

A multi-wavelength study of the first gamma-ray emitting LMXB XSS J12270-4859

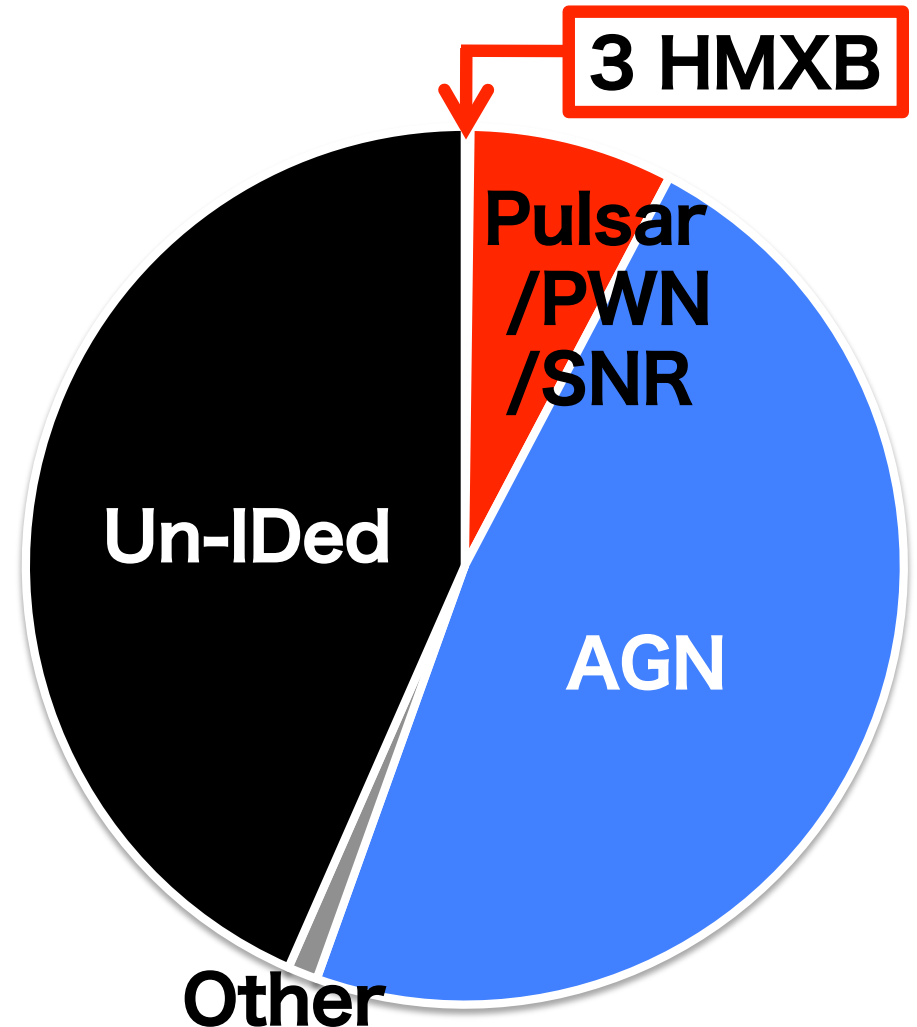
Saitou et al. 2009, PASJ, 61, L13
Saitou et al. 2011, PASJ, in press
(Suzaku special issue; arXiv:1105.4717)

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1. Introduction

Fermi detected 1451 γ -ray sources (Abdo+ 2010)
Most are **AGN**, some are **Galactic sources**.
Half of them are **un-IDed**.

