

Magnetar

Bursts & Outbursts

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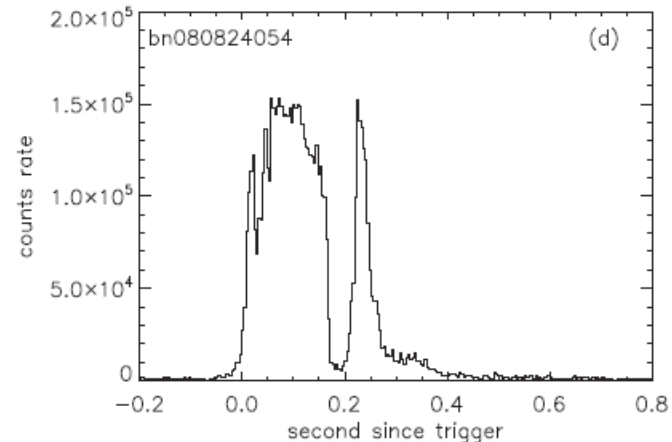
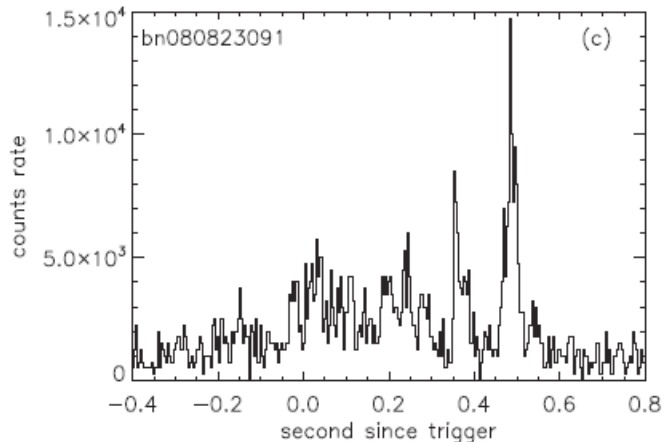
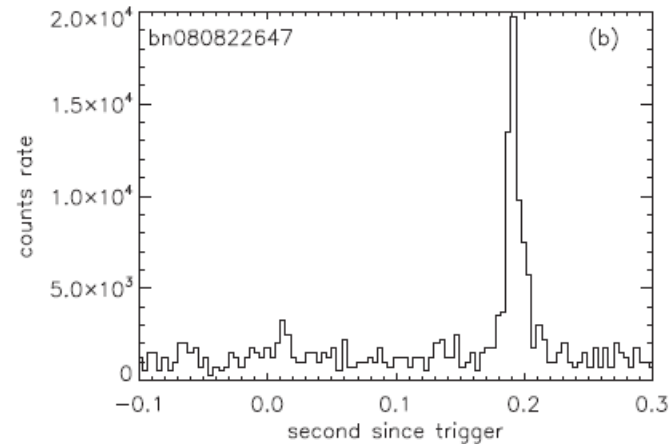
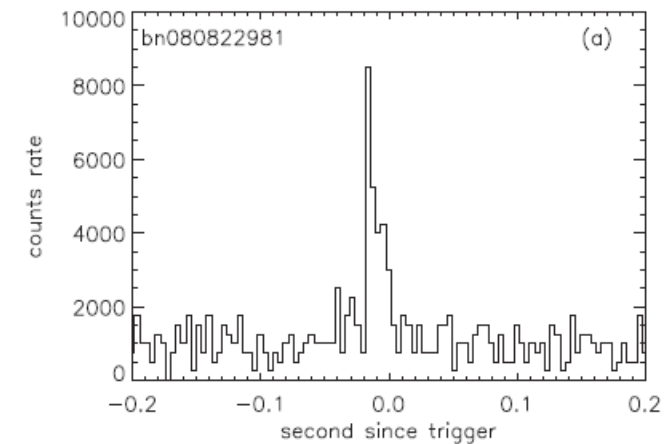
Beijing Normal University



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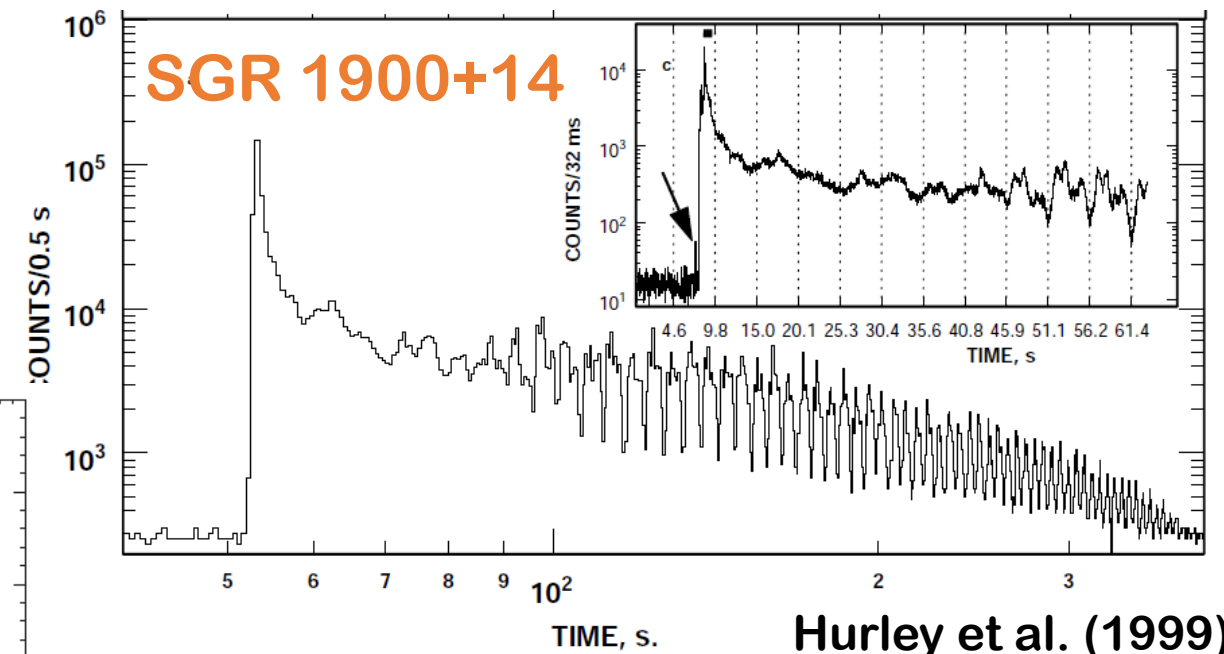


