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Faint LMXBs identified by INTEGRAL

In collaboration with

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Thanks to Chenevez & Brandt for JEM-X analysis discussion

AND

N. Gehrels for accepting our SWIFT ToO proposals

Contents

- The "burst-only" sources
- The two sources XMMU J174716.1-281048 and AX J1754.2-2754
- INTEGRAL caught type-I X-ray bursts
- Observations in public X-ray data archive
- Swift/XRT ToOs
- Discussion & Conclusion

Classifying the X-ray transients

(Wijnands et al. 2006)

Usually too dim… discovery during their bright outbursts.

Based on the maximum observed peak luminosities (2-10 keV) …

LMXB transients with Neutron Stars are:

Faint X-ray transients: $L_{peak}=10^{36-37}$ erg/s

Type-I X-ray bursters or millisecond pulsars$

Very Faint X-ray transients: $L_{peak}=10^{34-36}$ erg/s

NS accreting matter at very low rate from a low-mass companion star*

$ King (2000) suggested NS in very compact object (Porb < 80 min)

* Accretion NS from companions which were already brown dwarfs or planets when the system formed (King & Wijnands 2006)

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Burst-only sources

Cornelisse et al. (2002) reported on ***9 objects*** detected by BeppoSAX/WFC when they exhibited a type-I X-ray burst.

The persistent emission is lower than the WFC sensitivity (10 mCrab, 10^{36} erg/s in the GC)

Source	instrument	d_u (kpc)	L_{WFC} (10^{36} erg s^{-1})	t (s)	L_{pers} (10^{36} erg s^{-1})	range (keV)	
SAX J1324.5-6313	Chandra	6.2	<0.3	20	4	0.5-7	[5,6]
1RXS J1718.4−4029	ROSAT	6.5	<0.4	270	200	2-10	[11]
GRS 1741.9−2853	GRANAT	8.0	<2.0	15-30	14000	4-30	[3,14]
SAX J1752.4-3138	Chandra	9.2	<2.3	50	3	0.5-7	[4,6]
SAX J1753.5-2349	Chandra	8.8	<1.8	20	≤4	0.5-7	[19,6]
SAX J1806.5-2215[a]	Chandra	8.0	<1.5	20-150	2	0.5-7	[19,6]
SAX J1818.7+1424	Chandra	9.4	<1.8	10	4	0.5-7	[5,6]
SAX J1828.5−1037	ROSAT	6.2	<0.9	50	230	0.5-2.5	[5,6]
SAX J2224.9+5421	BeppoSAX	7.1	<0.2	8	12	2-10	[5]

[a]Persistent flux detected by RXTE/ASM.

Subsequent X-ray satellites revealed that: ***one*** is a very faint persistent (In't Zand et al. 05), ***two*** are faint X-ray transients (Cornelisse et al. 02), ***one*** is a VFXT (Hands et al. 04) and ***one*** (seen by INTEGRAL) could be an hard X-ray transient (Turler et al. 06,)

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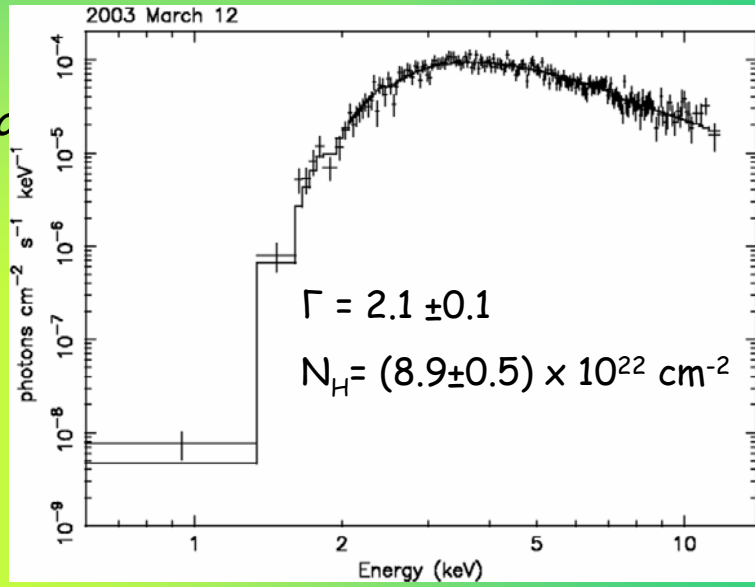
Two unidentified sources in the GC

XMMU J174716.1-281048



- Serendipitously discovered **in 2003** with *XMM-Newto*

$F_{(unabs.\ 2\text{-}10\ keV)}$ = (6.8 ± 0.4) x 10^{-12} erg/cm^2/s

- and serendipitously re-pointed **in 2005**

$F_{(unabs.\ 2\text{-}10\ keV)}$ = (4.3 +0.4/-1.0) x 10^{-12} erg/cm^2/s

but similar spectral parameters

AX J1754.2-2754

Unidentified source reported in the ASCA catalogue (Sakano et al., 2002).

