

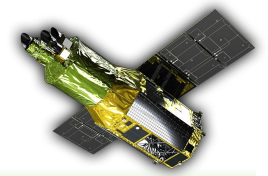
16th IACHEC meeting @Parador de La Granja
May 13–16, 2024

Overview of XRISM/Xtend Transient Search

Marina Yoshimoto (Osaka University)

XRISM/Xtend Transient Search Team
SOC Duty Scientists

XTS Members



Name / Interest

- Ehud Behar / Accretion sources
- Katja Pottschmidt / Accreting pulsar
- Tomokage Yoneyama / Pulsar, Magnetar
- Yohko Tsuboi / Star, Protostar
- Masayoshi Nobukawa / Blackhole (Sgr A*), etc
- Yukikatsu Terada / Stars, Supernovae
- Yuichi Terashima / Tidal disruption event
- Yoshitomo Maeda / Galactic center transients
- Megumi Shidatsu / Galactic/Extragalactic XRB
- Marc Audard / Protostar, T Tauri
- Misaki Mizumoto / X-ray Binary
- Takayoshi Kohmura / Neutron star
- Marina Yoshimoto / ULX
- Shun Inoue / Star
- Hiroyuki Uchida / Supernovae
- Noboru Nemoto / Star (– 2024.03)
- Koichiro Akasu / Star (– 2024.03)
- Yuiko Ishihara / Star (2024.04 –)

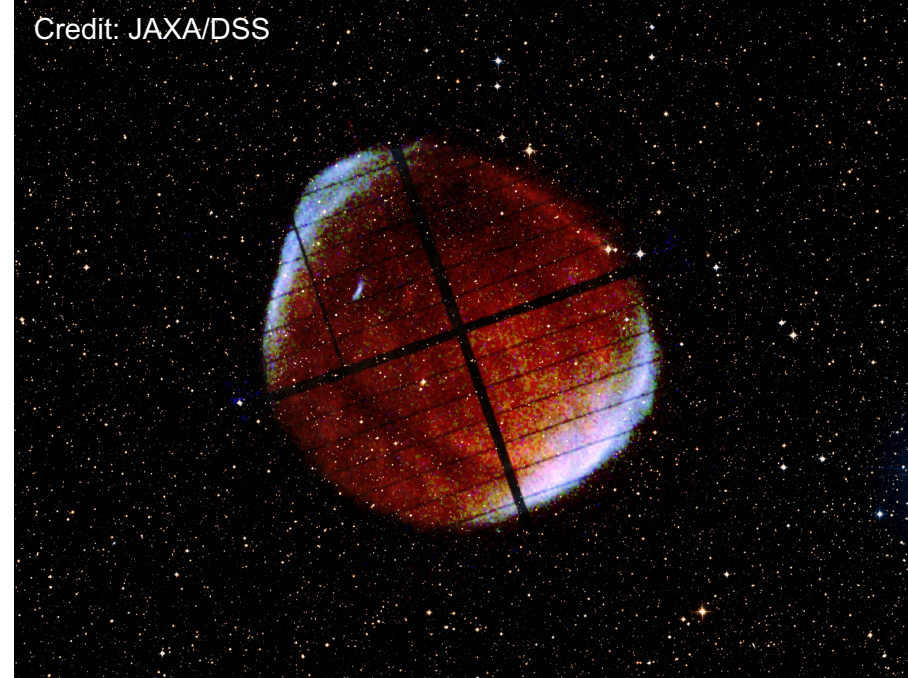
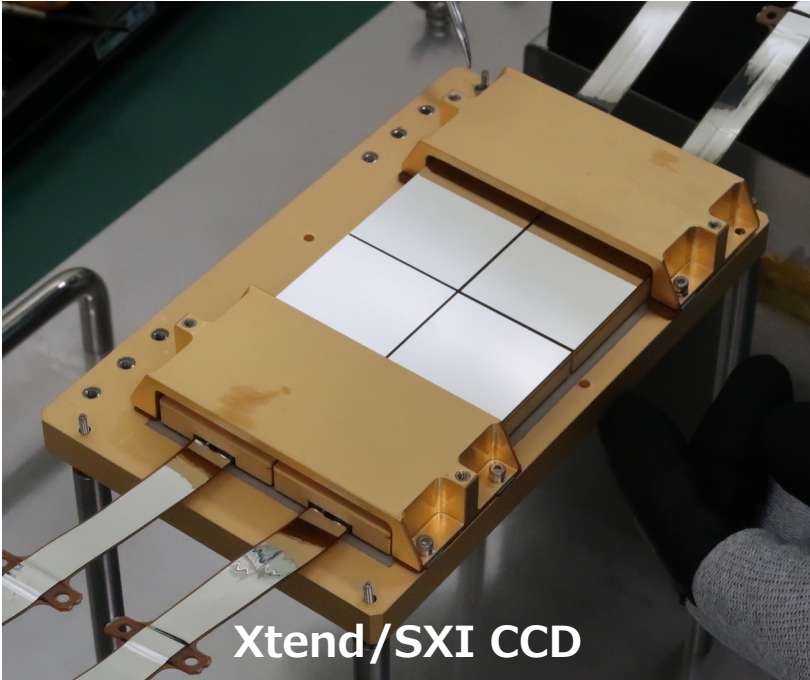
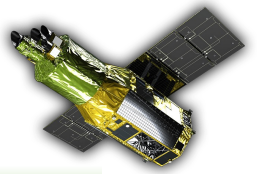
SOC Duty Scientists