Bursts

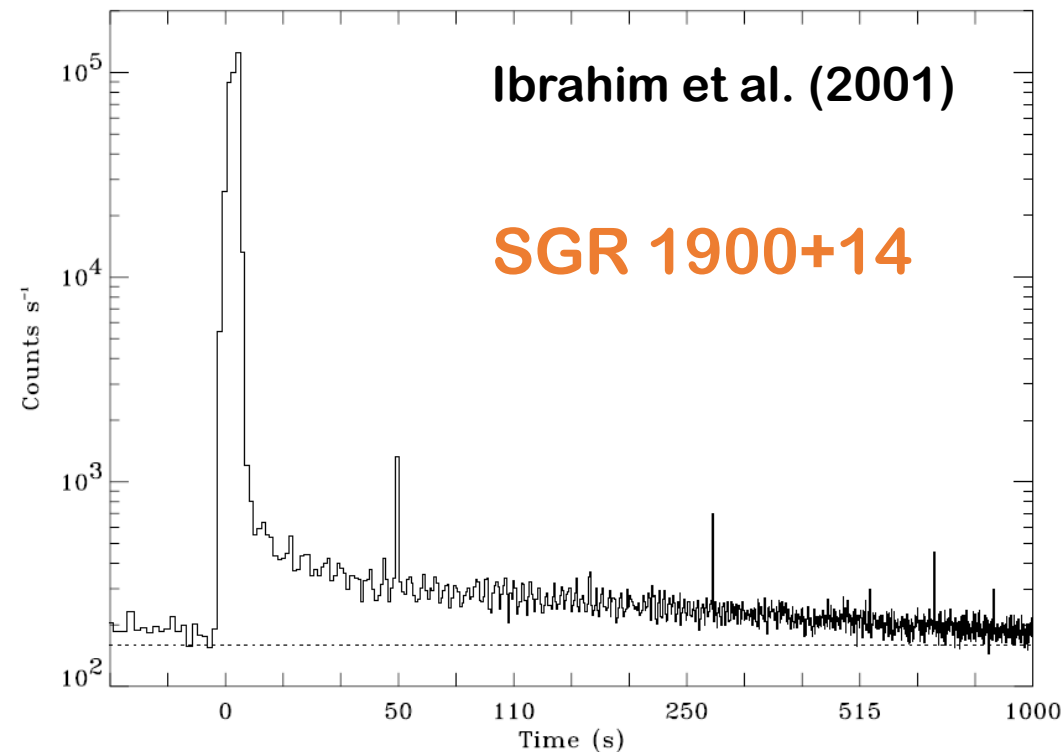


Lin et al. (2011)

SGR 0501+4516



Hurley et al. (1999)



Ibrahim et al. (2001)

SGR 1900+14

Burst: Duration

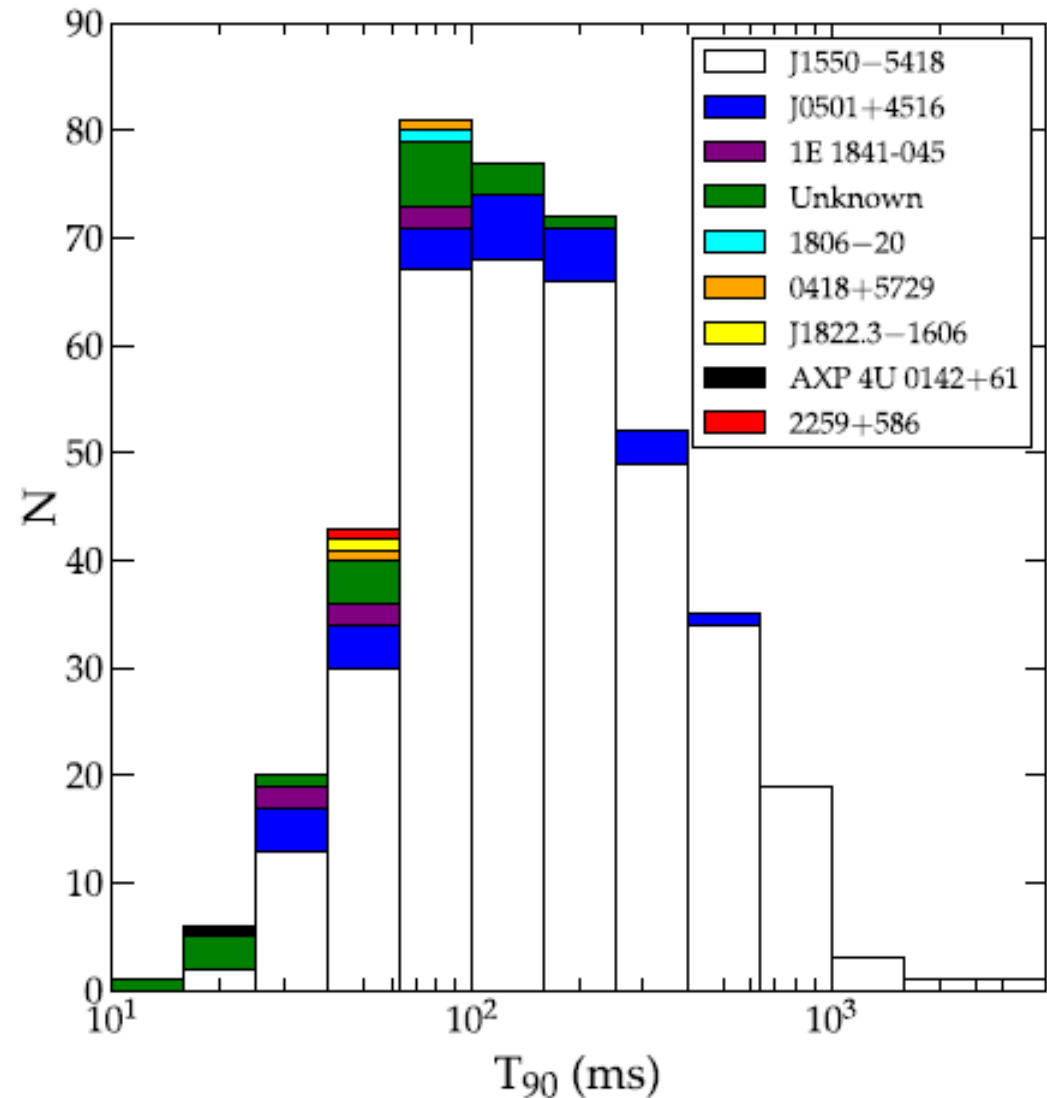
Bursts last for several ms to about 1 s.

$$\langle T_{90} \rangle \sim 0.1 \text{ s}$$

1st five-year Fermi/GBM magnetar burst catalogue

- 446 bursts

Source	Burst Active Periods	Number of Bursts with TTE data
SGR J1550–5418	2008 Oct–2009 Apr	386
SGR J0501+4516	2008 Aug/Sep	29
1E 1841–045	2011 Feb–Jul	6
SGR J0418+5729	2009 Jun	2
SGR 1806–20	2010 Mar	1
SGR J1822.3–1606	2011 Jul	1
AXP 4U 0142+61	2011 Jul	1
AXP 1E 2259+586	2011 Aug	1
Unknown	...	19