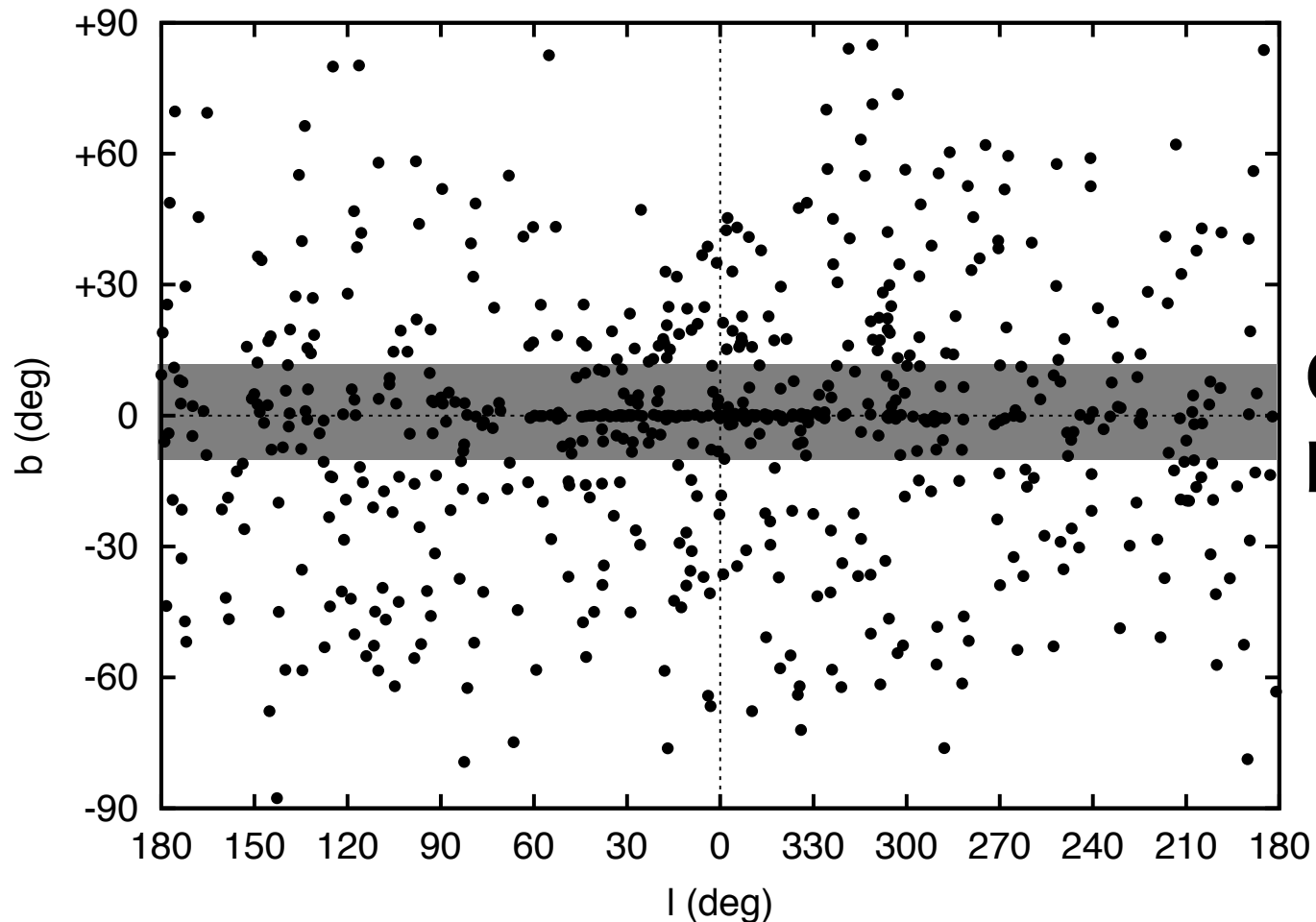


1. Introduction

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HMXB

Star
VN
IR

Galactic
plane

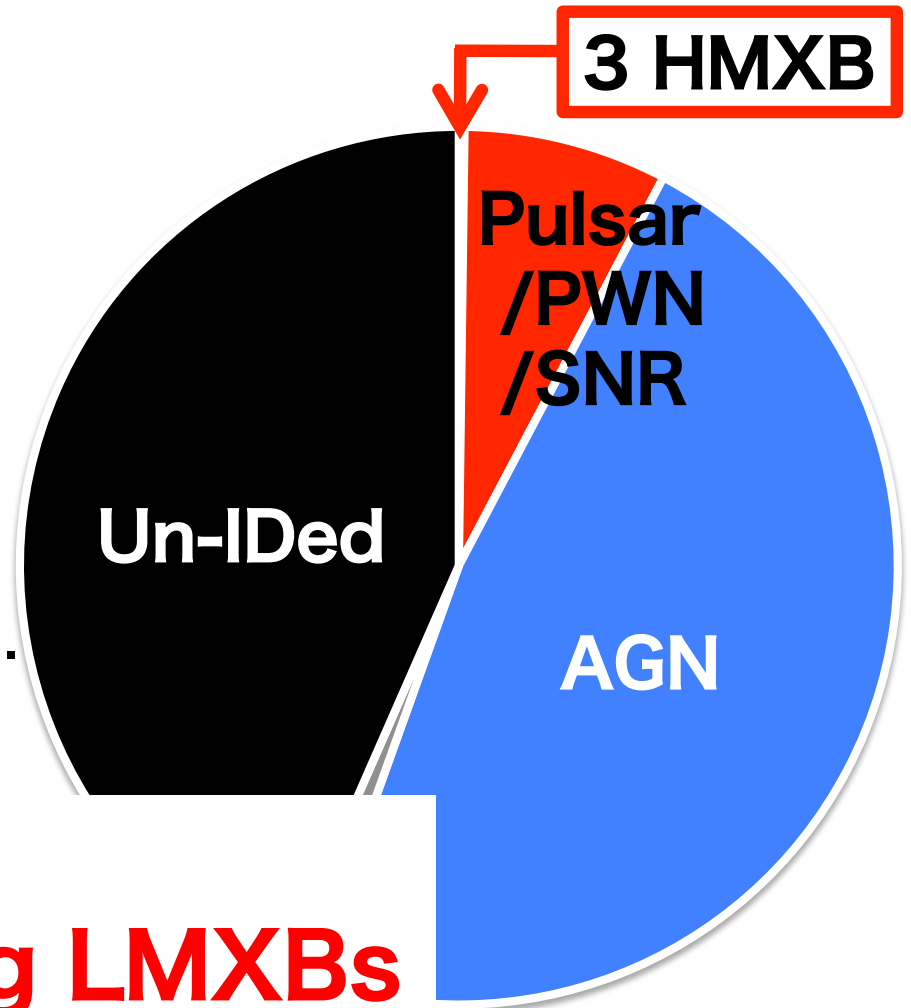
AGN

1. Introduction

Fermi detected 1451 γ -ray sources (Abdo+ 2010)
Most are **AGN**, some are **Galactic sources**.
Half of them are **un-IDed**.

There are many un-IDed Galactic sources.

So, there must be new classes of Galactic sources.



**Goal of this study:
to find γ -ray emitting LMXBs**

1. Introduction

Approach

1. Find LMXBs from the INTEGRAL catalog.

- Optical spectroscopy can find CVs and LMXBs. (Masetti+ 2006; Pretorius 2009)
- X-ray observations distinguish CVs and LMXBs. (Saitou+ 2009)

CVs: Fe lines, long-term variability (~hours).

LMXBs: no Fe lines, short-term variability (~sec).

2. Find the Fermi counterpart.

- Correlation of γ -ray and others. (de Martino+ 2010; Hill+ 2011)

3. Reveal the nature.

- Simultaneous X-ray / IR observations. (Saitou+ 2011)
- Broad-band SED. (Saitou+ 2011)

2. LMXB? - Optical spectroscopy

We observed INTEGRAL sources with Suzaku.

XSS J12270-4859

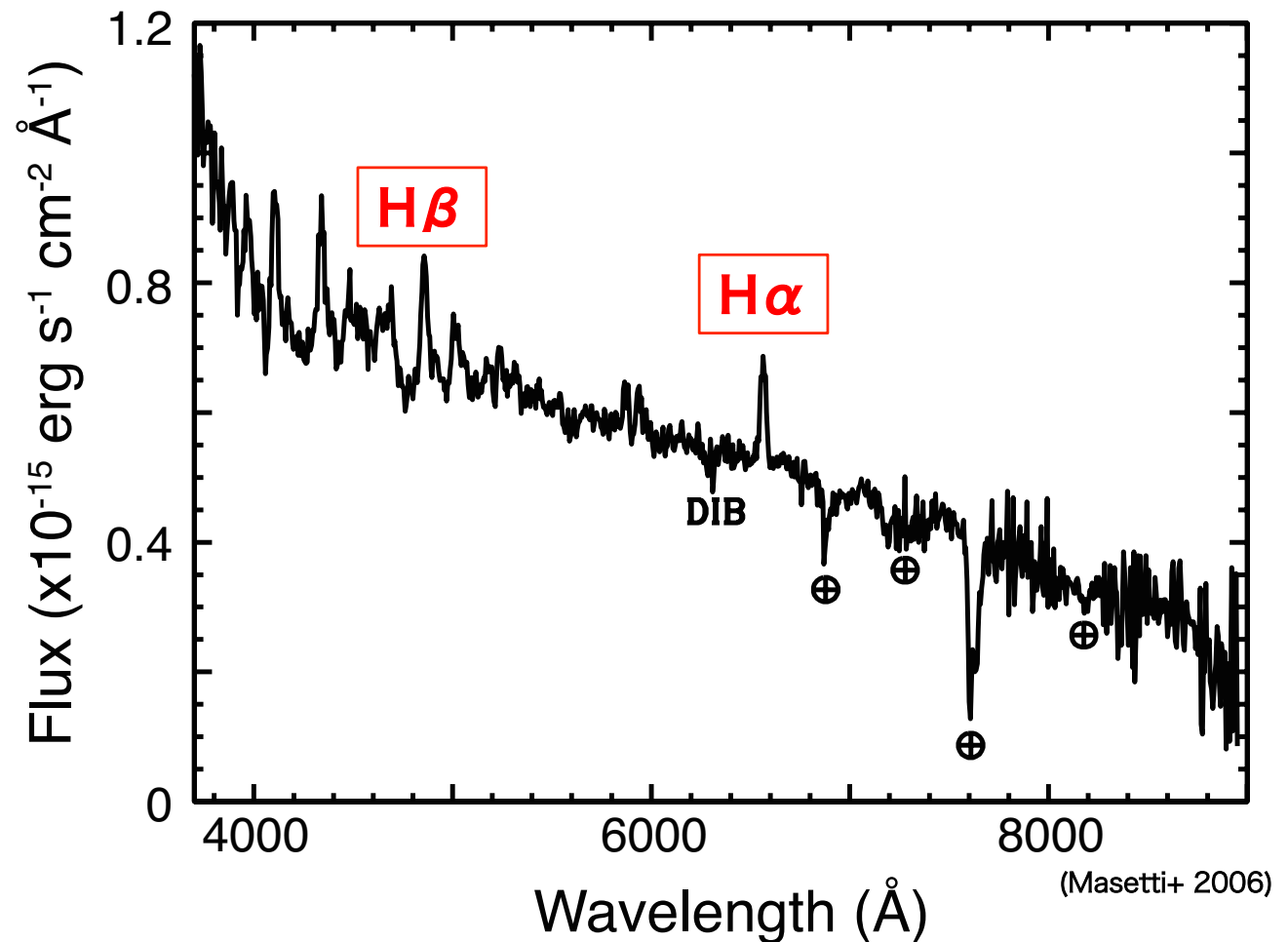
- discovered by RXTE (Revnivtsev+ 2004)
- re-discovered by INTEGRAL (Bird+ 2007)
- a binary system with a low-mass companion
by follow-up optical spectroscopy
(Masetti+ 2006; Pretorius 2009)

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XSS J12270-

- discovered
- re-discovered
- a binary system
- by follow-up
- (Masetti+ 2006)

