 7.8



<http://flix.irap.omp.eu/stonks>

- **Significant development to prepare for reprocessing**
- **SOC re-reprocessed all 17199 observations ready for production of 5XMM**
- **Catalogue simplified, one single stacked catalogue, with ~450 columns**
- **To include :**
 - **OM + multi-wavelength counterparts**
 - **upper limits**
 - **long-term variability information + OM variability**
 - **spectral fits**
 - **classifications**
 - **photometric redshifts**
- **Expected for early 2026**

- 25 years of XMM-Newton has provided a plethora of data and great tools
- Results from stars, planets, X-ray binaries, galaxies+clusters, supernovae, ...
- New software and tools available & 5XMM coming in 2026
- Alerts now available for long-term transients

Here's to many more years of XMM-Newton !



...and looking forward to NewAthena !

BACK UP SLIDES

IMPORTANCE OF DATA EXPLOITATION

Estimate of the carbon footprint of astronomical research infrastructures

2022, Nature Astronomy, Volume 6, p. 503-513

Jürgen Knödlseider¹, Sylvie Brau-Nogué¹, Mickael Coriat¹, Philippe Garnier¹, Annie Hughes¹, Pierrick Martin¹ & Luigi Tibaldo¹

worldwide active astronomical research infrastructures currently have a carbon footprint of 20.3 ± 3.3 MtCO₂ equivalent (CO₂e) and an annual emission of $1,169 \pm 249$ ktCO₂e yr⁻¹ corresponding to a footprint of 36.6 ± 14.0 tCO₂e per year per astronomer. Compared with contributions from other aspects of astronomy research activity, our results suggest that research infrastructures make the single largest contribution to the carbon footprint of an as-

Note: average carbon footprint / European / year : ~8 tCO₂e

Findings include :

- Operations are ~1-2 % of carbon footprint of typical space based mission
 - More comprehensive exploitation of data limits carbon footprint
- => **Longevity of XMM-Newton coupled with intense archive exploitation reduces carbon footprint of X-ray astronomy in Europe 😊**