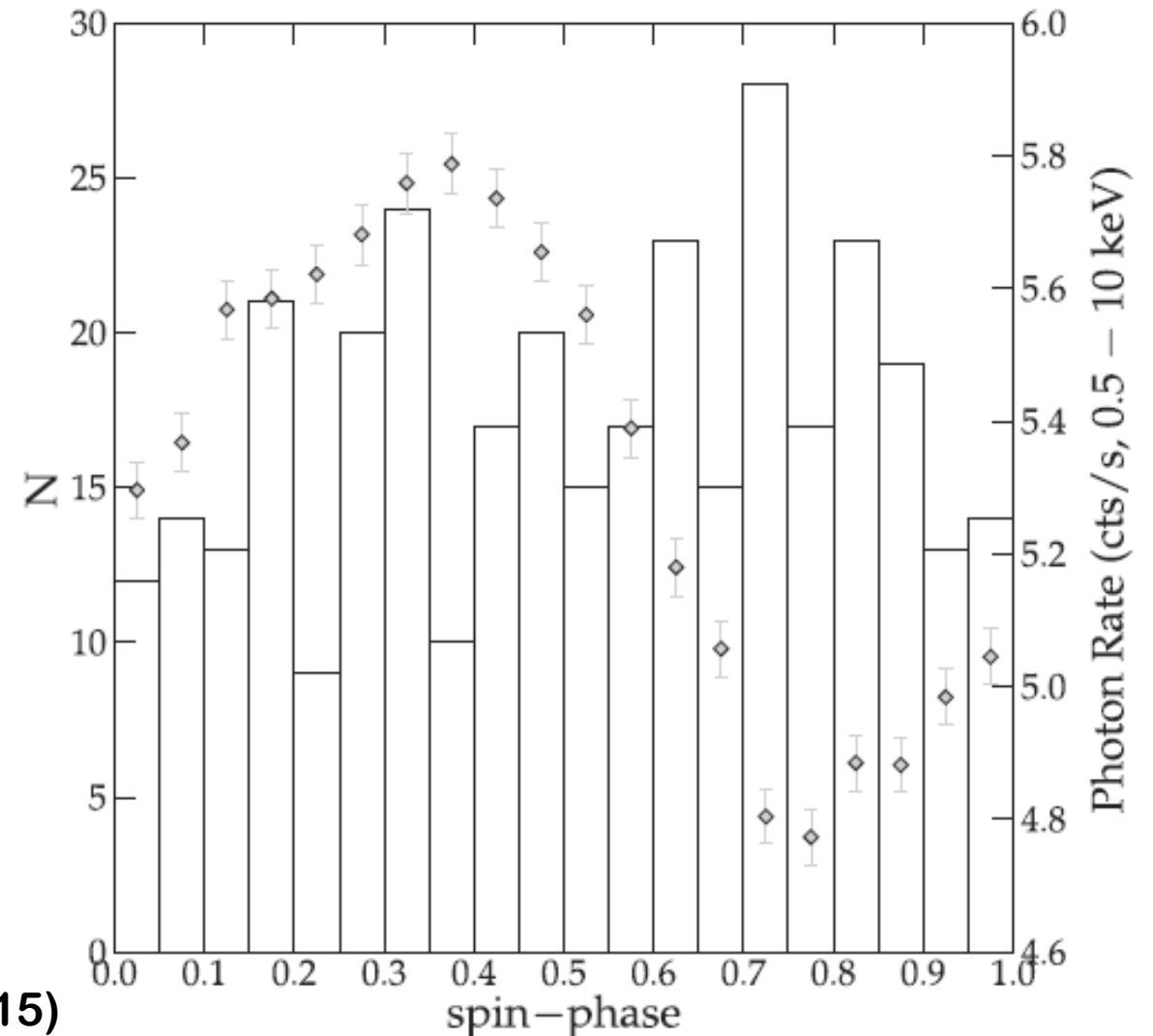


Collazzi et al. (2015)

Burst: Spin Phase

NO preferred spin phase
for burst peaks.
* in three AXPs, burst
seems to prefer the peak
of the pulse profile.

Distribution of the phase of the
peak of all the SGR 1550-5418
bursts detected with GBM.



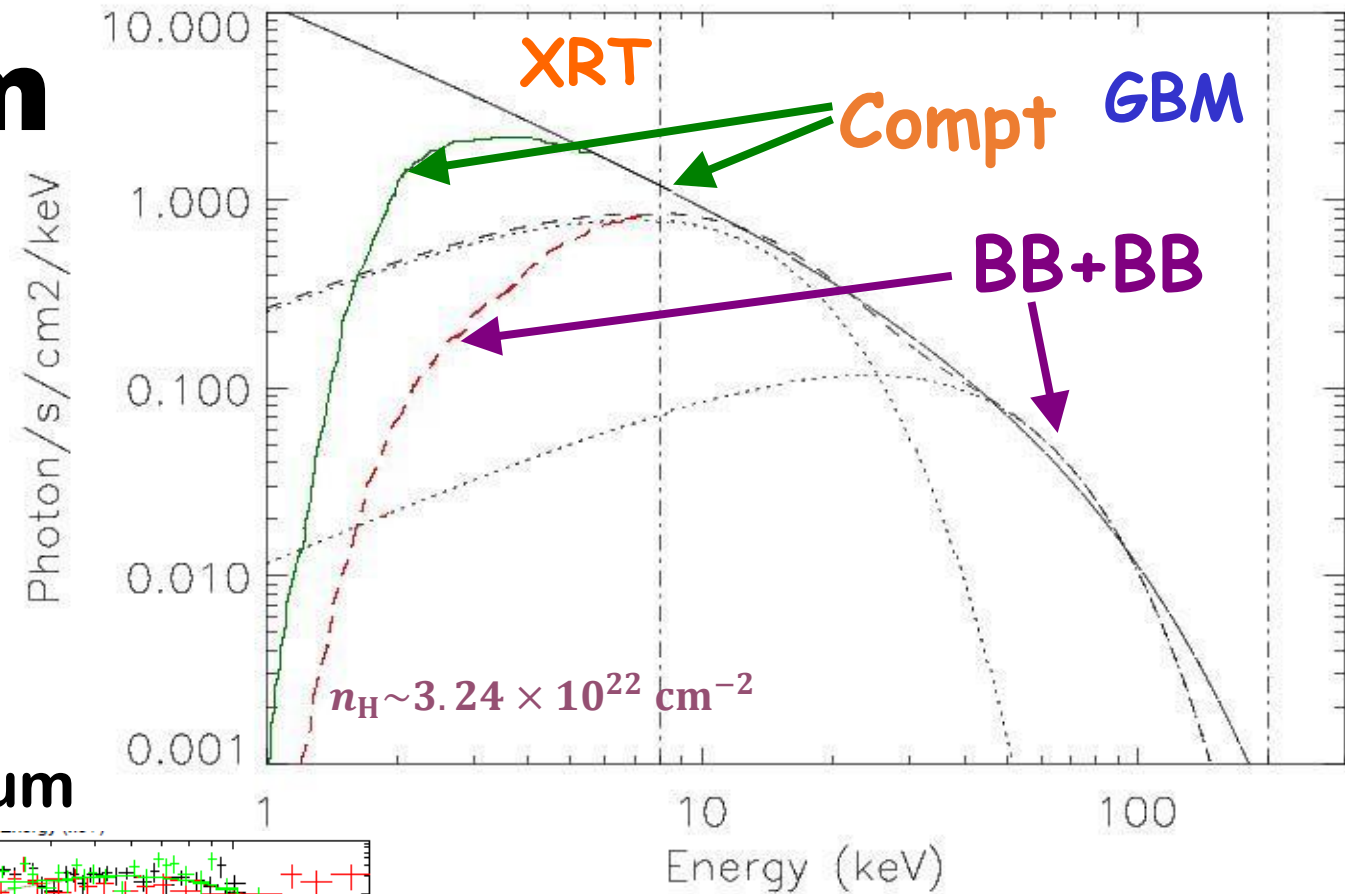
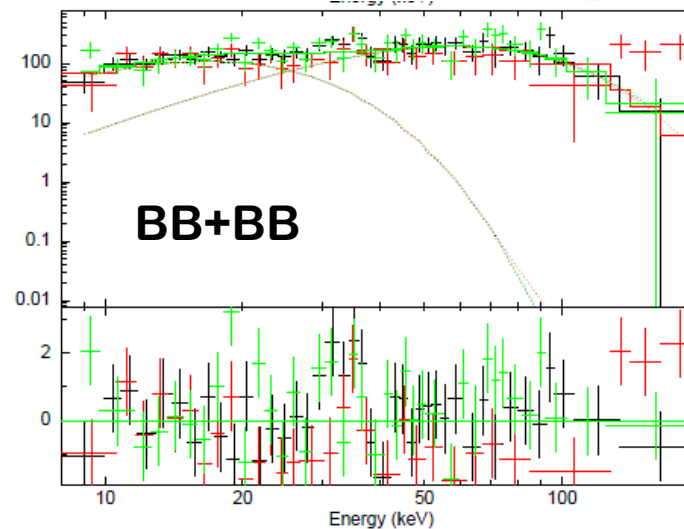
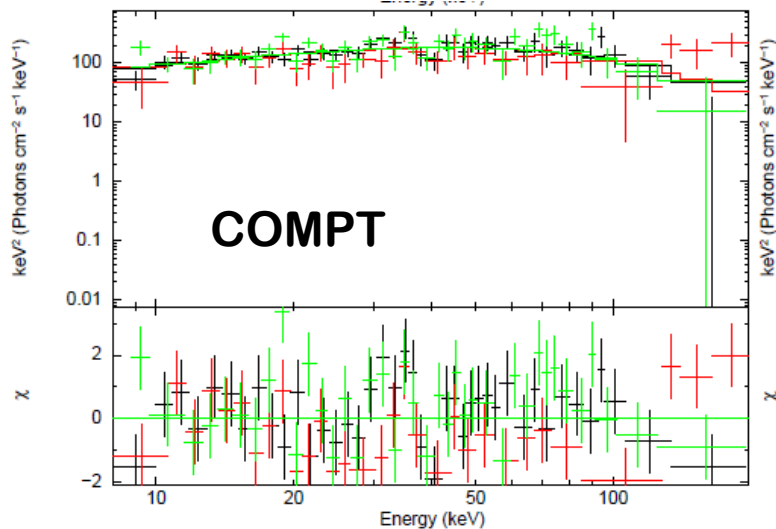
Collazzi et al. (2015)