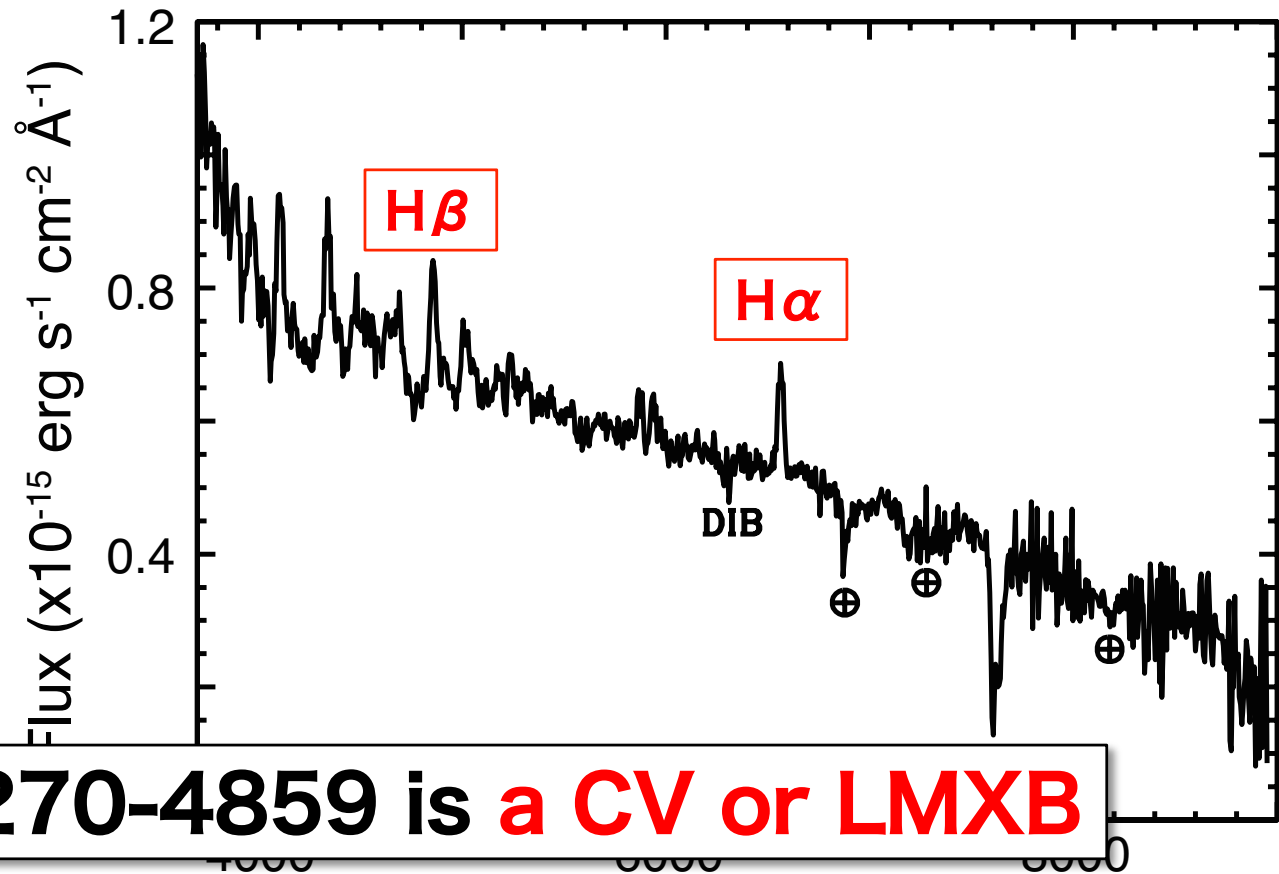


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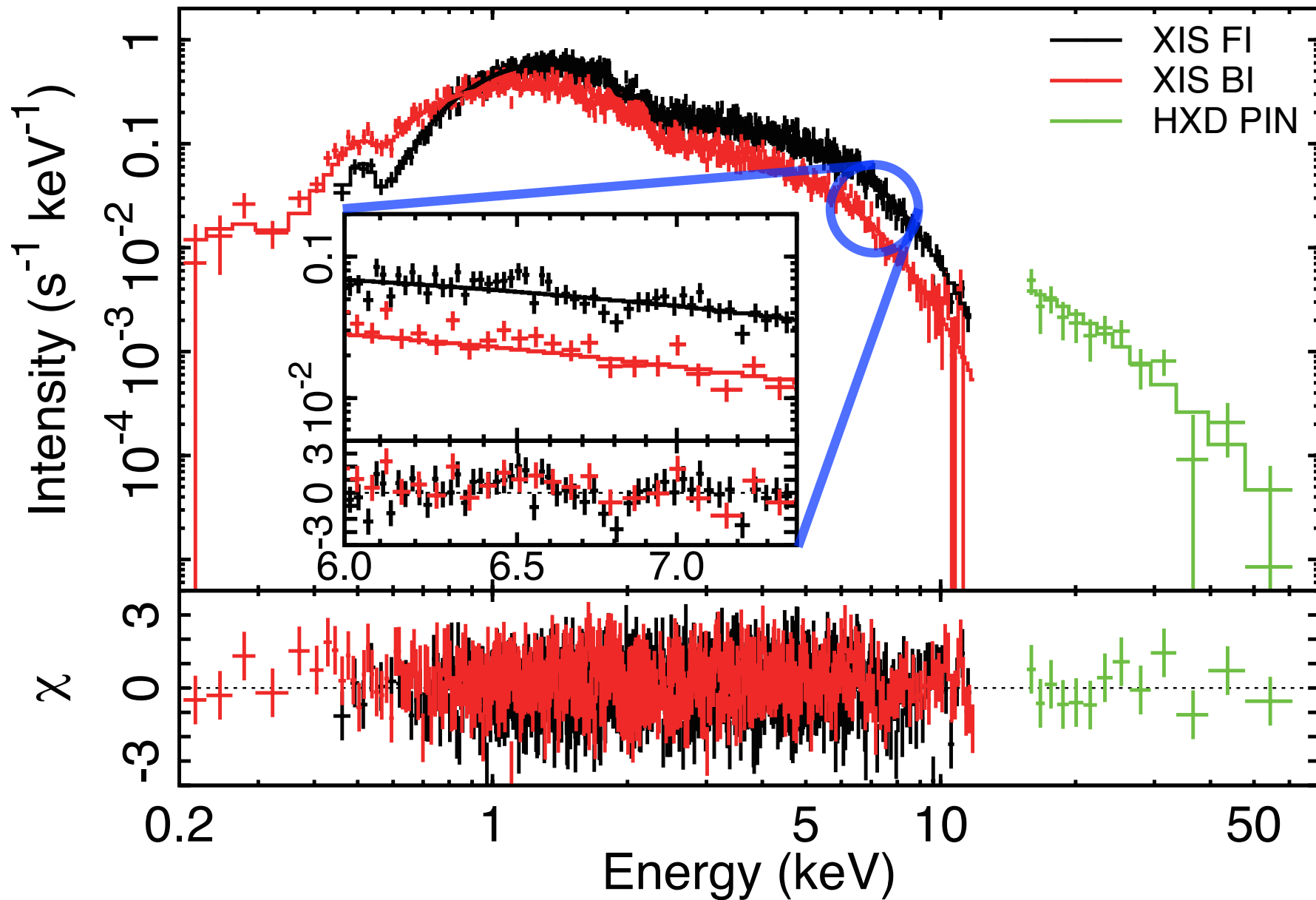


XSS J12270-4859 is a CV or LMXB

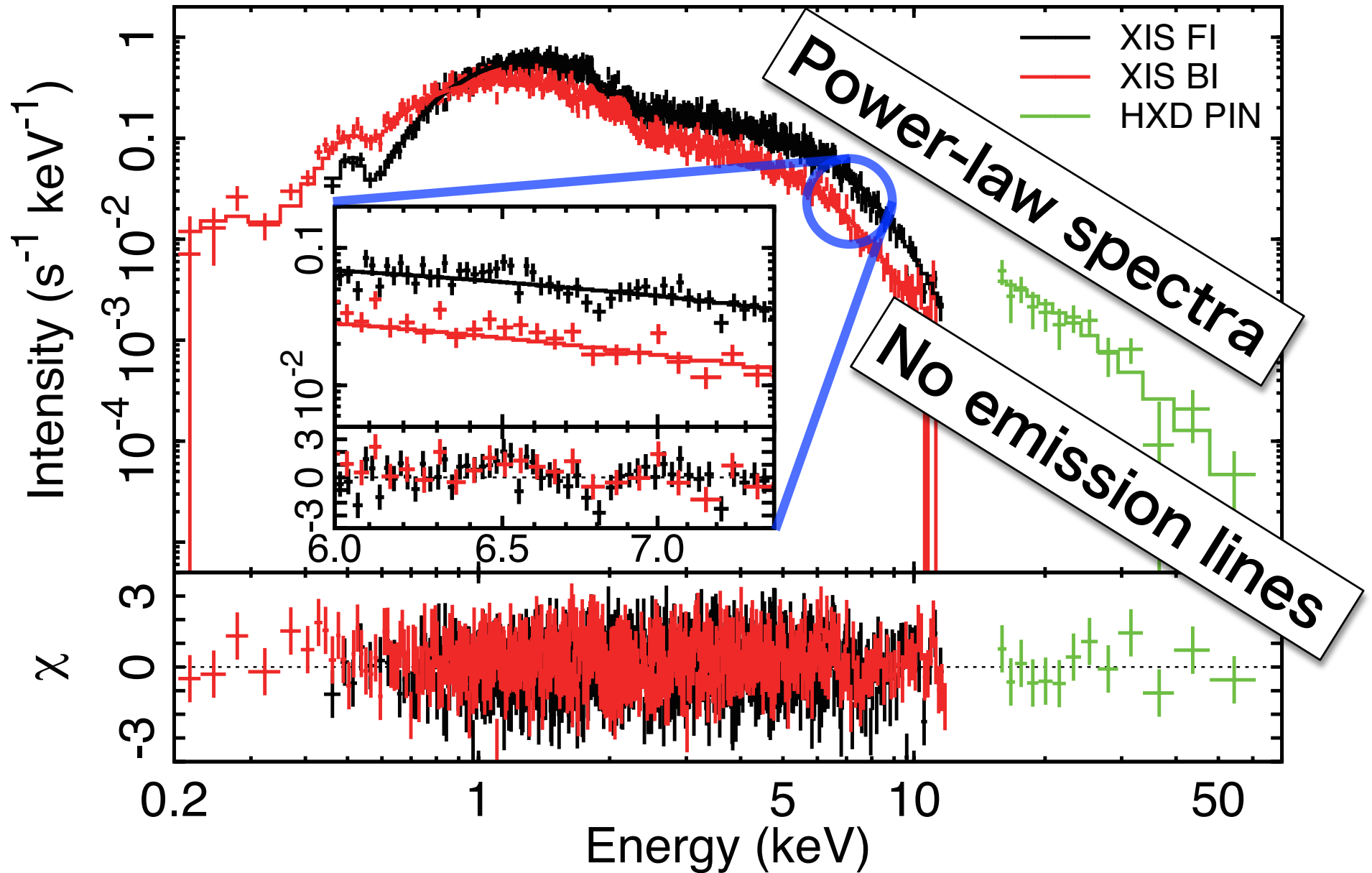
Wavelength (Å)