$F_{(unabs.\ 2\text{-}10\ keV)}$ = 1.6 x 10^{-11} erg/cm^2/s, Γ=3.7 and N_H ~ 4.5x10^{22} cm^{-2}

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INTEGRAL unveiling

A possible X-ray burst from the new transient IGR J17464-2811 was observed with JEM-X (Brandt et al. 2006, ATel #970).

Because of spatial coincidence (29") and the temporal closeness of INTEGRAL (2005, March 22) and XMM-Newton (2005 February 26-27) Wijnands (2006) suggested that the X-ray burst from IGR J17464-2811 is associated with the transient XMMU J174716.1-281048.

IGR J17464-2811 is XMMU J174716.1-281048

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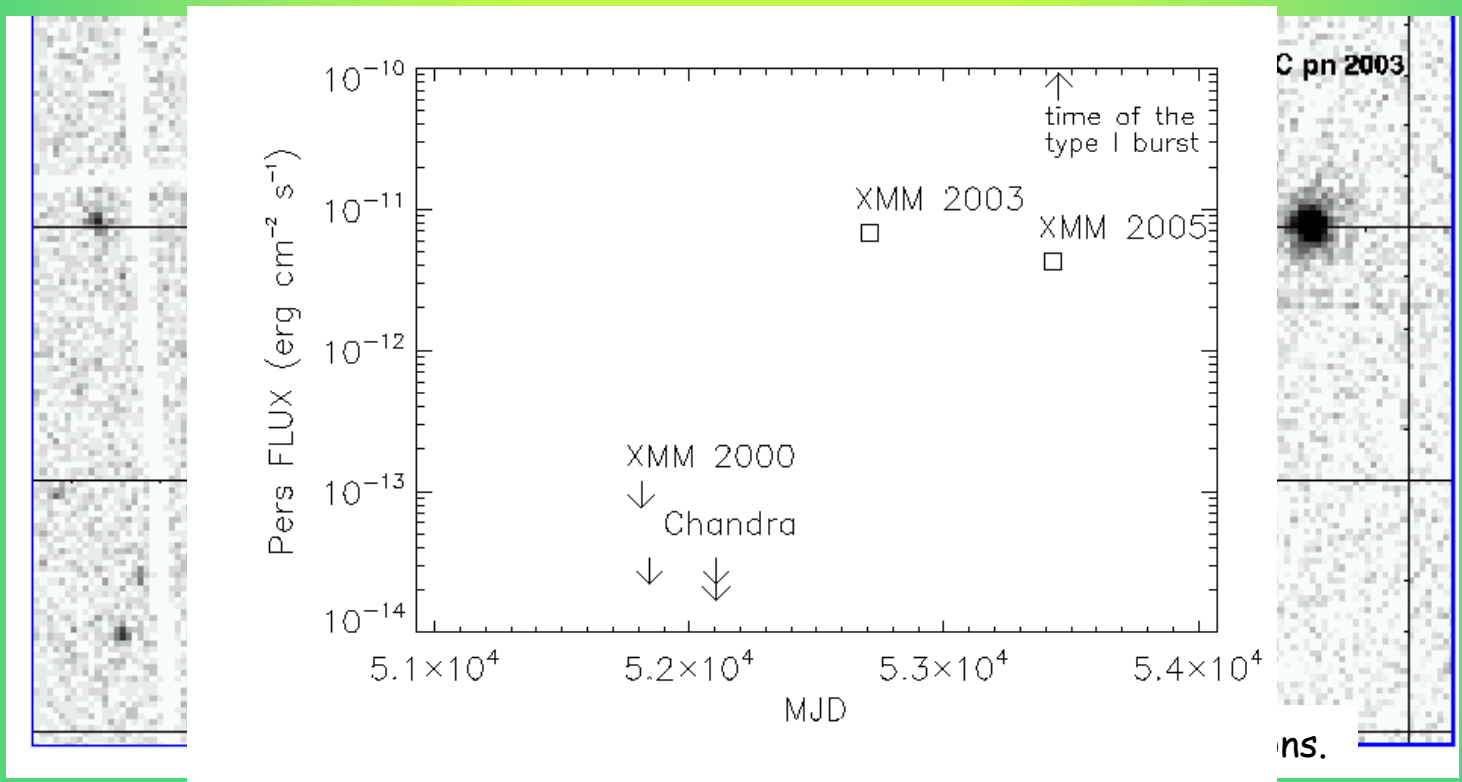
FIVE YEARS OF INTEGRAL, October 17th - 19th, 2007