Burst: Spectrum

Model survived:

- Thermal : **BB+BB**
- Non-thermal : a power law with exponential cutoff (**COMPT**)

a SGR1550-5418 burst GBM spectrum



The Soft X-ray band (<10 keV) is critical.

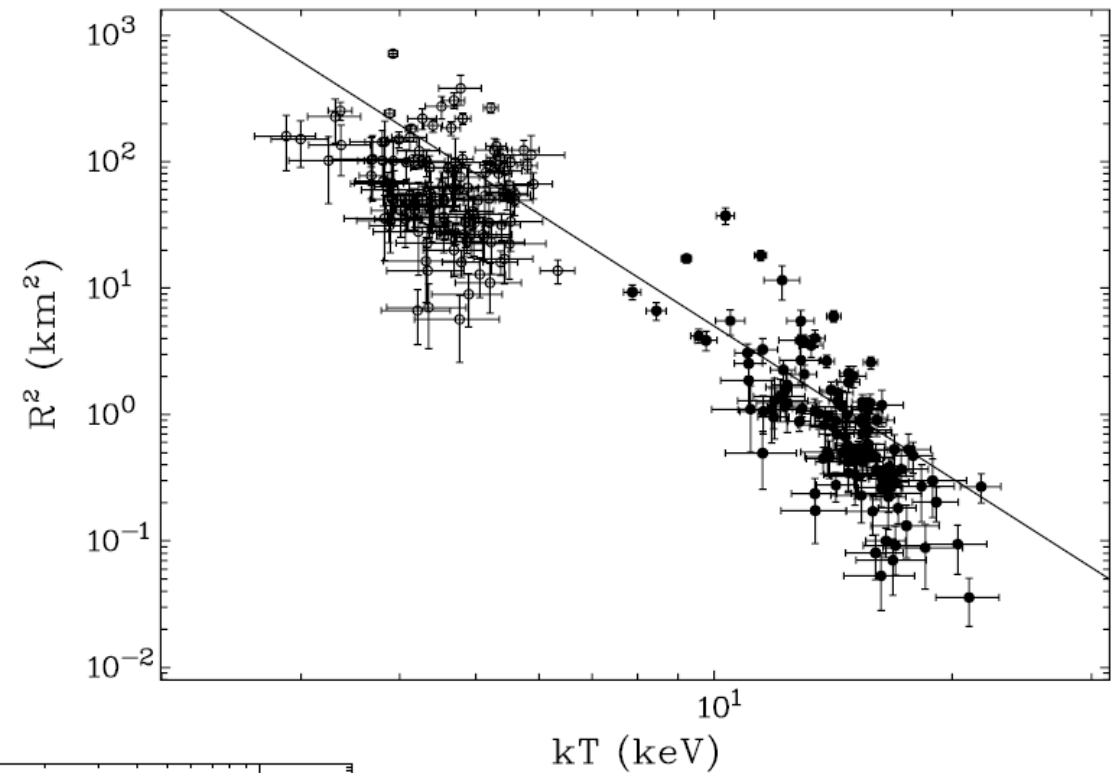
Lin et al. (2012)

Burst: Spectrum

BB+BB

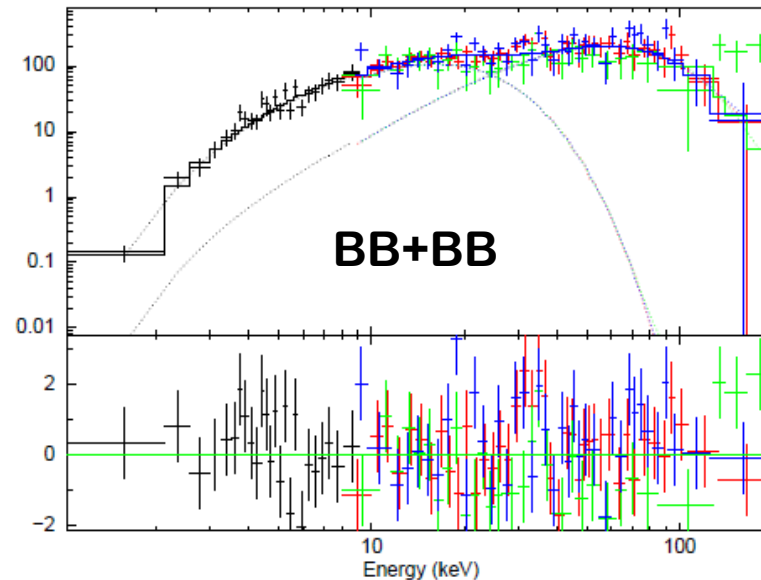
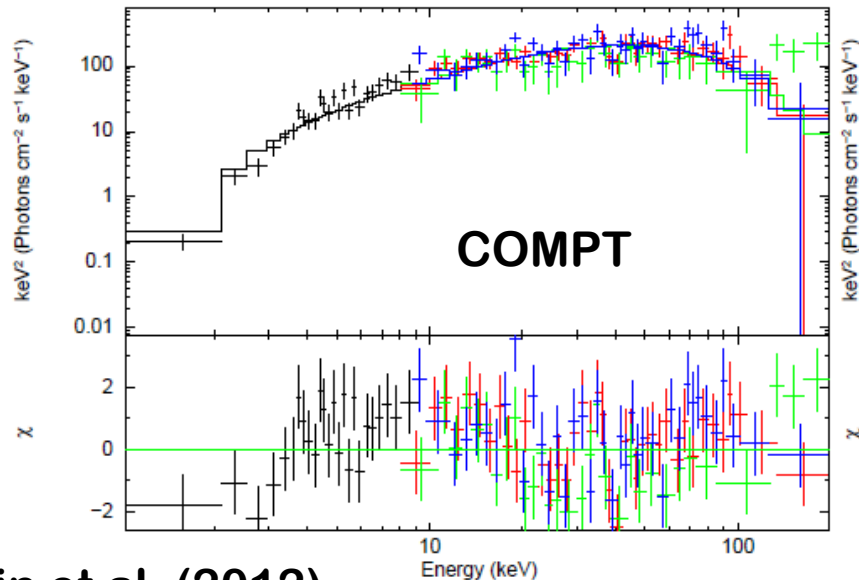
low kT : 3~6 keV , $\langle kT \rangle \sim 4.5$ keV

high kT : 10~20 keV , $\langle kT \rangle \sim 15$ keV



van der Horst et al. (2012)