- Kotaro Fukushima
- Katsuhiro Hayashi
- Yoshiaki Kanemaru
- Shoji Ogawa
- Tessei Yoshida

23 members

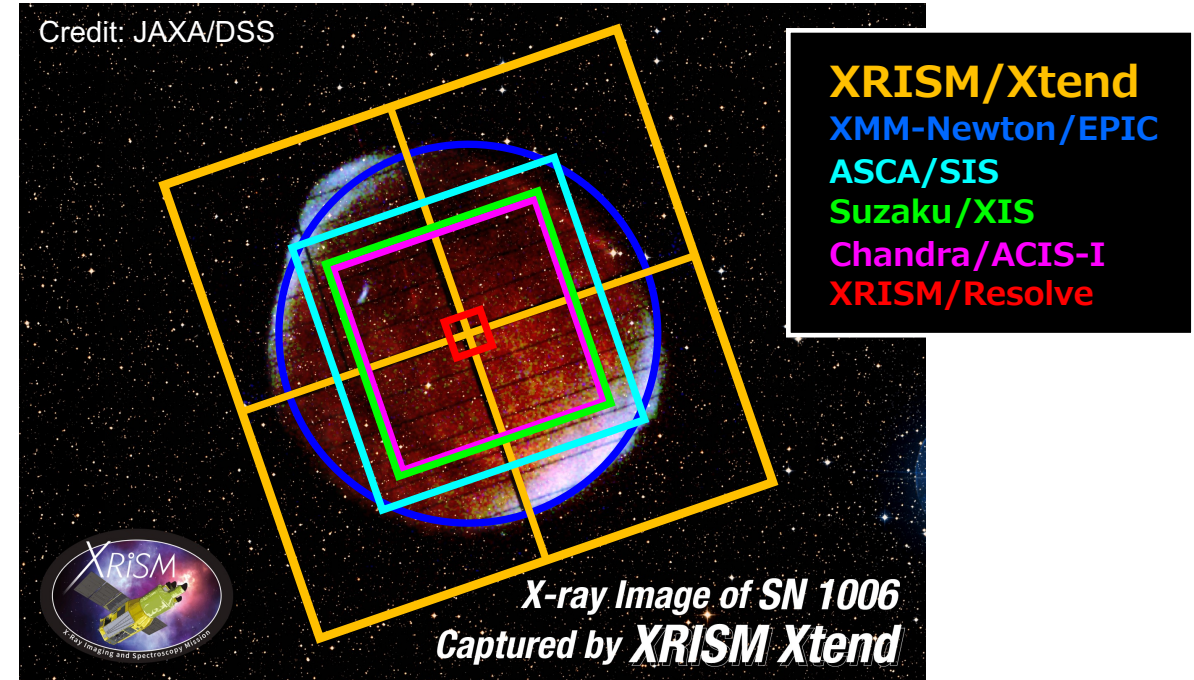
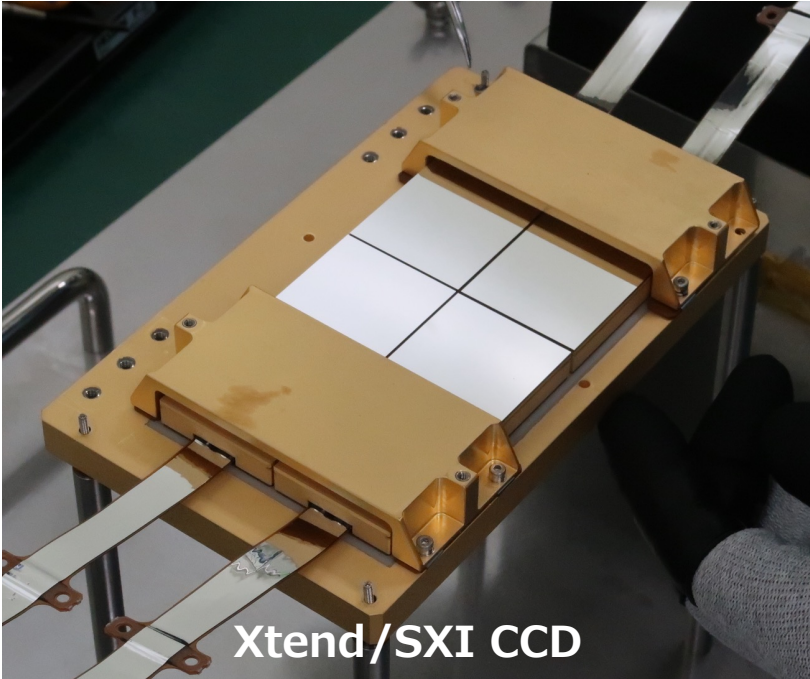
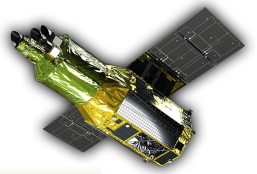
Various interests!