The transient nature of XMMU J174716.1-281048

INTEGRAL on **2005** March 22 (IBIS/ISGRI and JEM-X data)

XMM-Newton on **2000** September 23, **2003** March 12, **2005** February 26-27 (EPIC data)

Chandra on 2000 October 27, 2001 July 16 (2 pointings, ACIS data)



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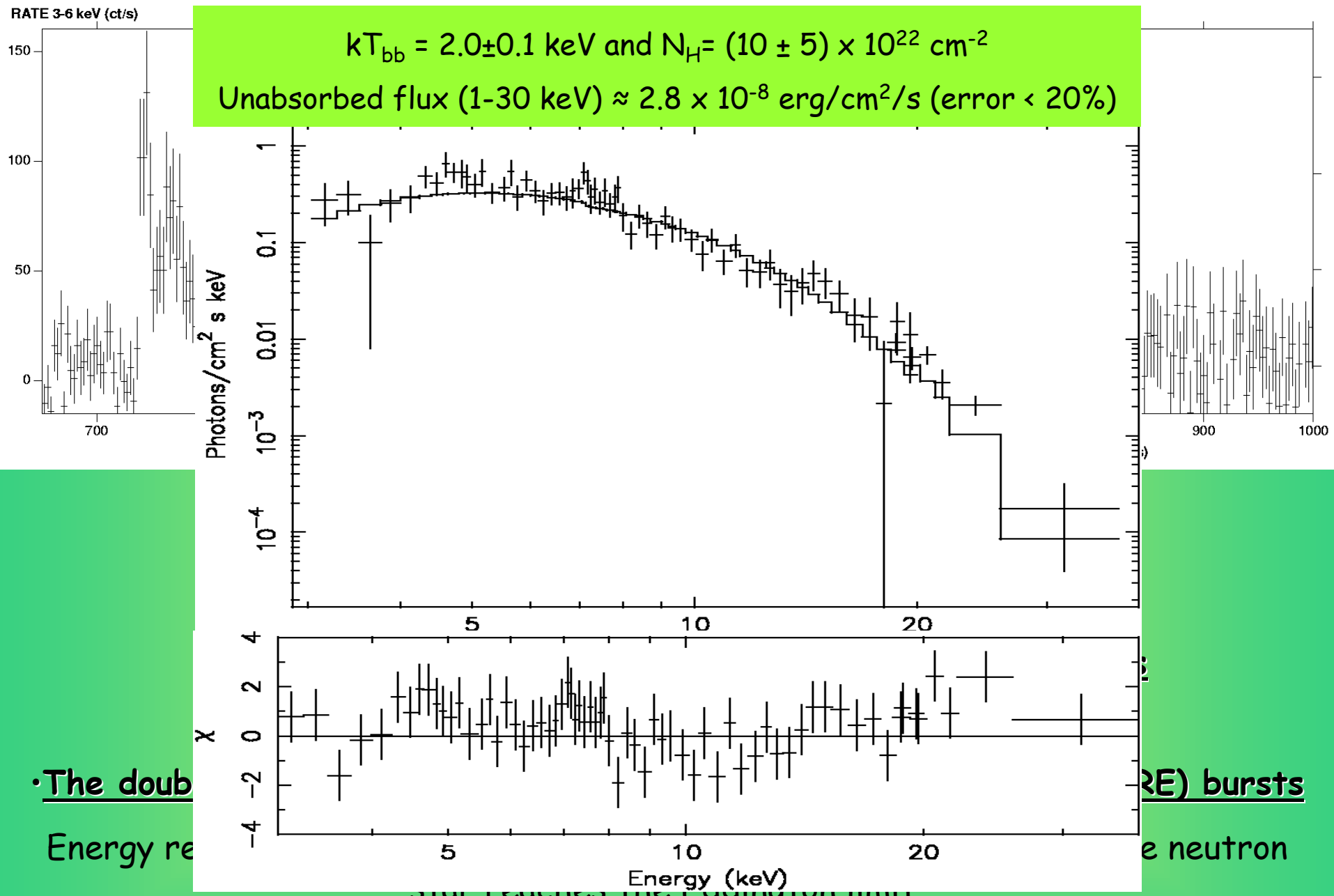
kT_{bb} = 2.0±0.1 keV and N_H= (10 ± 5) x 10^{22} cm^{-2}