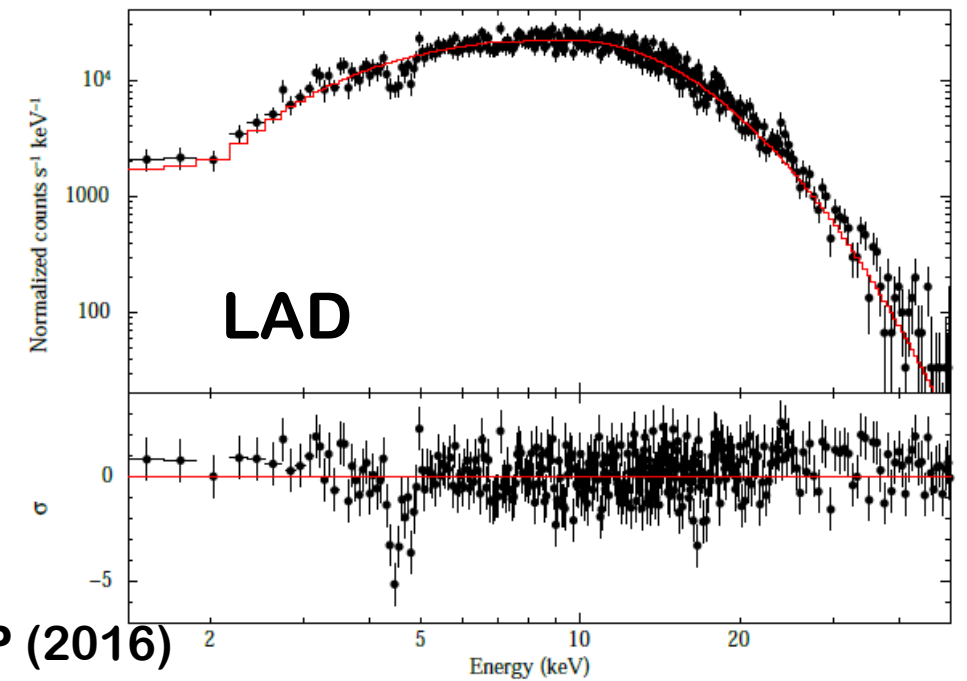
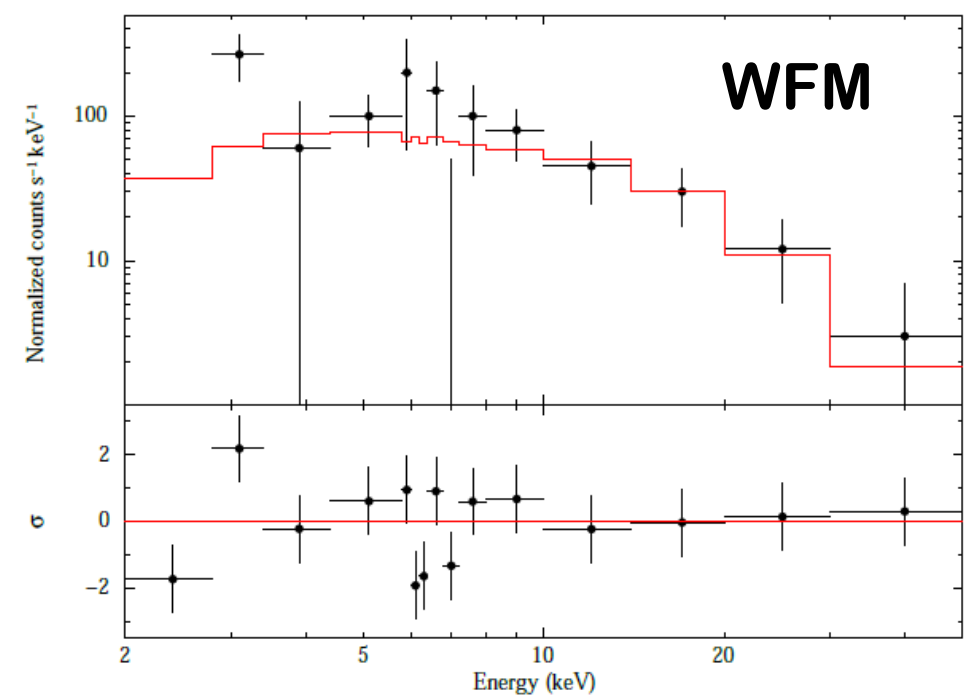
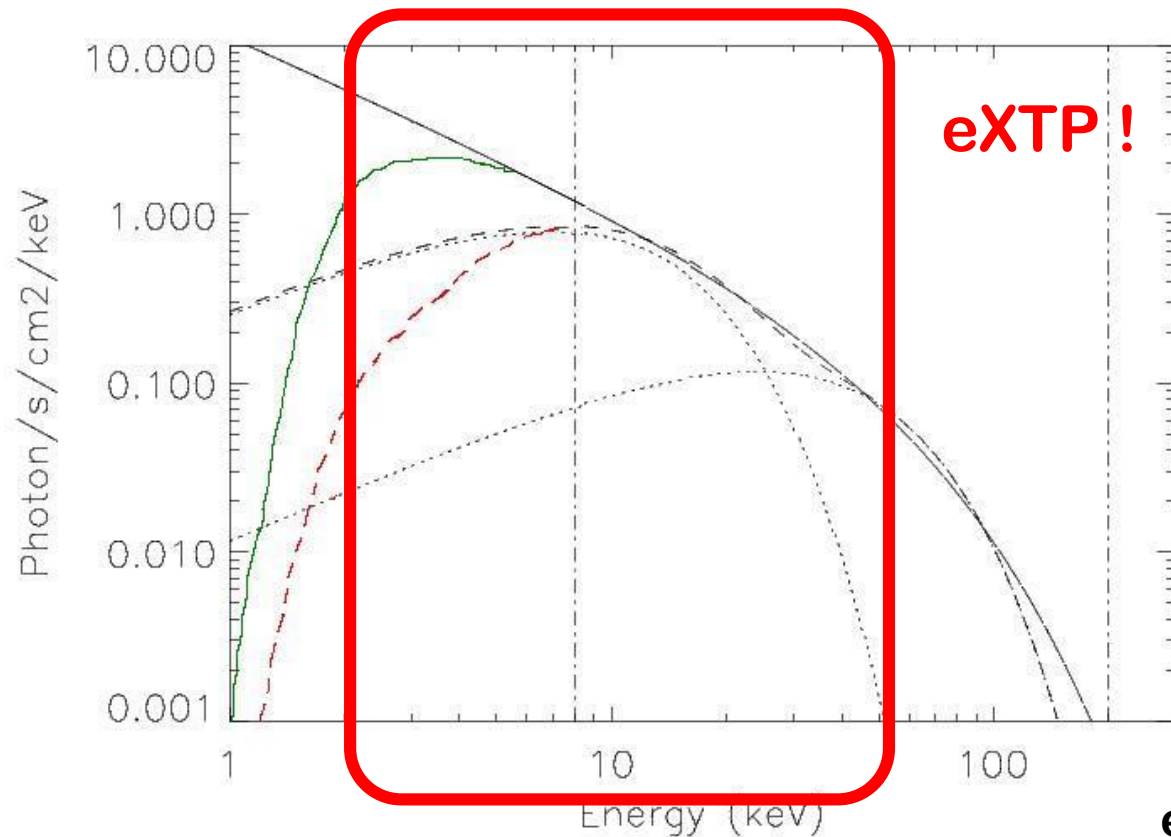
$$L_{hot} \propto L_{cool}^{0.8 \sim 1}$$



Lin et al. (2012)