(Masetti+ 2006)

2. LMXB? - X-ray spectroscopy

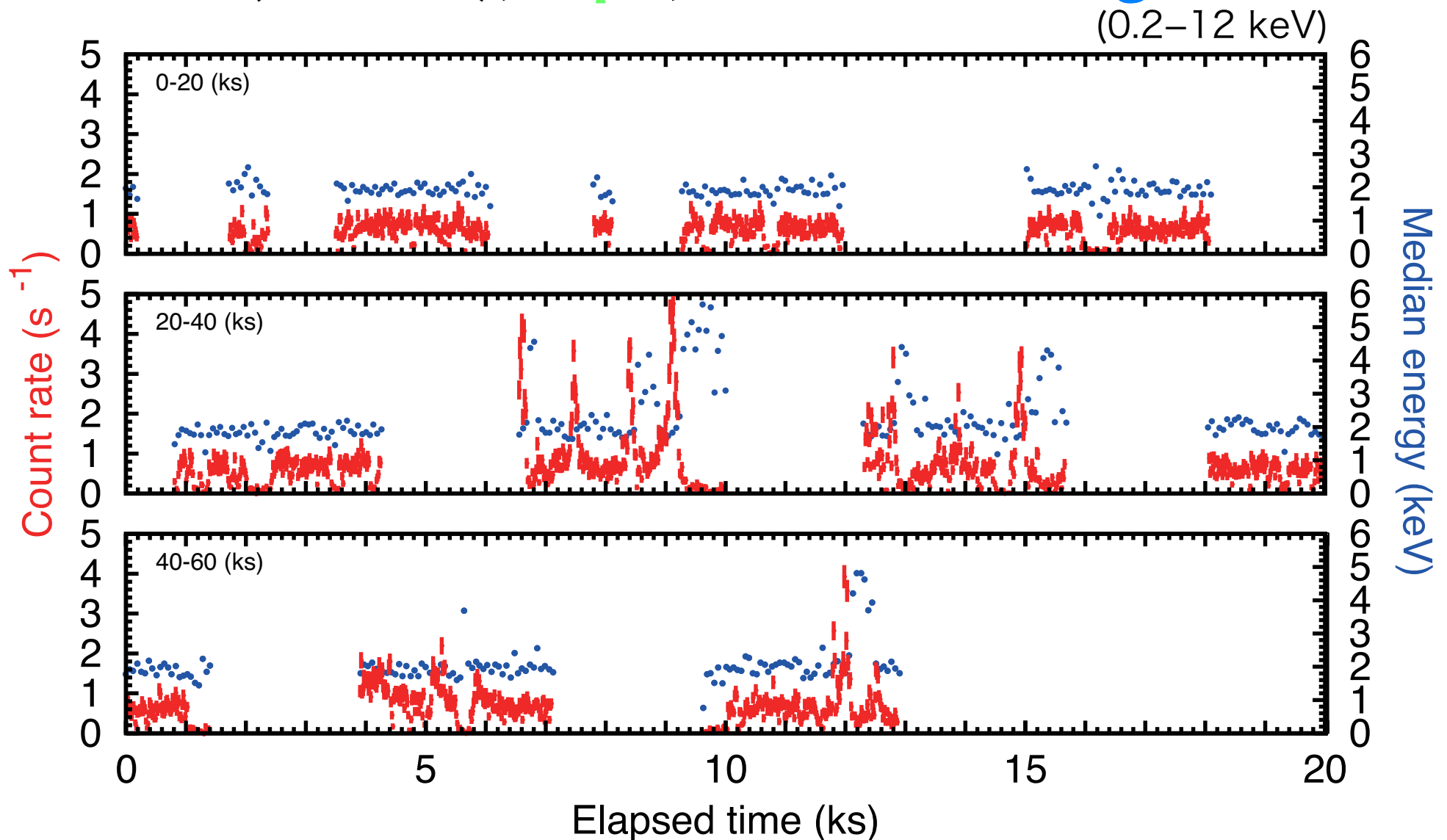


2. LMXB? - X-ray spectroscopy



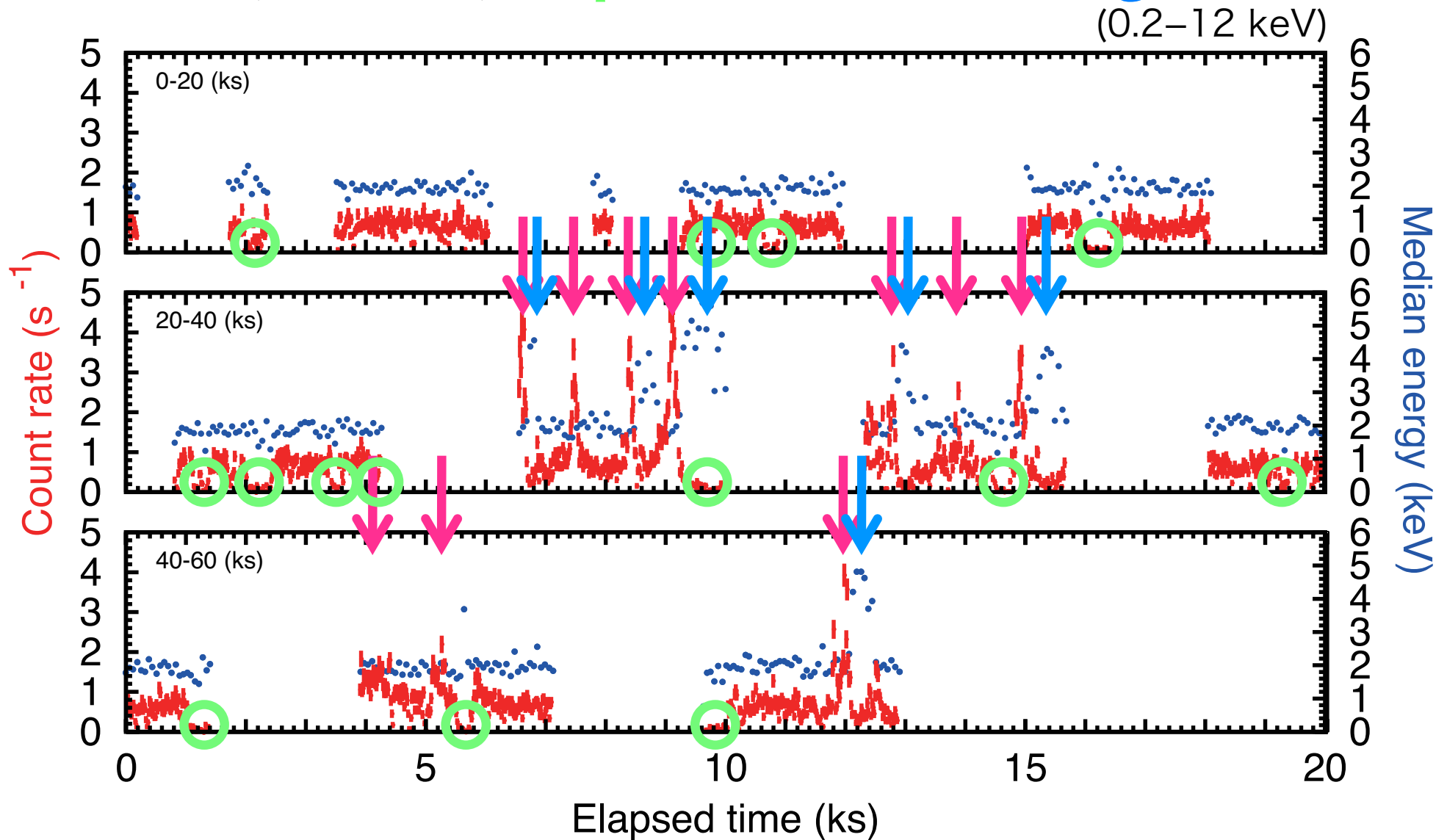
2. LMXB? - X-ray light curve