Unabsorbed flux (1-30 keV) ≈ 2.8 x 10^{-8} erg/cm^2/s (error < 20%)



•**The doub** **RE) bursts**

Energy re e neutron

star reaches the Eddington limit.

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Distance evaluation & Recurrence time

The bolometric peak flux is 5×10^{-8} erg/cm^2/s

Assuming $L_{Edd} = 3.8 \times 10^{38}$ erg/s (Kulkeers et al. 2003)

d ~ 8 kpc (Del Santo et al., 2007, ATel #1207)

Did the two XMM-Newton observations catch the same outburst?

(Del Santo et al., 2007, A&A Letters, vol. 468, issue 1, L. 17)

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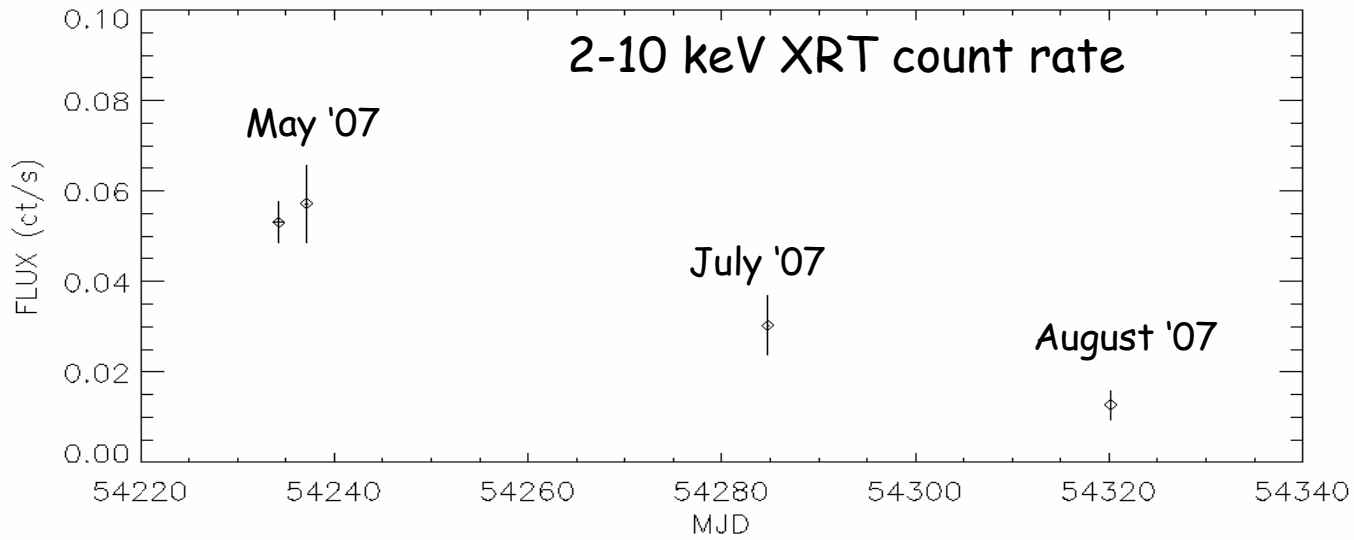
We are performing a Swift monitoring campaign on XMMU J174716.1-281048



First results in Sidoli et al. 2007, ATel #1174

Motivated by our paper Degenaar et al. proposed a Swift ToO, as well as a Chandra ToO, on XMMU J174716.1-281048.