Burst: Spectrum

42 bursts in XRT+GBM :
31 BB+BB, 1 COMPT, 10 unclear

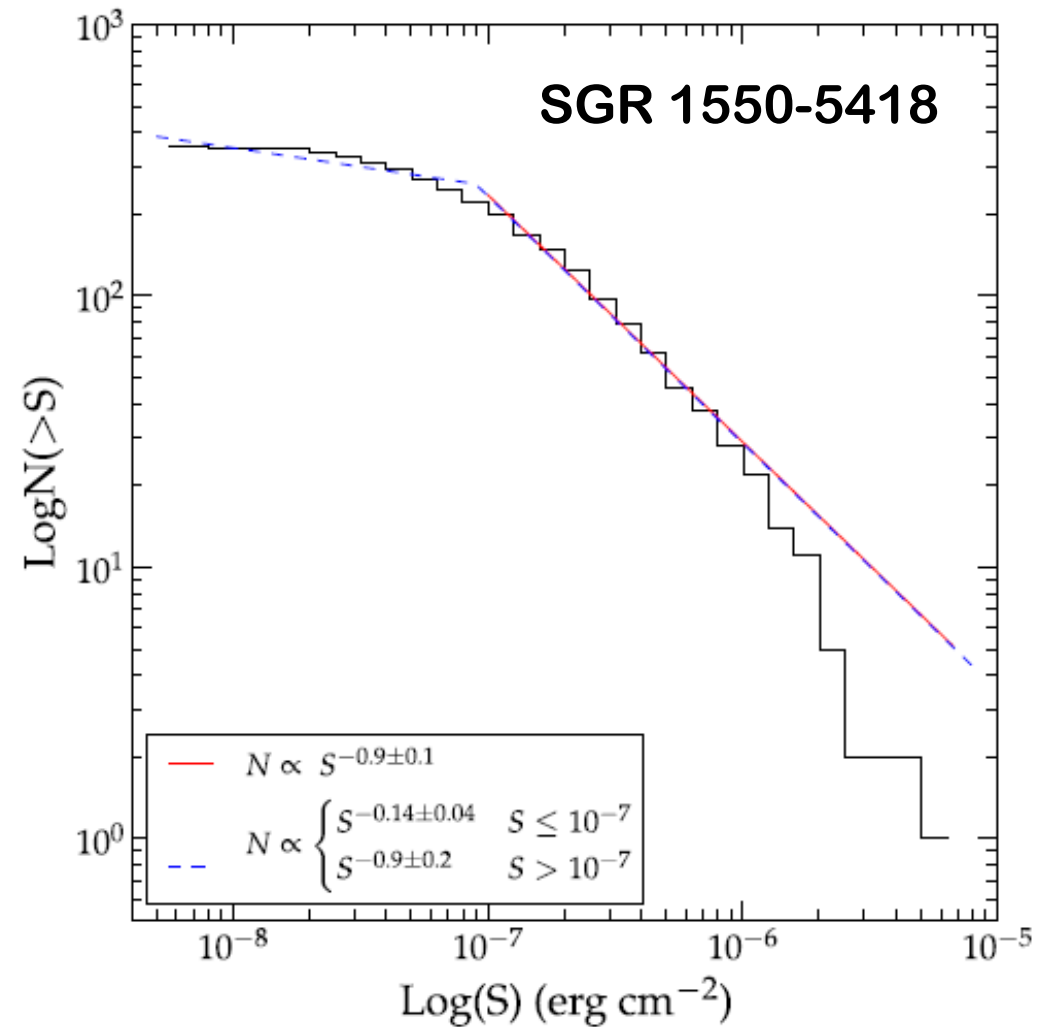


eXTP WP (2016)

Burst: Energetic

SGR 1550-5418 for example:

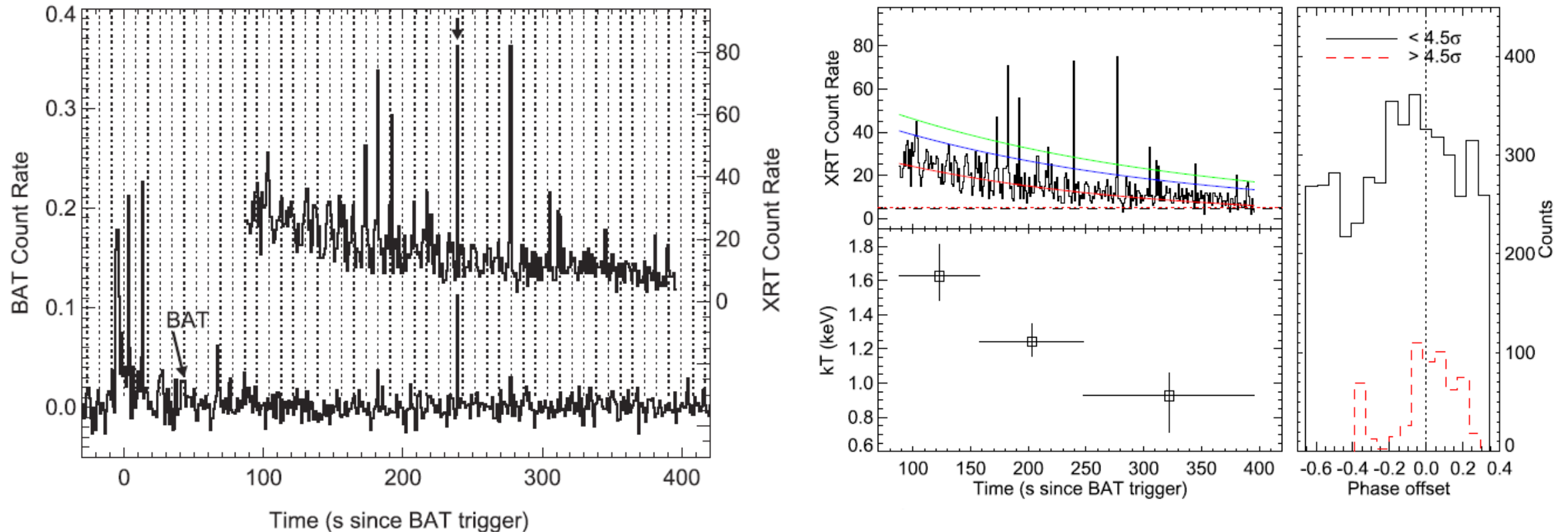
- Energy from one burst
 $10^{37} \sim > 10^{40}$ erg (~ 5 kpc)
- Total energy emitted in bursts
 $> 6.6 \times 10^{41}$ erg
- $\log N \sim \log S$
a single power law ($-0.4 \sim -1$)



Collazzi et al. (2015)