XRISM/Xtend Transient Search (XTS)



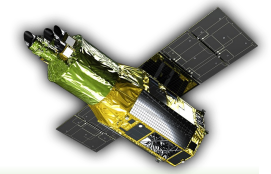
- Utilize a large field of view (FOV; $38' \times 38'$) of Xtend data for...
 - **searching for X-ray transient sources**
 - **reporting the sources via the Astronomer's Telegram (ATel)**
- ⇒ first attempt to search & report **instantly** (~ 1 day) with pointing satellites (e.g., Chandra, XMM)
- ⇒ fainter sources are expected to be detected compared to those of survey satellites (e.g., MAXI, Swift)
- **Time-domain astronomy with XRISM!**

XRISM/Xtend Transient Search (XTS)

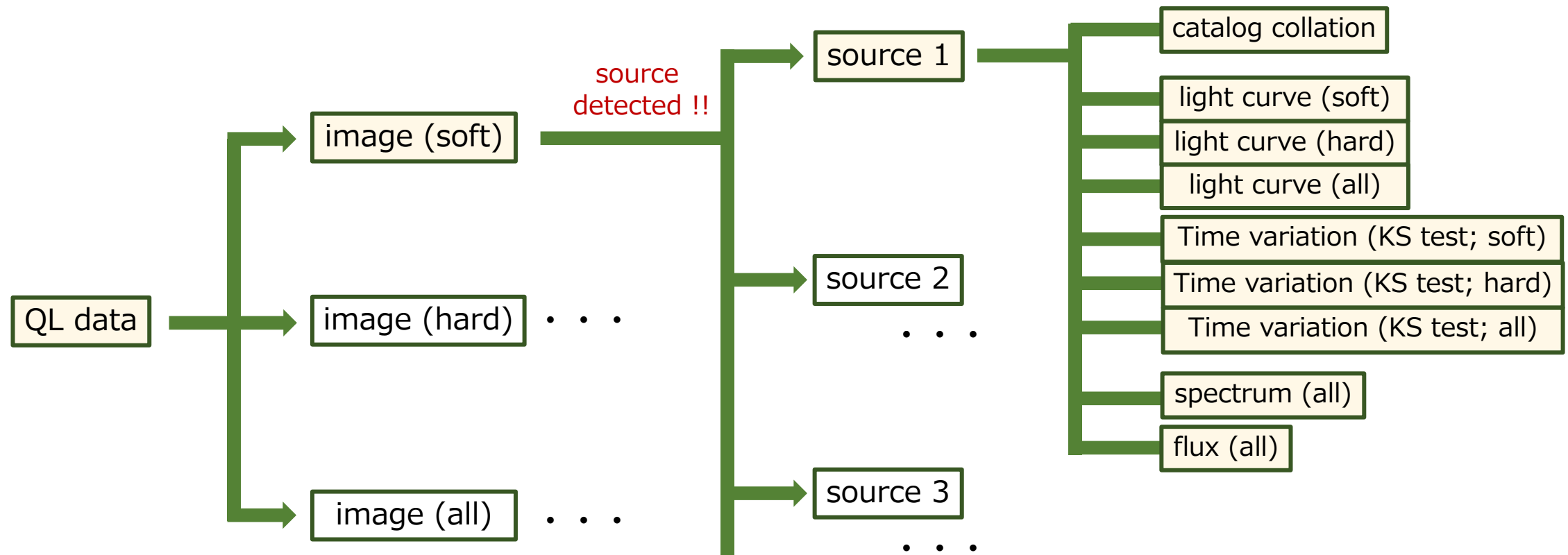


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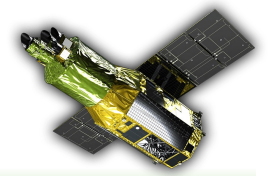
Detection Process



- **Quick Look (QL) data** are subject to XTS
- Exploration in three energy bands (soft: 0.4–2.0 keV, hard: 2.0–10 keV, all: 0.4–10 keV)
- Applying a **2D Mexican hat wavelet algorithm** from the SAS task “ewavelet” to images
- The products are image, catalog collation, light curve, time variable, spectrum, and flux



Procedure / Schedule



– Procedure

- ISAS/JAXA SOC duty scientists run the XTS process **once a day**
- XTS team makes the decision for detected sources to report

– Schedule

• Commissioning / Calibration phase

- development of the system

• PV phase

- performed on all observation
- search on full FOV of Xtend

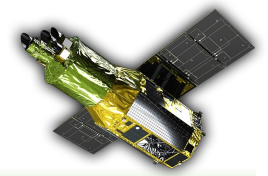
• GO phase

- performed with PI permission
- search outside of Resolve FOV

⌘ The scientific analysis will not be published, only use for ATel reports in GO phase

⌘ If the detected sources have big scientific value, we will trigger a ToO observation for XRISM