Flares (~250 s), **Dips**, and **Hardenings**



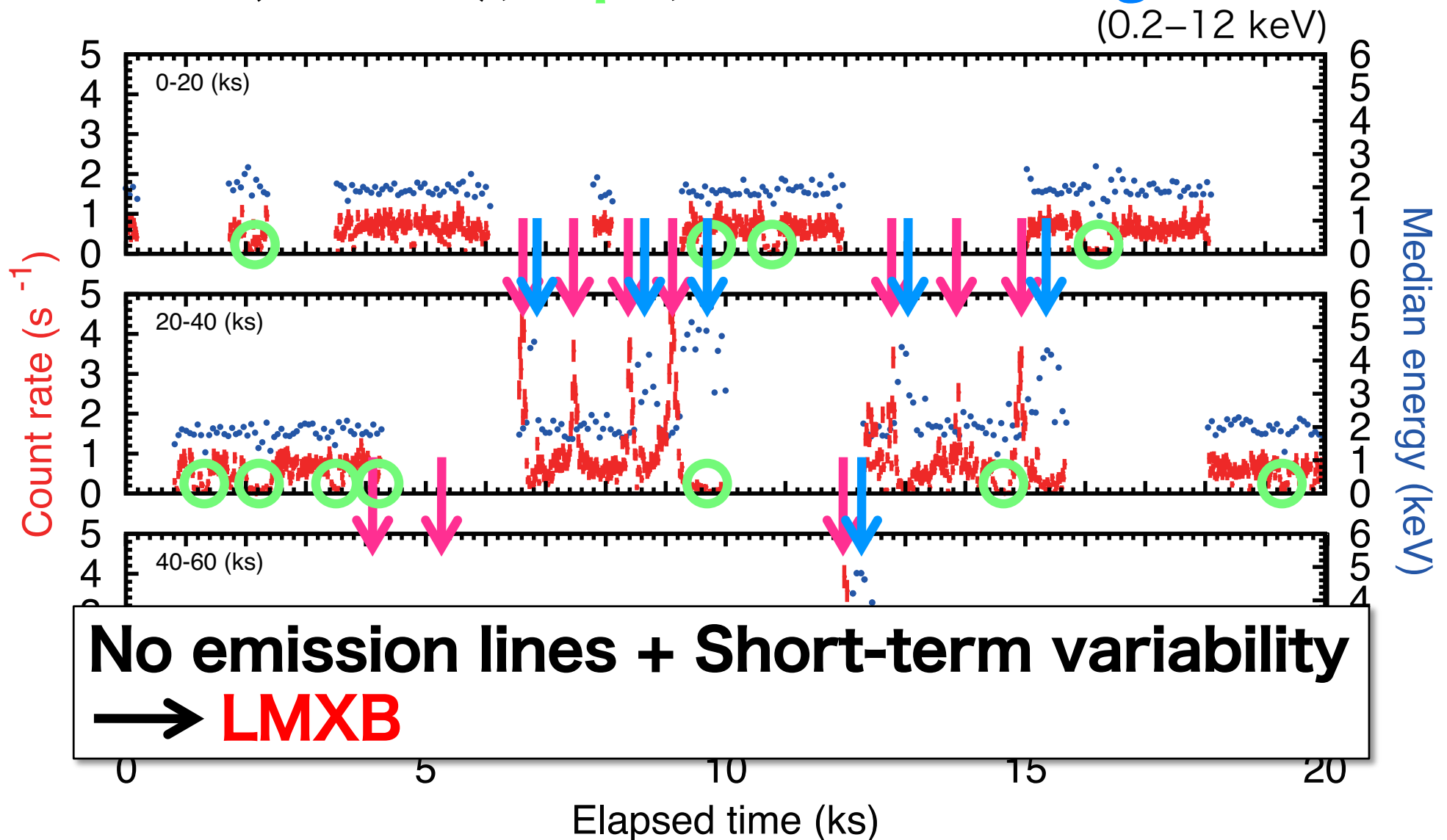
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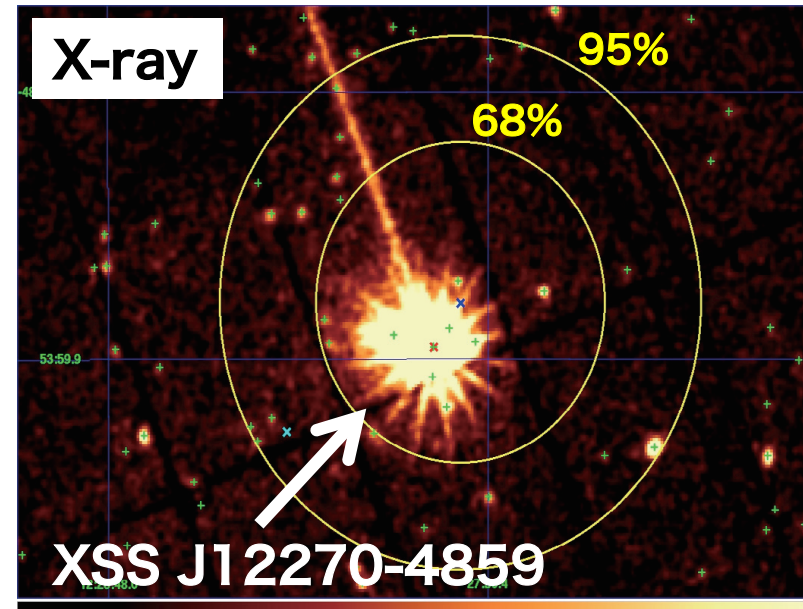
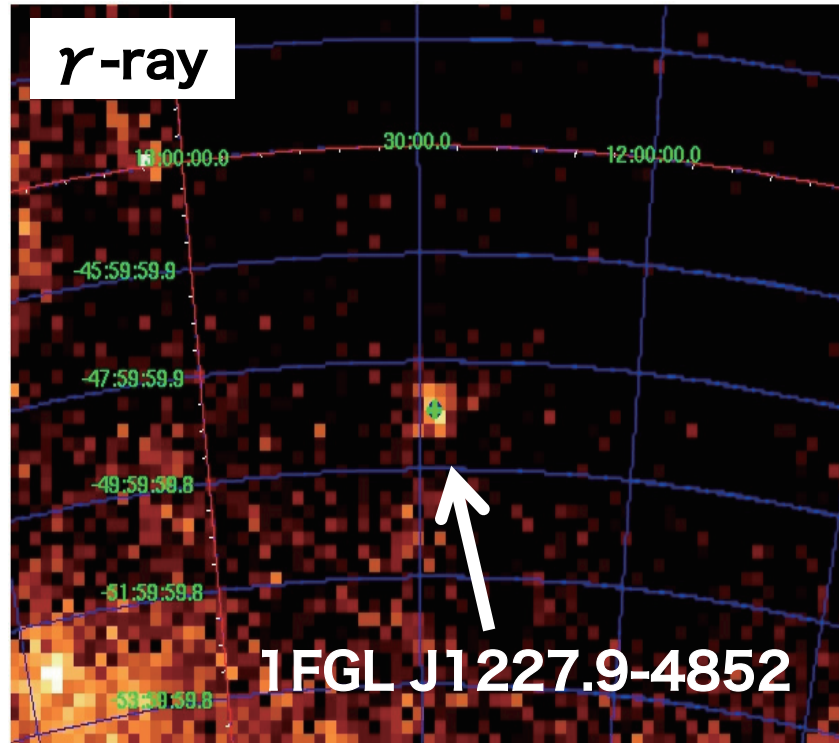