Burst: Tail – also found in short bursts

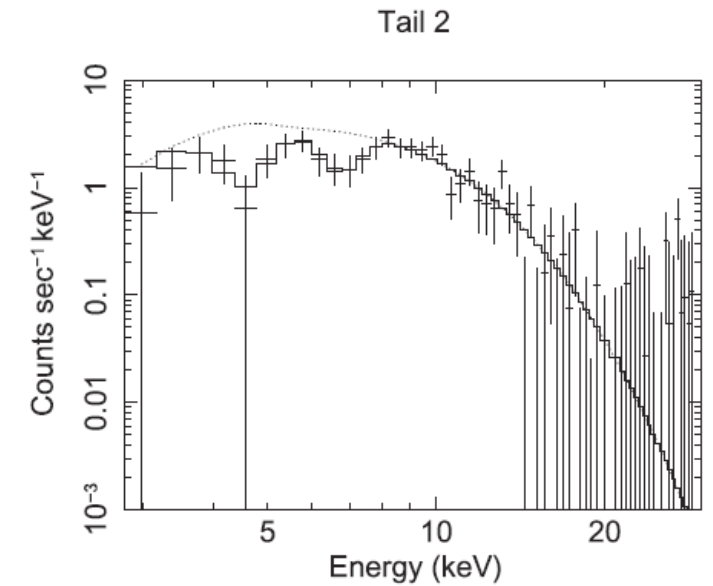
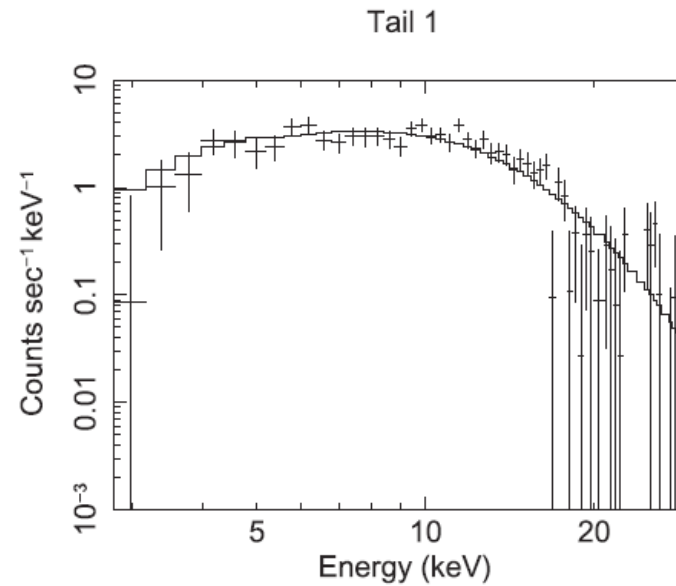
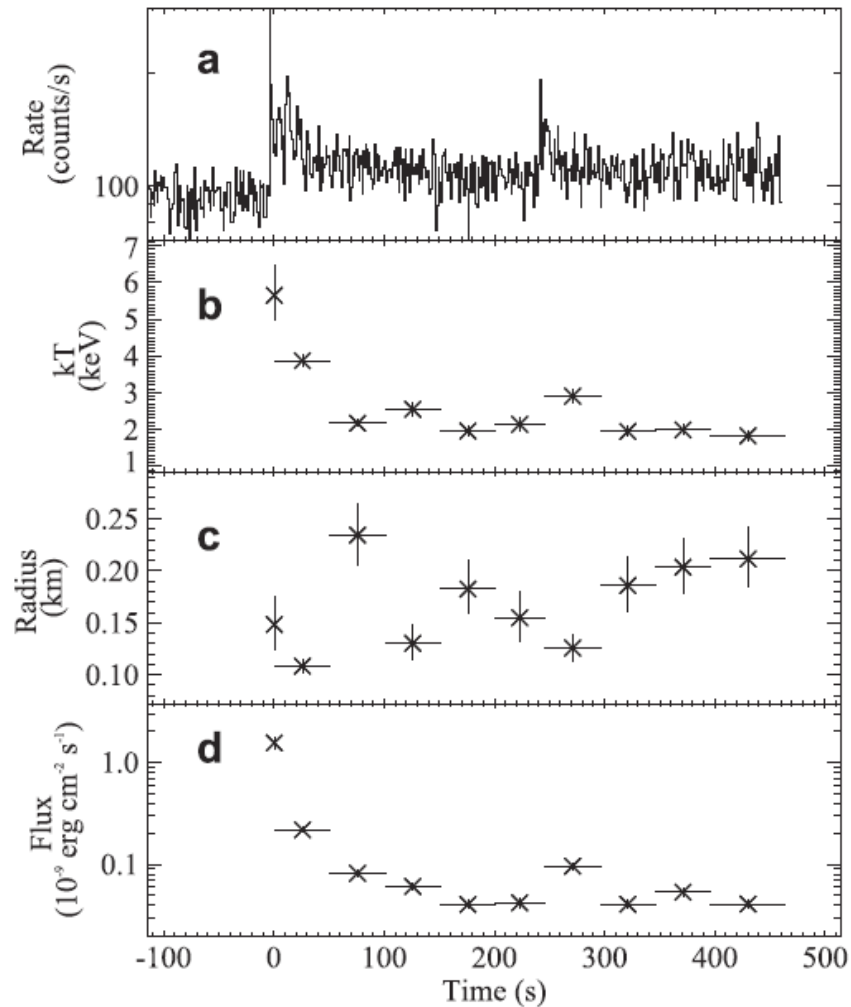
4U 0142+61 bursts on 2015 Feb. 28 observed with Swift



- Evolutions through the tail: $kT \downarrow$, BB area \rightarrow , pulse fraction \uparrow
- X-ray bursts' phases basically aliened with the peak of the pulse profile from the continues emission.

Burst: Tail – spectral lines

4U 0142+61 bursts on 2006 Jun. 25



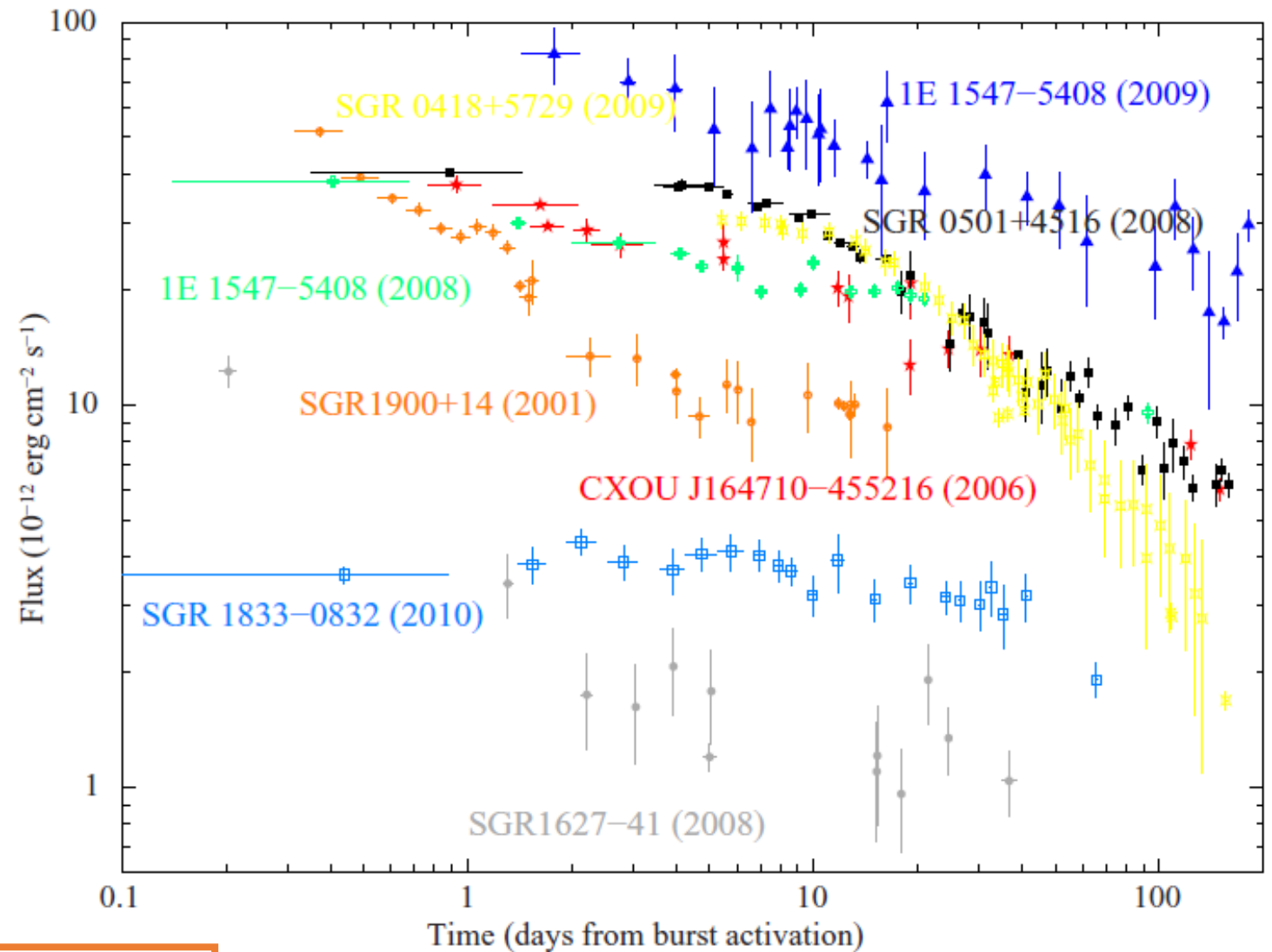
Absorption feature at ~ 4.5 keV and ~ 6.5 keV in the 2nd tail bin.