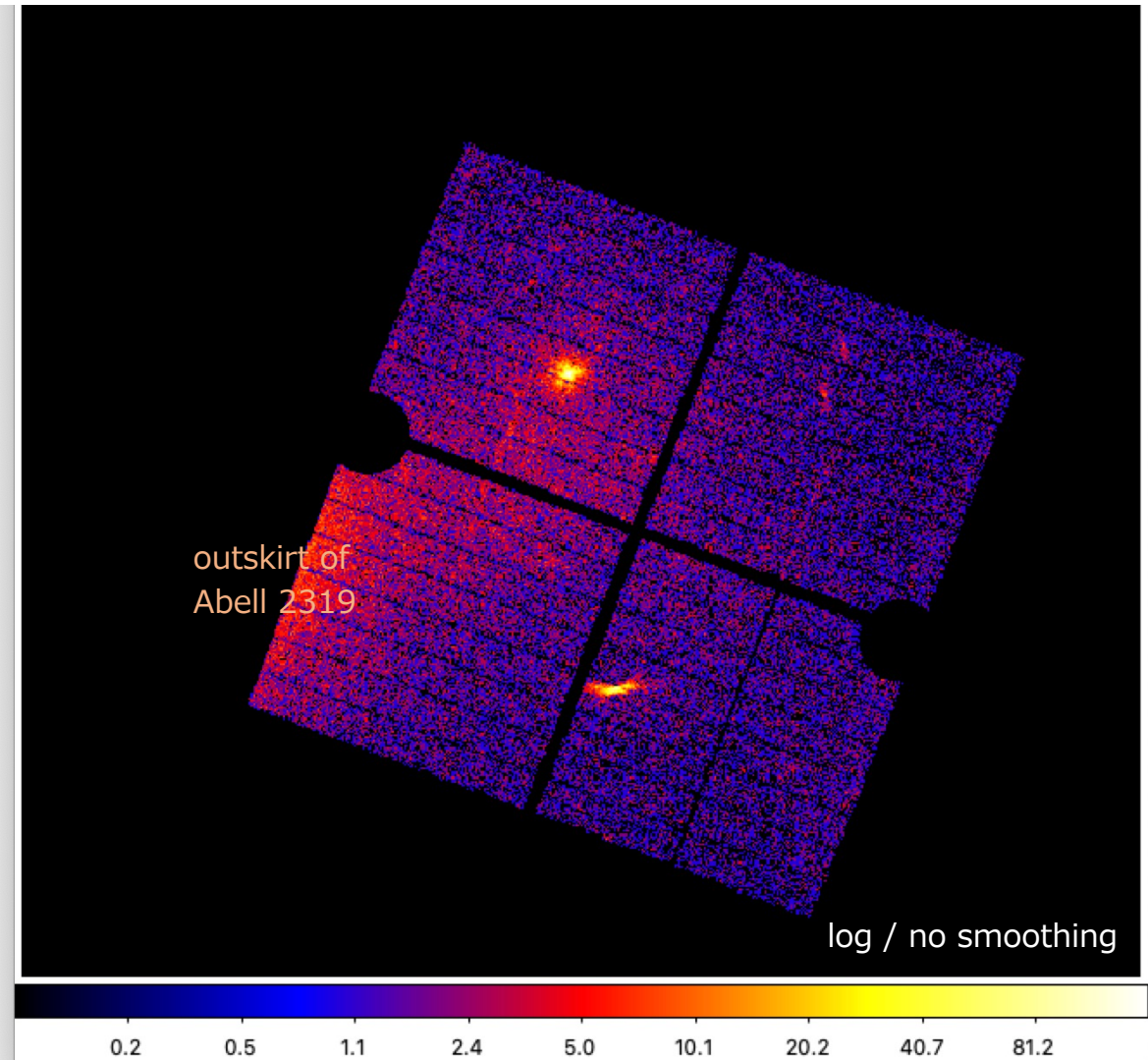
Trial Operation



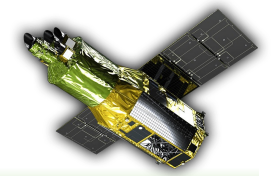
– example

Abell 2319 Blank Sky

- exposure: 50 ks
- full window mode
- energy range: 0.4 – 10 keV



Trial Operation



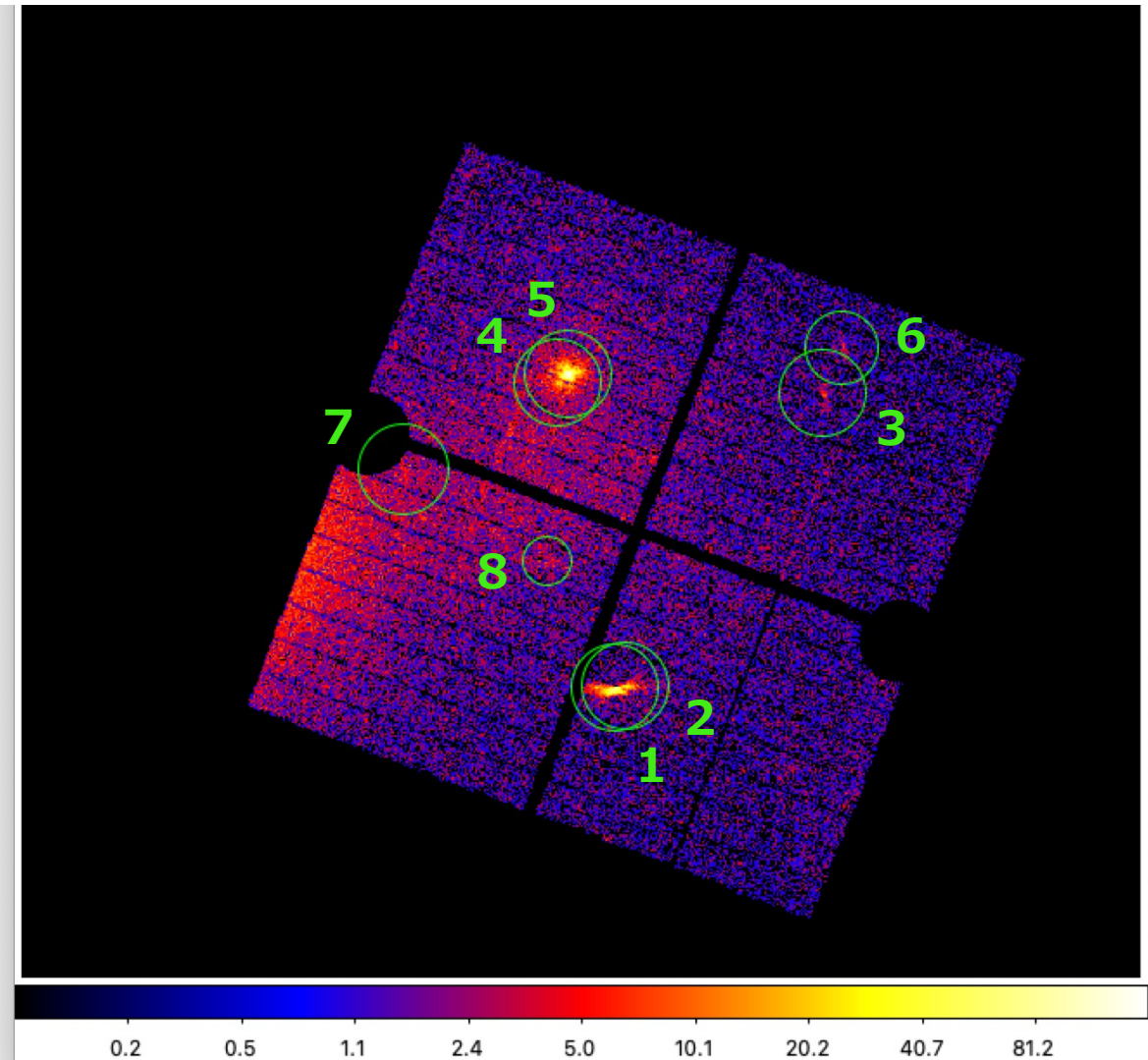
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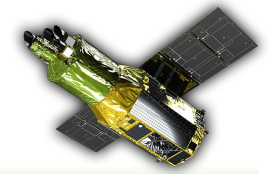
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■ Results