2. LMXB? - X-ray light curve

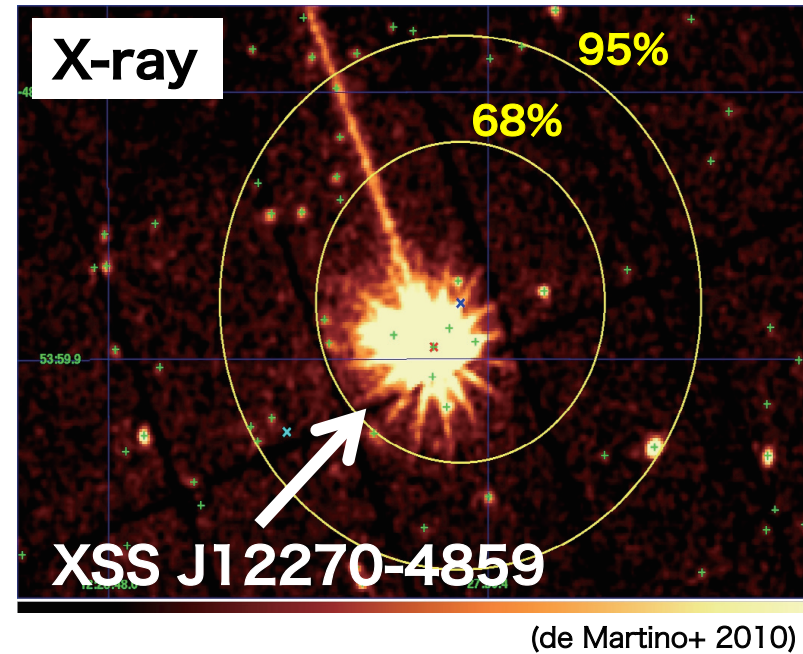
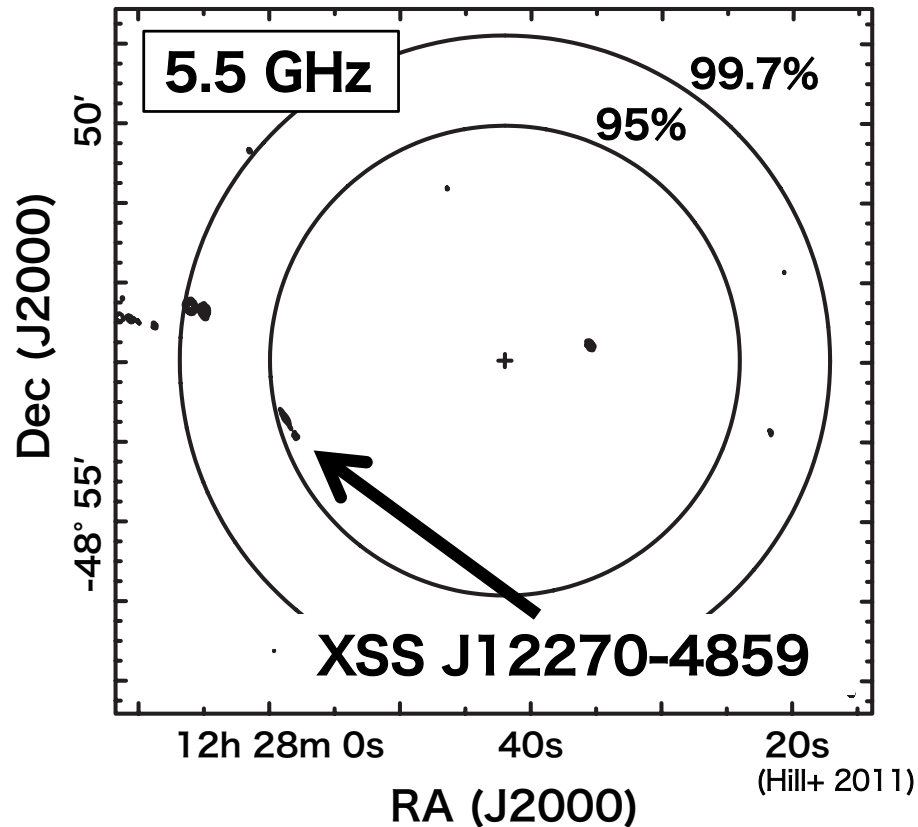
Flares (~250 s), **Dips**, and **Hardenings**



3. Fermi counterpart? - γ -ray and radio



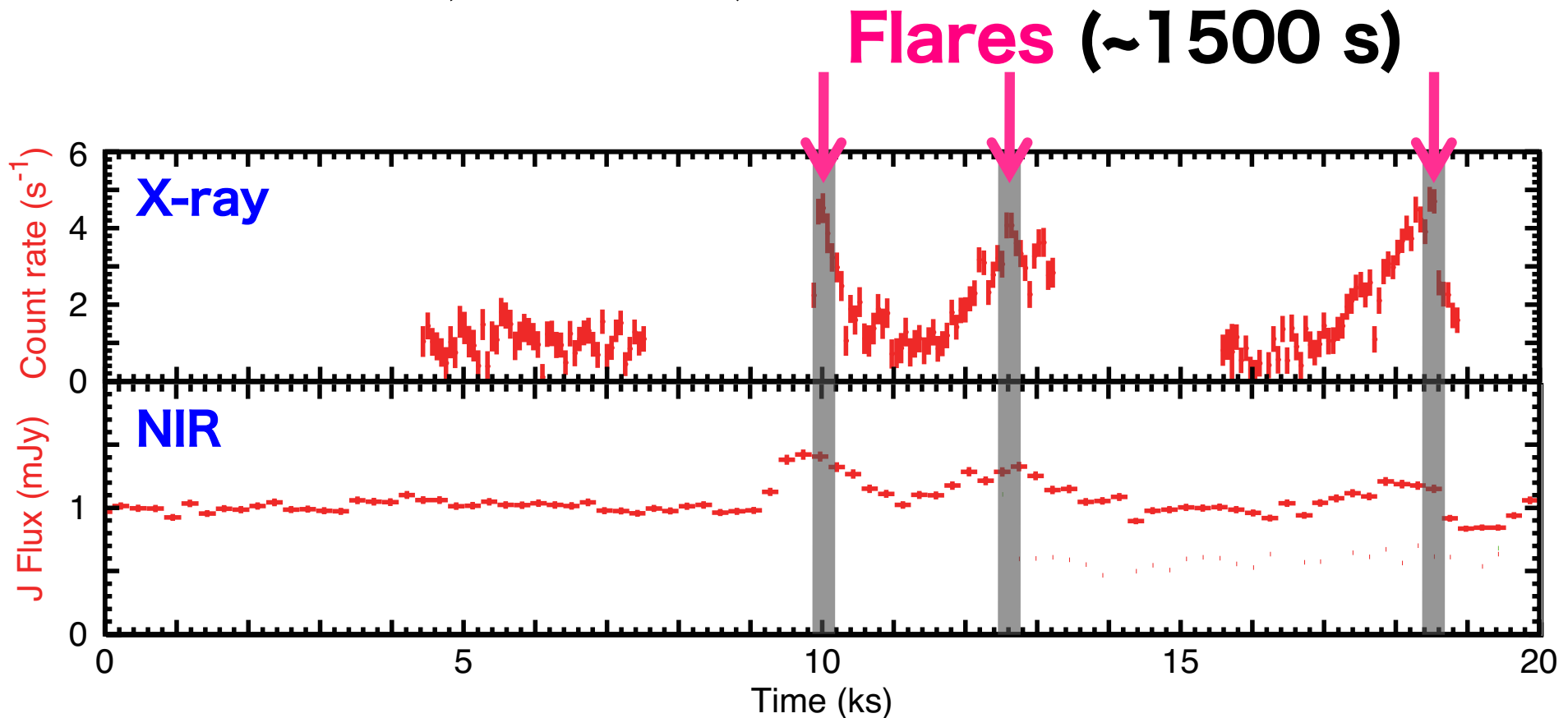
3. Fermi counterpart? - γ -ray and radio