They strengthened our suggestion that the system is undergoing a prolonged accretion episode of many years (ATel #1078)

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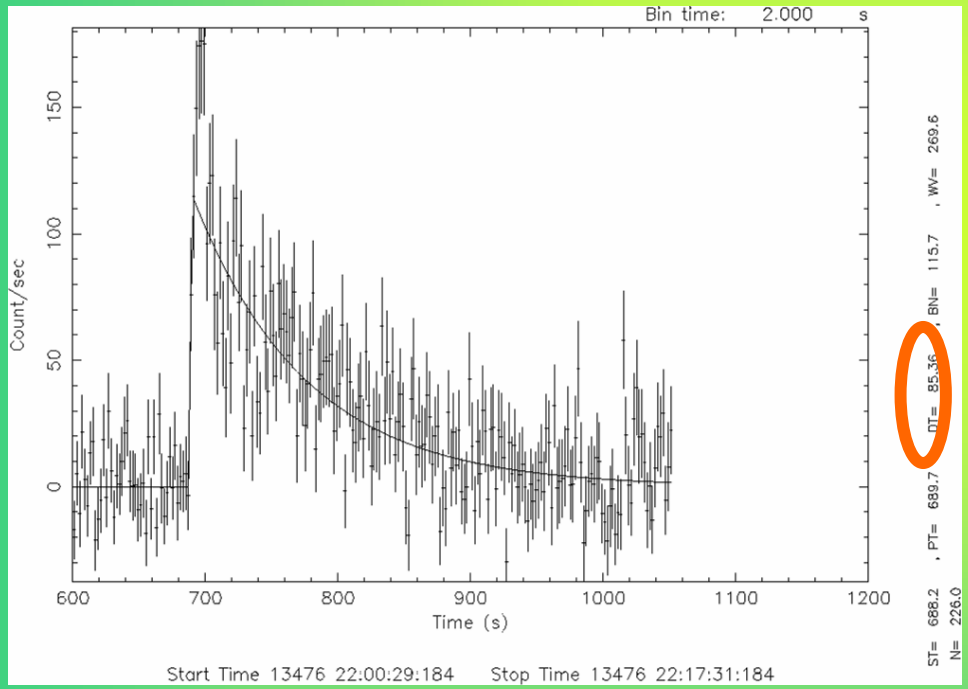
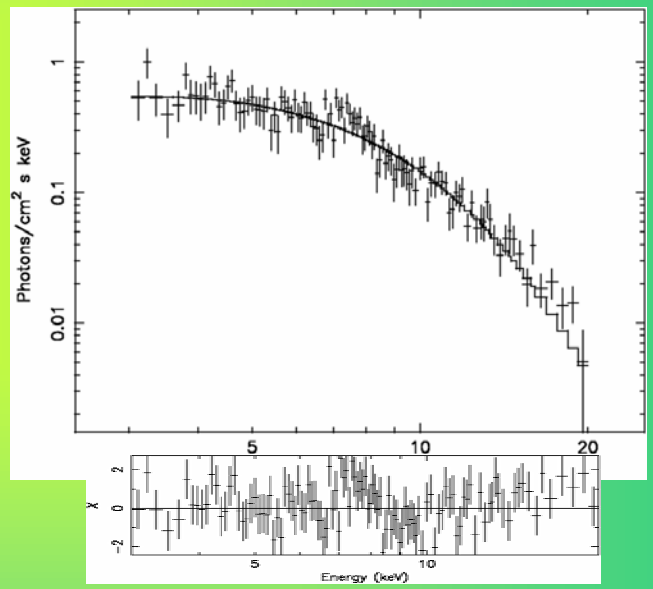
Identification of AX J1754.2-2754

JEM-X detected an intense type-I X-ray burst (2005, April 16th) from the unidentified source **AX J1754.2-2754**.

Distance estimation → d=6.8±0.7 kpc (Chelovekov & Grebenev 2007, ATel #1094)





kT_{bb} = 1.96±0.06 keV

F_{bol} =3.3x10^{-8} erg/cm^2/s (err ~ 15%)