- **Detection of 6 sources (8 regions)**
- corresponding object in the 4XMM, 2SXPS, or 2RXS catalog



Trial Operation



- example

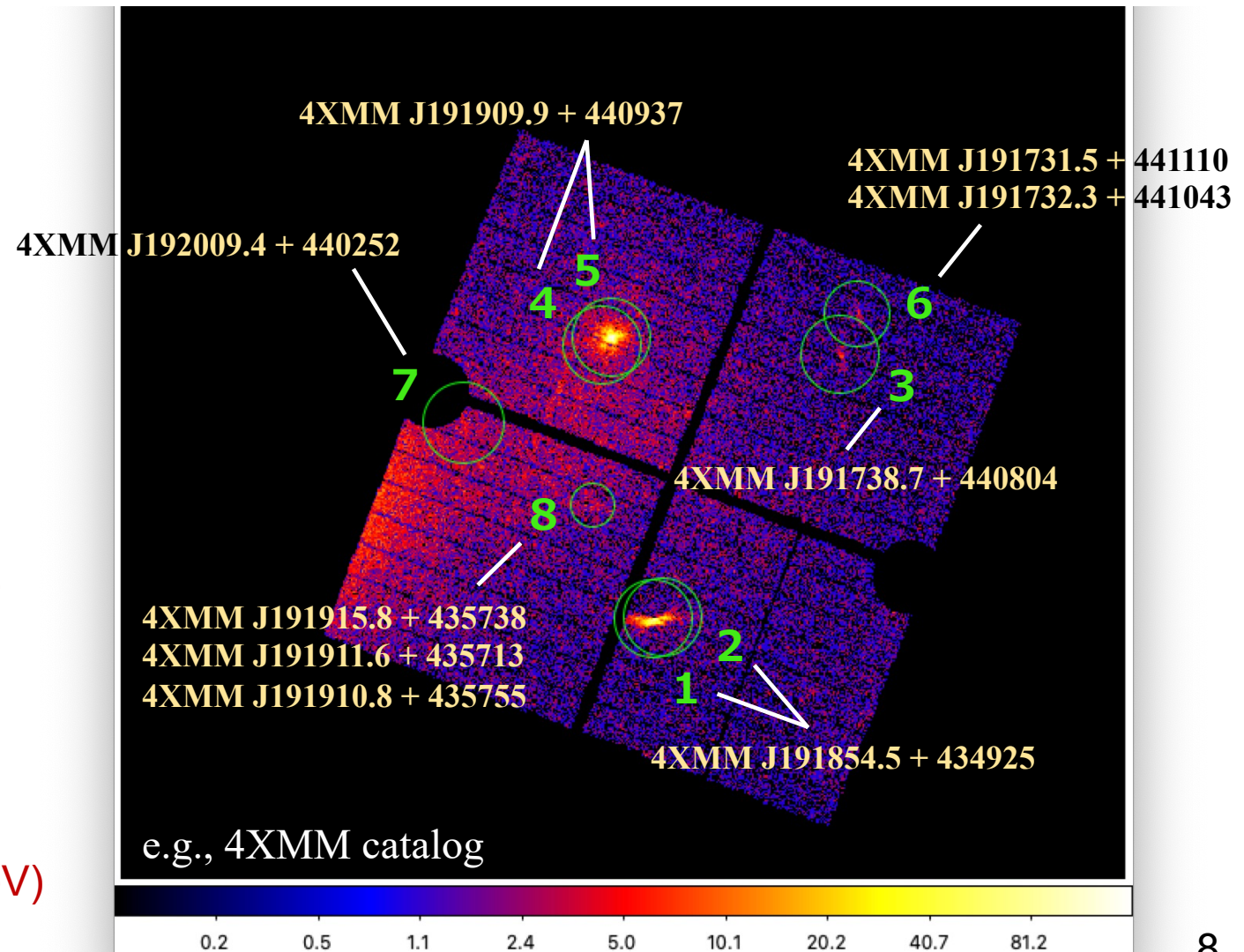
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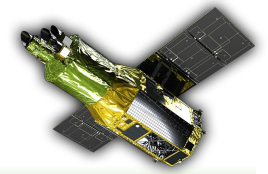
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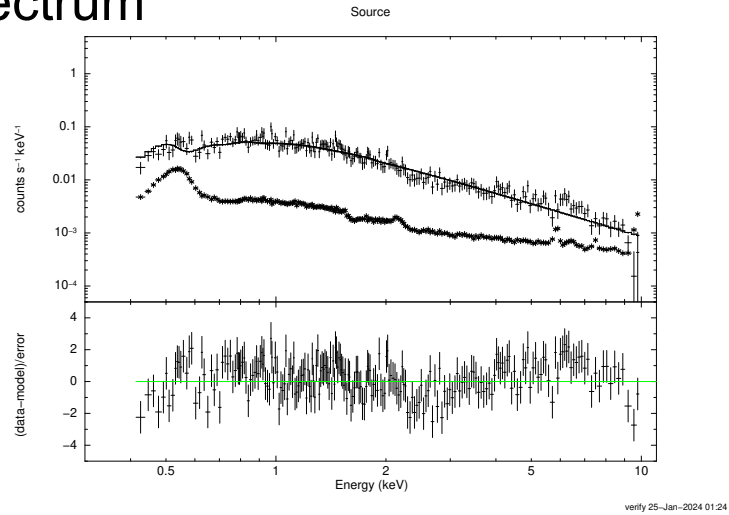
XTS has detected
source flux of $> 10^{-14}$ ergs cm^{-2} s^{-1} (0.4-10 keV)