**XSS J12270-4859 is a Fermi source
and a radio source**

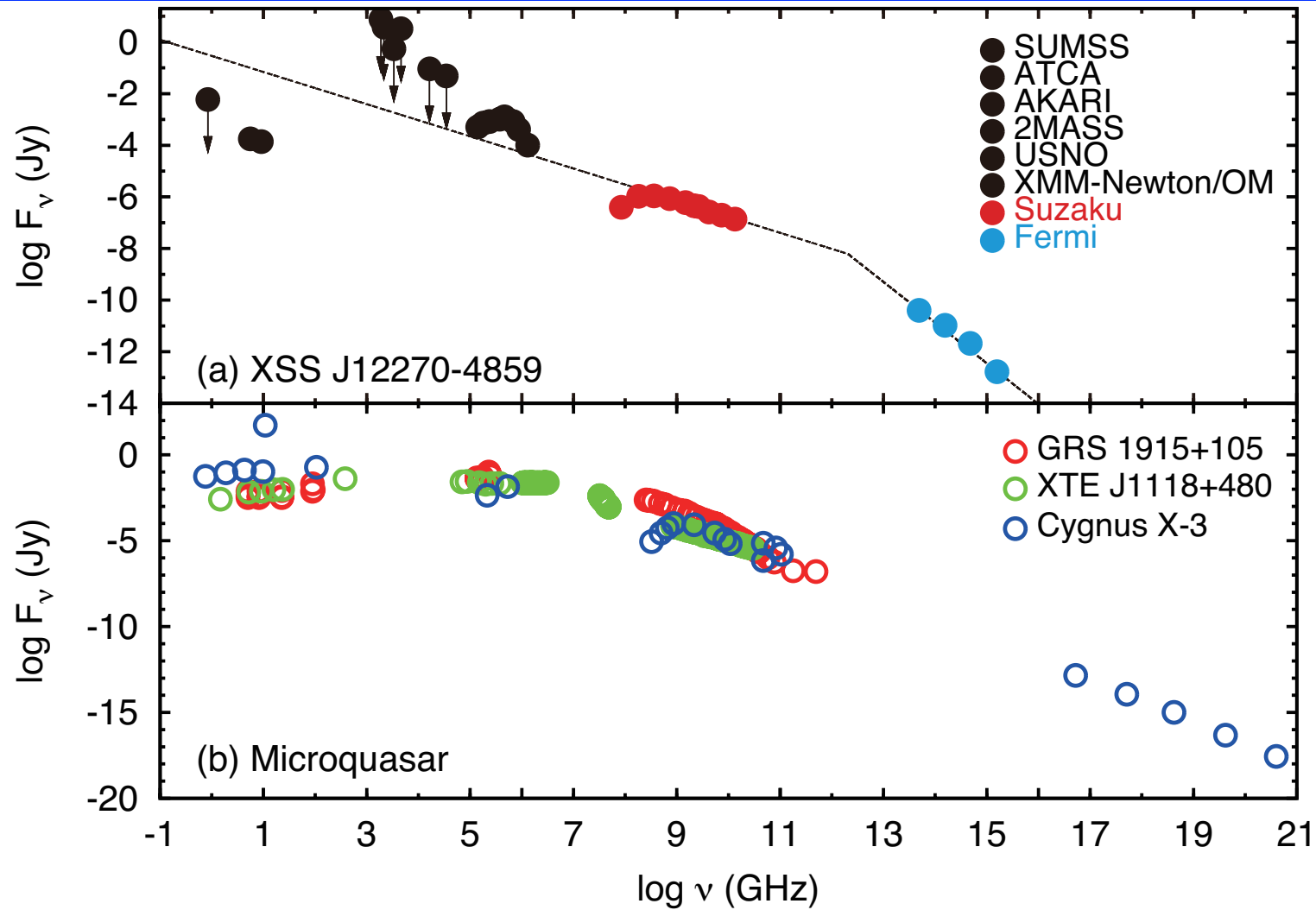
4. Nature? - Simultaneous X-ray / IR

X-ray (RXTE; 2-10 keV) and NIR (IRSF; J, H, Ks) observations (PI: Saitou)

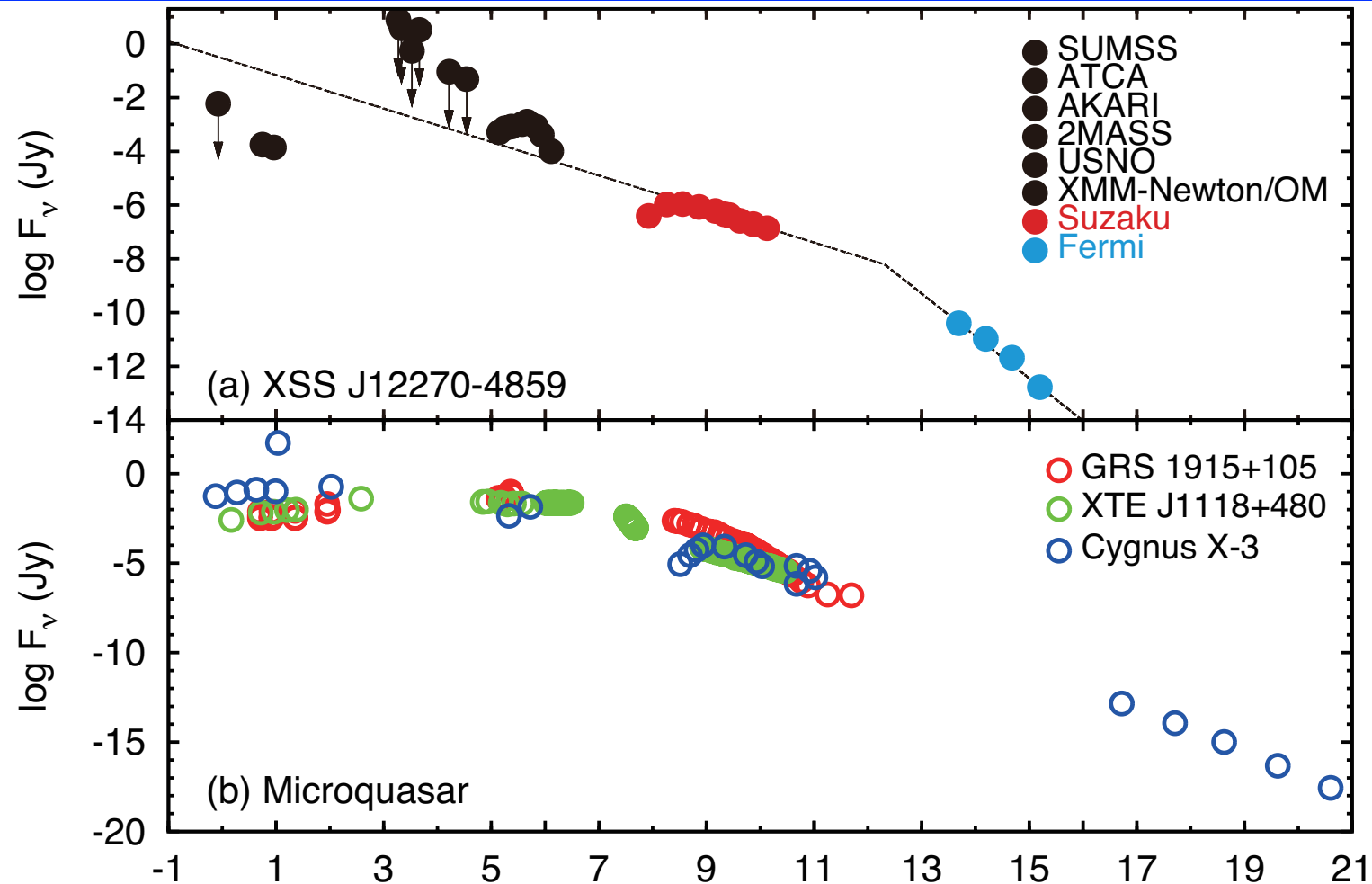


X-ray and IR emissions have **the same origin**

4. Nature? - Broad-band SED



4. Nature? - Broad-band SED



Broad-band SED + repetitive flares
→ **microquasar** with synchrotron jet

5. Discussion

1. Find LMXBs from the INTEGRAL catalog.
Suzaku revealed the source is a LMXB.
2. Find the Fermi counterpart.
The source has the Fermi counterpart.
3. Reveal the nature.
A microquasar with a synchrotron jet.