Chakraborty et al. (2016)
also Gavriil et al. (2011)

Outbursts

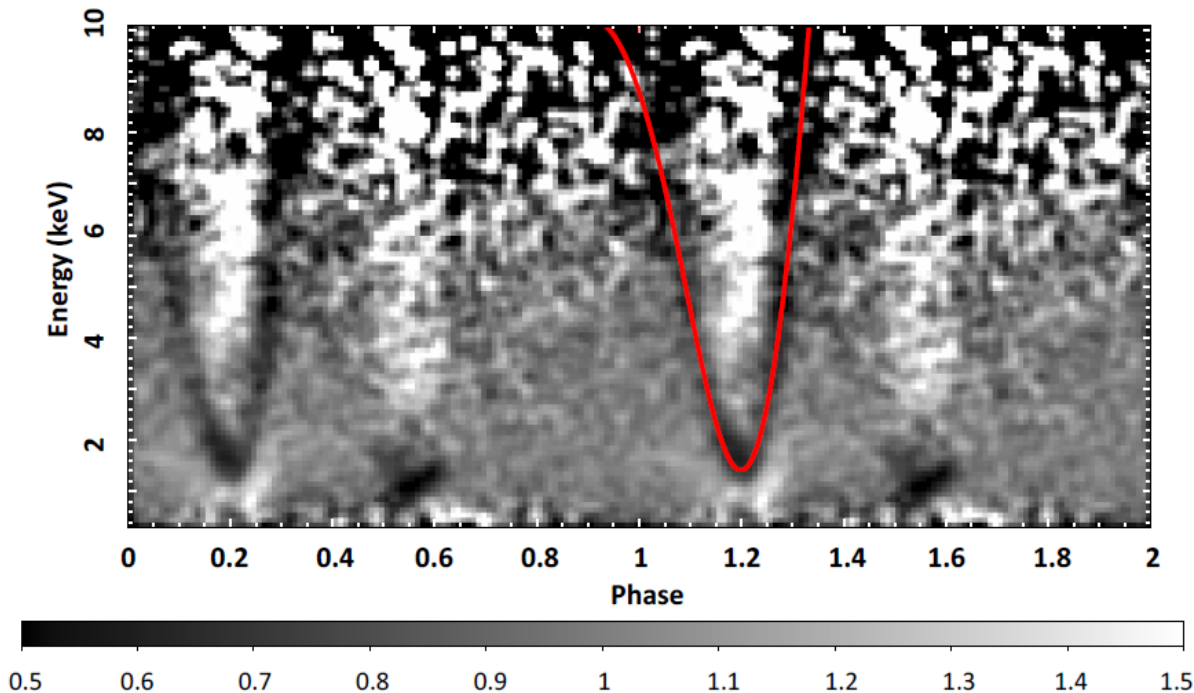
- F_x of the source increase by 10~1000 times
- last/decay for weeks to years
- spectra become softer during outbursts
- connection between outbursts and bursts

the onset of the outburst?
eXTP/WFM



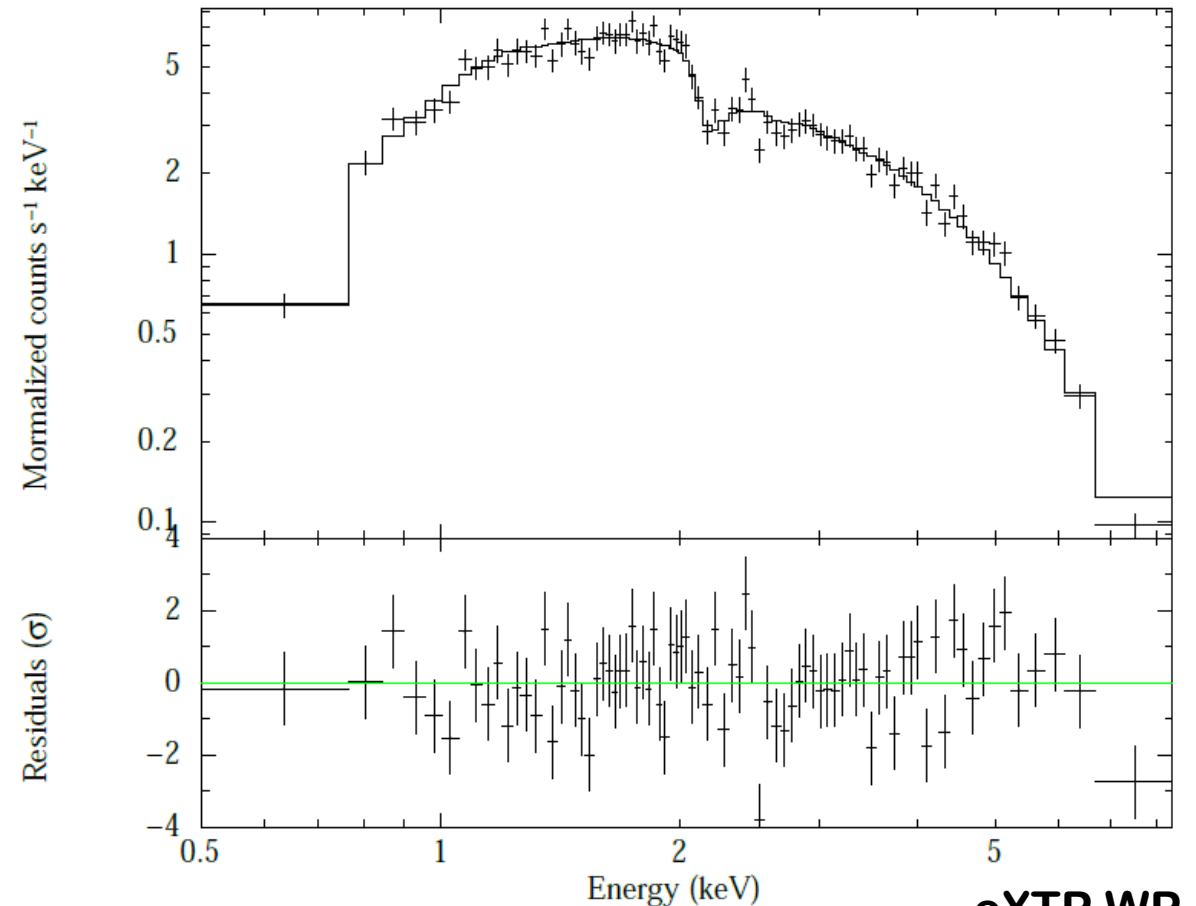
Outbursts: spectral lines

phase variable absorption feature
in SGR 0418+5729 outburst



Tiengo et al. (2013)

phase resolved spectrum
simulation



eXTP WP

Summary

	eXTP
Bursts	Spectrum is thermal or non-thermal
Burst tails	Discover more tails, X-ray bursts Detailed spectral & timing studies
Outbursts	Timing properties, phase-resolved spectra and the onset of the outburst