Trial Operation

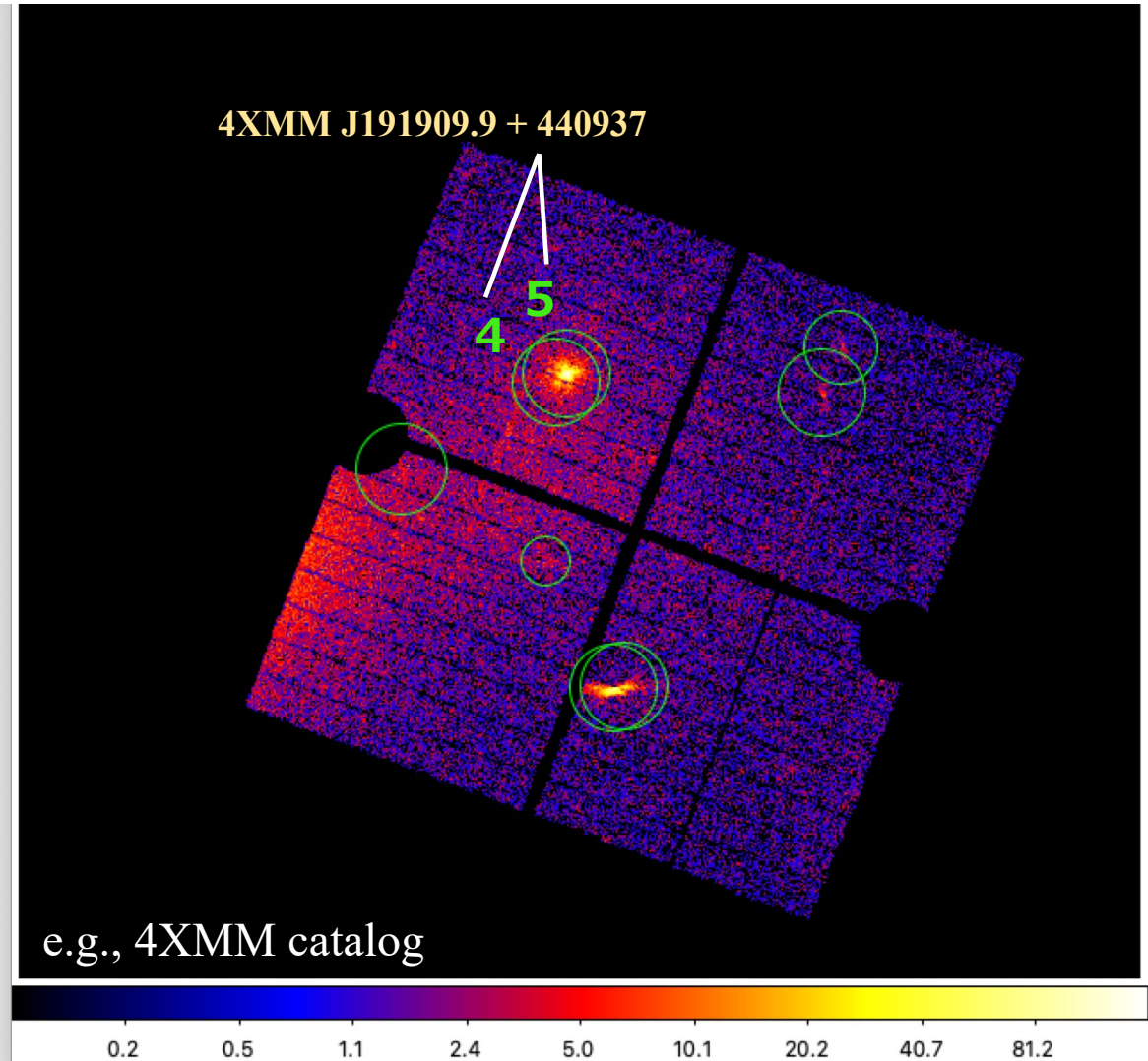
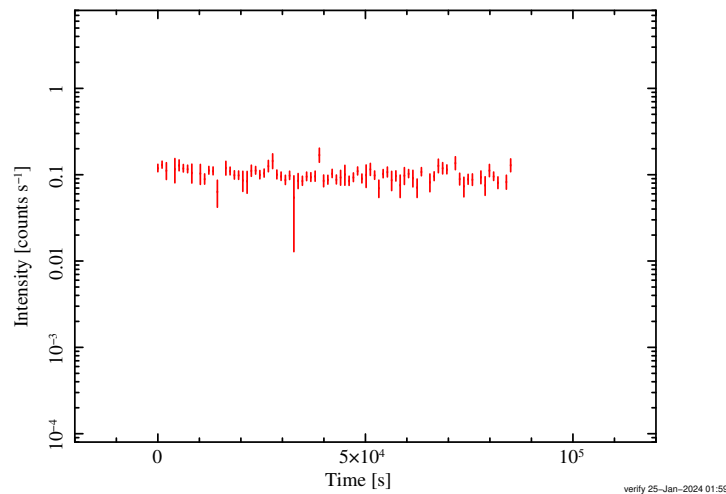