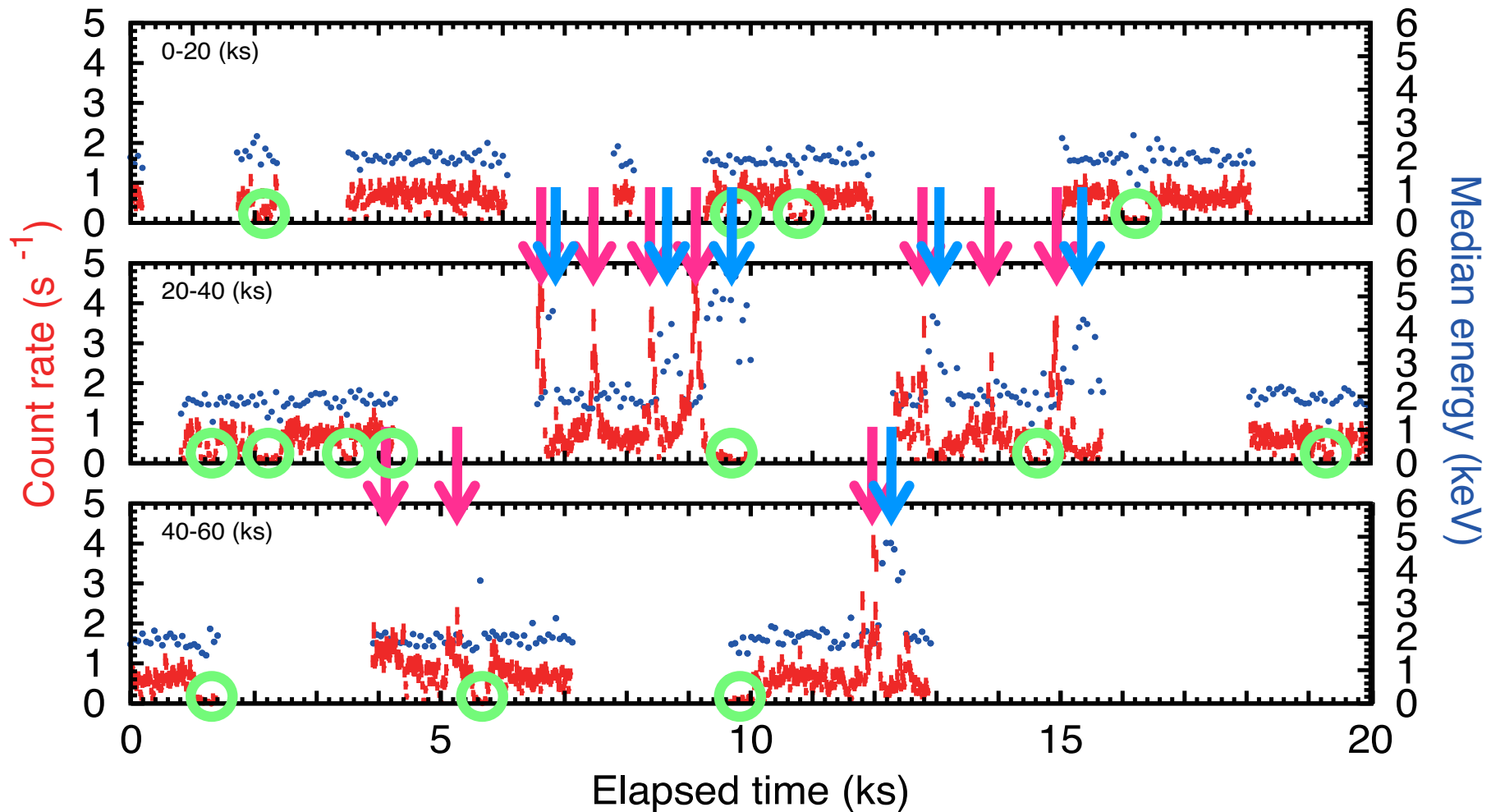
At 1 kpc, $L_{\text{bol}} \sim 10^{34}$ erg/s, $\sim 10^{-4} L_{\text{Edd}}$ for $1 M_{\odot}$.

XSS J12270-4859 is

- **the first γ -ray emitting LMXB**
- **a microquasar at low luminosity state**

5. Discussion

XSS J12270-4859 shows characteristic variability



5. Discussion

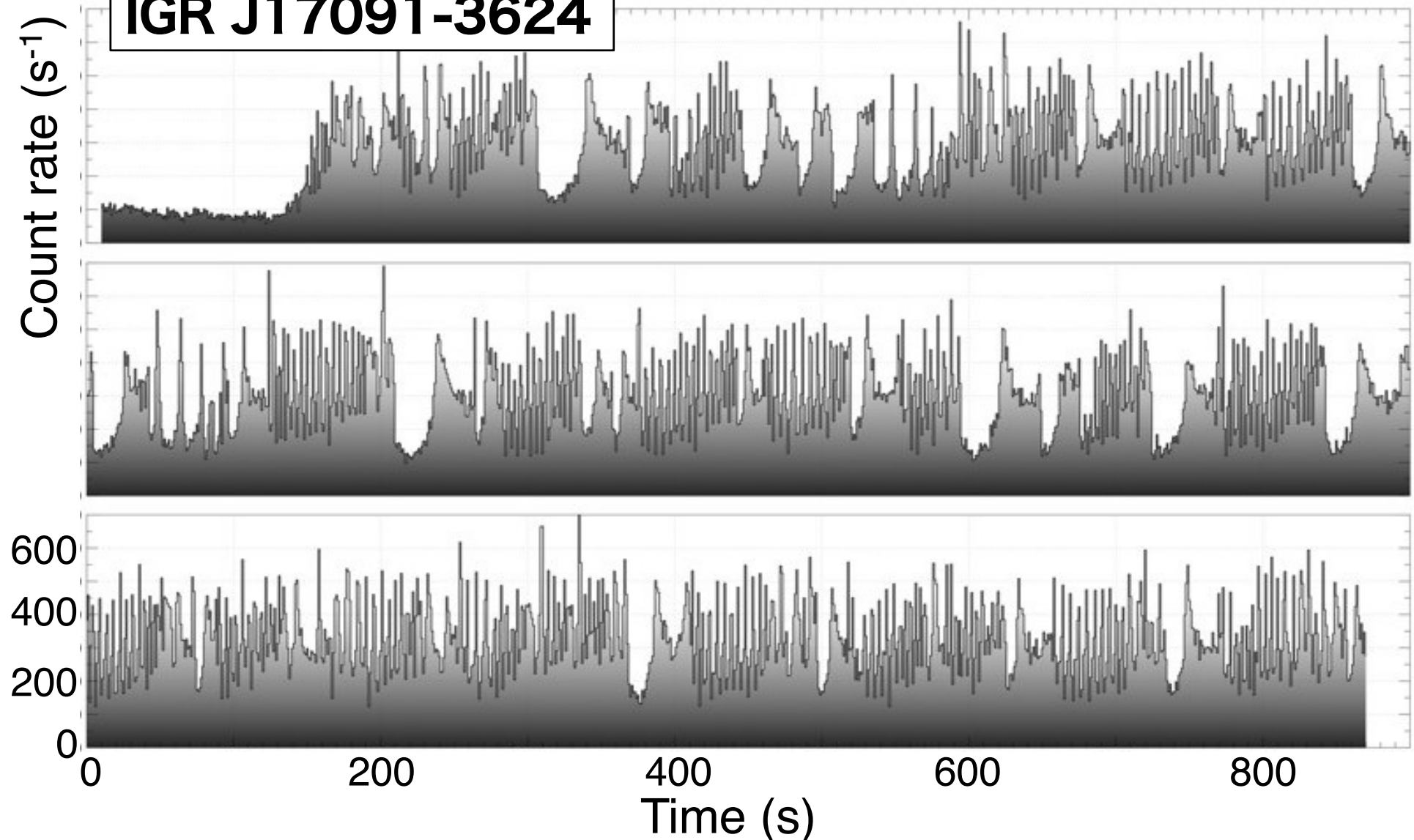
Are there similar variable sources?

Yes.

Similar variable source IGR J17091-3624
is discovered (Altamirano+ 2011).

5. Discussion

IGR J17091-3624



(<http://web.me.com/tbelloni/BlackHoleTransients/IGR17091.html>)

5. Discussion

Are there similar variable sources?

Yes.

Similar variable source IGR J17091-3624 is discovered (Altamirano+ 2011).

Similar variable γ -ray sources may be still hidden in the Galaxy.

6. Summary

Lots of un-IDed Galactic sources in the Fermi catalog.
There must be new classes of sources.

XSS J12270-4859 is a good example.

- first γ -ray LMXB at low L_{bol}
- microquasar with a synchrotron jet
- unique X-ray variability

In the future, eROSITA & ASTRO-H are helpful to identify these un-IDed Fermi sources.

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References

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- Altamirano et al. 2011, ATel, 3299
- Bird et al. 2007, ApJS, 170, 175
- de Martino et al. 2010, A&A, 515, A25
- Hill et al. 2011, MNRAS, 415, 235
- Masetti et al. 2006, A&A, 459, 21
- Pretorius 2009, MNRAS, 395, 386
- Revnivitsev et al. 2004, A&A, 418, 927
- Saitou et al. 2009, PASJ, 61, L13
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