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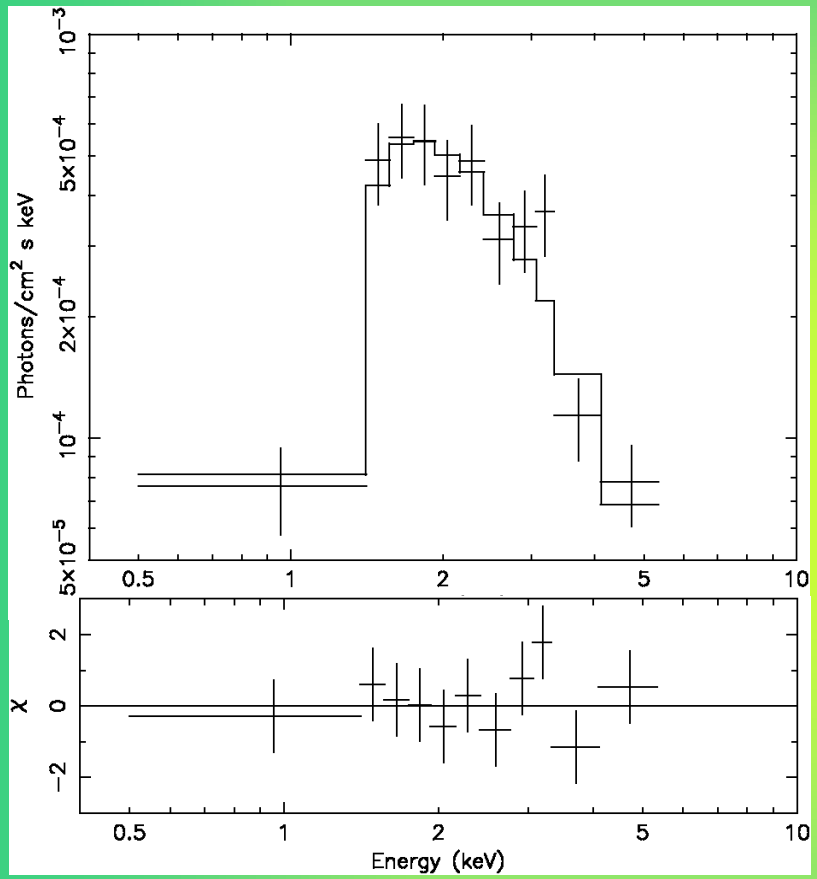
Swift ToO on AX J1754.2-2754



Refined position with error radius 3.8″

(Del Santo et al., 2007, ATel #1143)

$\Gamma = 3.6 \pm 0.7$

$N_H = (2.8 \pm 0.7) \times 10^{22}$ cm^{-2}

$F_{\text{(unabs. 2-10 keV)}} \approx 6.1 \times 10^{-12}$ erg/cm^2/s

$L \approx 4 \times 10^{34}$ erg/s

<u>Comparing with ASCA persistent emission</u>

Similar spectral parameters.

Decreased luminosity ($L_{ASCA} \approx 1 \times 10^{35}$ erg/s)

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Discussion

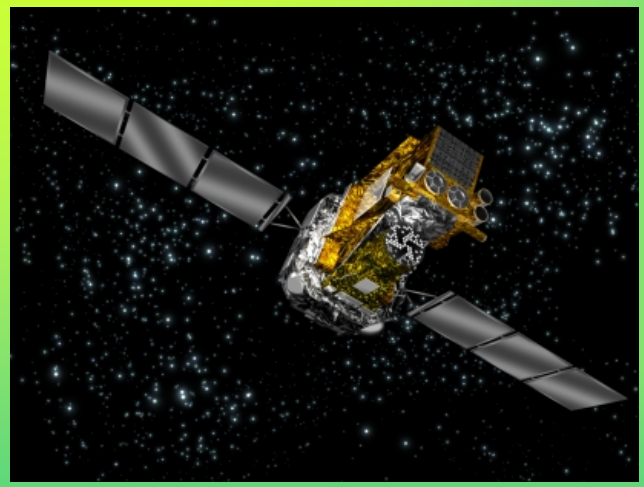
- In the Beppo-SAX era **XMMU J174716.1-281048** and **AX J1754.2-2754** would have been included in the "burst-only" sources list.
- **XMMU J174716.1-281048** is the first VFXT displaying a "quasi-persistent" behaviour, similar to brighter transients displaying long outbursts (i.e., MXB 1659-29 and KS 1731-260)
- **AX J1754.2-2754** is a faint persistent (to date) source observed at luminosity lower than 10^{36} erg/s (not present in WFC catalogue, Capitanio et al. in prep.)
- The X-ray burst in the lowest accretion regime are fewer than predicted (Cornelisse et al. 2004). **XMMU J174716.1-281048** and **AX J1754.2-2754** increase the number of the burster observed at $M_{dot} < 10^{-10}$ M_{sun}/yr

Thanks to INTEGRAL

•It has been possible the distance evaluation for **XMMU J174716.1-281048** and **AX J1754.2-2754**, both located in the Galactic Centre as found by Chandra and XMM-Newton surveys, suggesting that the high stellar density near Sgr A* could play a role in the formation of these faint X-ray binaries (King 2000).

•The INTEGRAL monitoring of the Galaxy combined with large fields of view allowed us to detect rare type-I bursts and eventually identify faint sources.

Happy Birthday!



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Grazie!