- spectrum

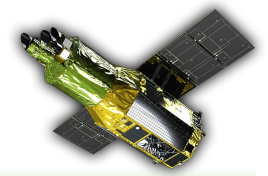


- light curve

of file /nasA_xarm1/transient_search/analysis/0052/targetA/outfile/total/so



ATel Report

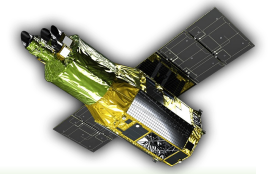


XTS detected 5 X-ray transients and reported them through the ATel!

(as of May 14, 2024)

ATel	Date	Title
#16532	Mar 15, 2024	“XRISM/Xtend Transient Search (XTS) detected an X-ray flare from a plausible optical counterpart LP 593-21”
#16558	Mar 28, 2024	“XRISM/Xtend Transient Search (XTS) detected an X-ray flare possibly from 4XMM J190821.5+065854”
#16561	Mar 31, 2024	“XRISM/Xtend Transient Search (XTS) detected an X-ray flare possibly from a YSO candidate”
#16592	Apr 17, 2024	“XRISM/Xtend Transient Search (XTS) detected an X-ray flare possibly from a spectroscopic binary”
#16607	May 1, 2024	“XRISM/Xtend Transient Search (XTS) detected an X-ray outburst from a high-mass X-ray binary AX J1910.7+0917”

ATel Report



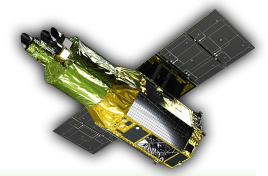
ATel	Date	Type	Origin	unabsorbed model flux [erg s ⁻¹ cm ⁻²] (0.4-10 keV)
#16532	Mar 15, 2024	flare	M dwarf binary	$1.1 (\pm 0.3) \times 10^{-12}$ (apec)
#16558	Mar 28, 2024	flare	XMM source?	$4.6 (+3.4/-1.9) \times 10^{-13}$ (apec)
#16561	Mar 31, 2024	flare	YSO?	$1.6 (+0.4/-0.5) \times 10^{-12}$ (apec)
#16592	Apr 17, 2024	flare	spectroscopic binary?	$< 3 \times 10^{-12}$ (apec)
#16607	May 1, 2024	outburst	HMXB AX J1910.7+0917 (NS)	$3.6 (+0.4/-0.2) \times 10^{-11}$ (power-law)

※ in flare or burst phase

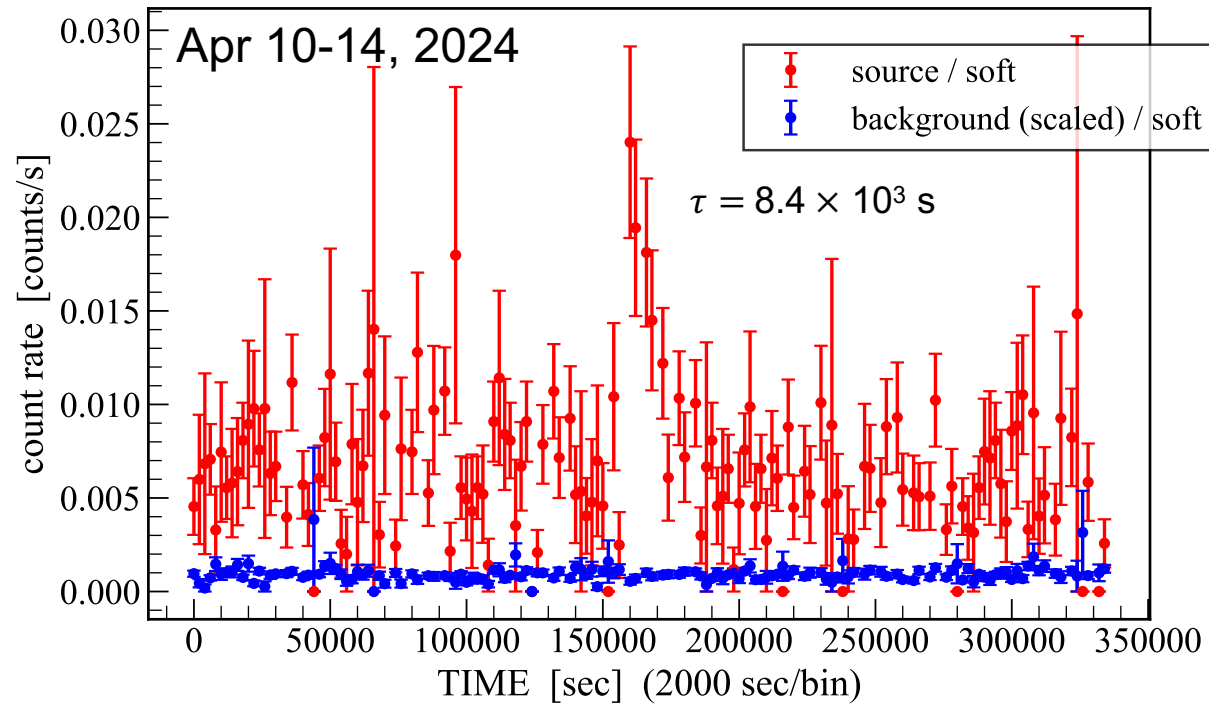
- XTS detected flares and outburst from YSO, star, and HMXB
- The fastest report was in 20 hours from transient occurred
- 5 reports in nominal phase (2 months) → 30 transients/year

Our universe is far more active than we imagined!

ATel Report

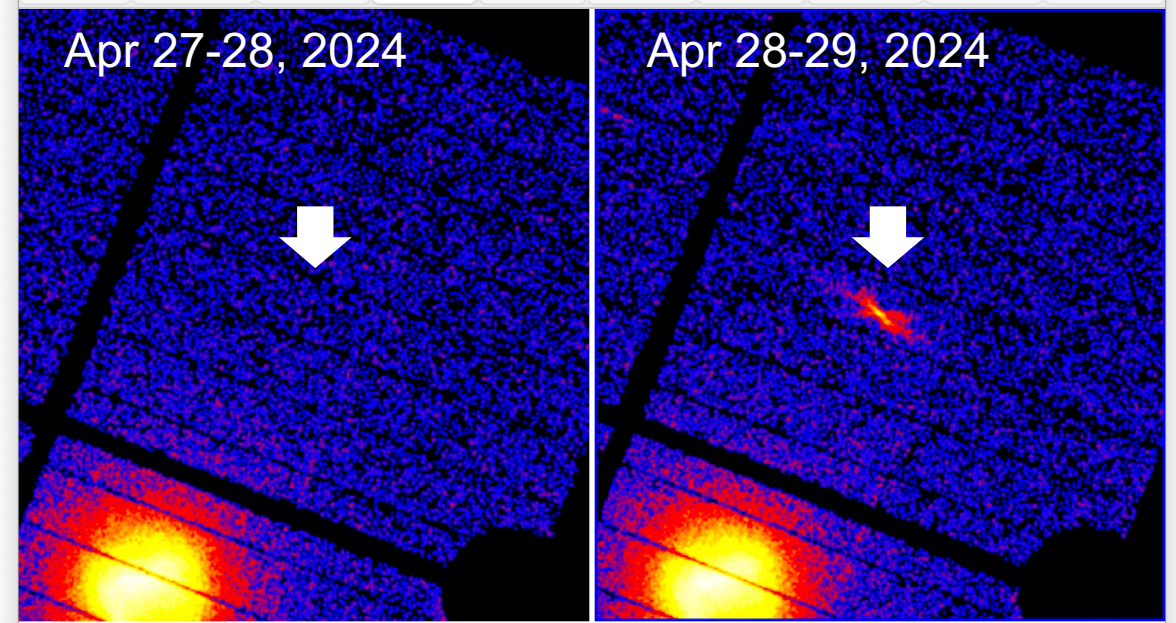


#16592



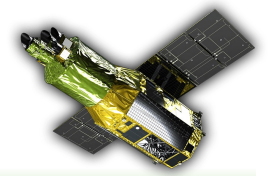
X-ray flare possibly from a spectroscopic binary

#16607



outburst from the HMXB AX J1910.7+0917 (NS)

Summary



- We developed the XRISM/Xtend Transient Search (XTS) system
The system is running every day
- XTS system can
 - search for X-ray transient sources
 - reporting the sources via the ATel (~1 day after observation)
- ISAS/JAXA SOC duty scientists will run the XTS process once a day
- The XTS team determines the ATel report for detected sources
- In trial operation, the system successfully detected point sources
- XTS is in normal operation
- 5 X-ray transients were detected and reported through the ATel