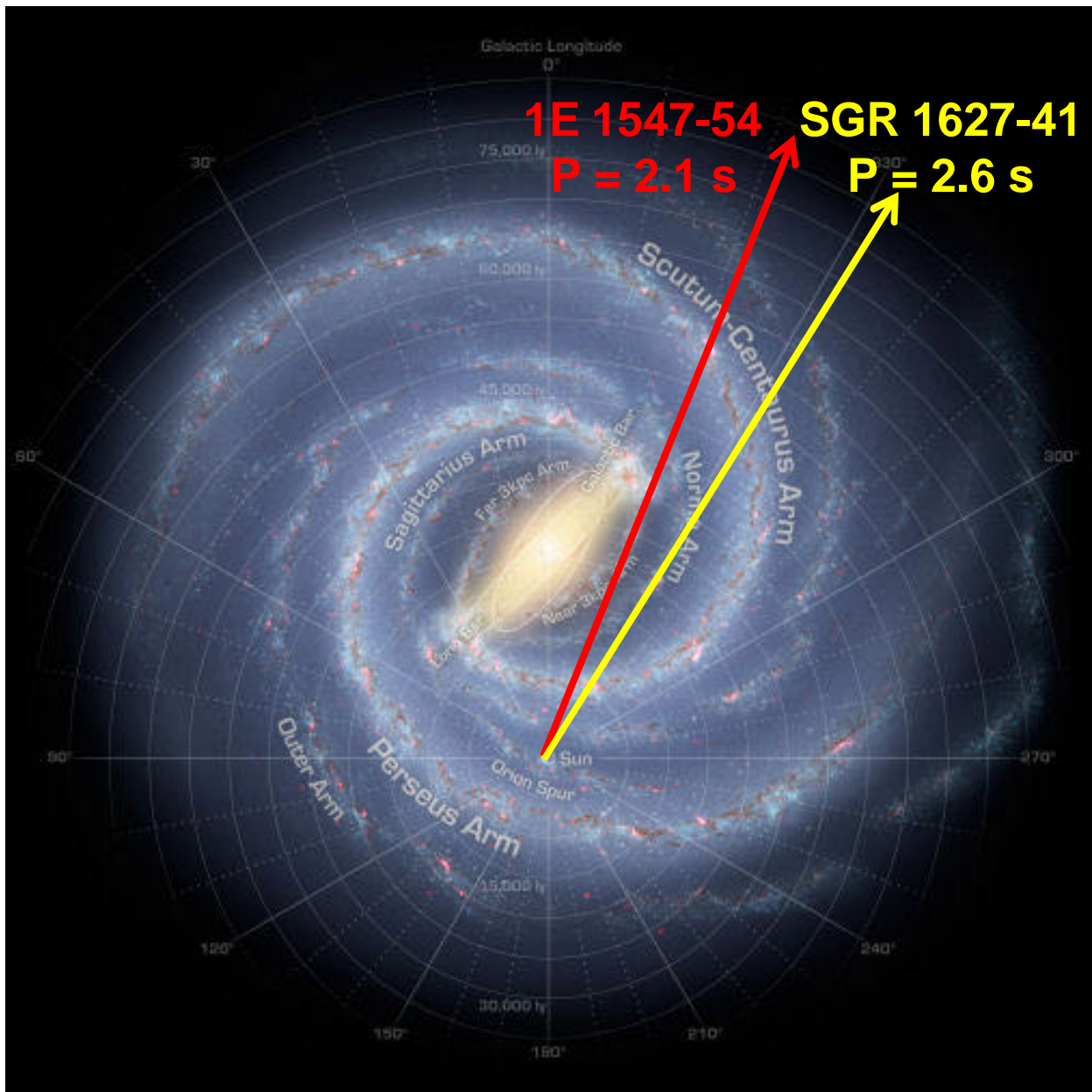


Recent results on the “twin” magnetars
SGR 1627-41
and
AXP 1E 1547-5404

Sandro Mereghetti
INAF – IASF Milano

in collaboration with P. Esposito, A. Tiengo, G. Vianello, N.Rea,
D.Gotz, G.L.Israel, L.Stella, S. Dall’Osso, R.Turolla, S.Zane , K.Hurley,
F. Senziani, P. Romano, V. Mangano, R. Perna, S. Campana, G.
Weidenspointner, A. von Kienlin, C. Winkler, P. Ubertini, & al....



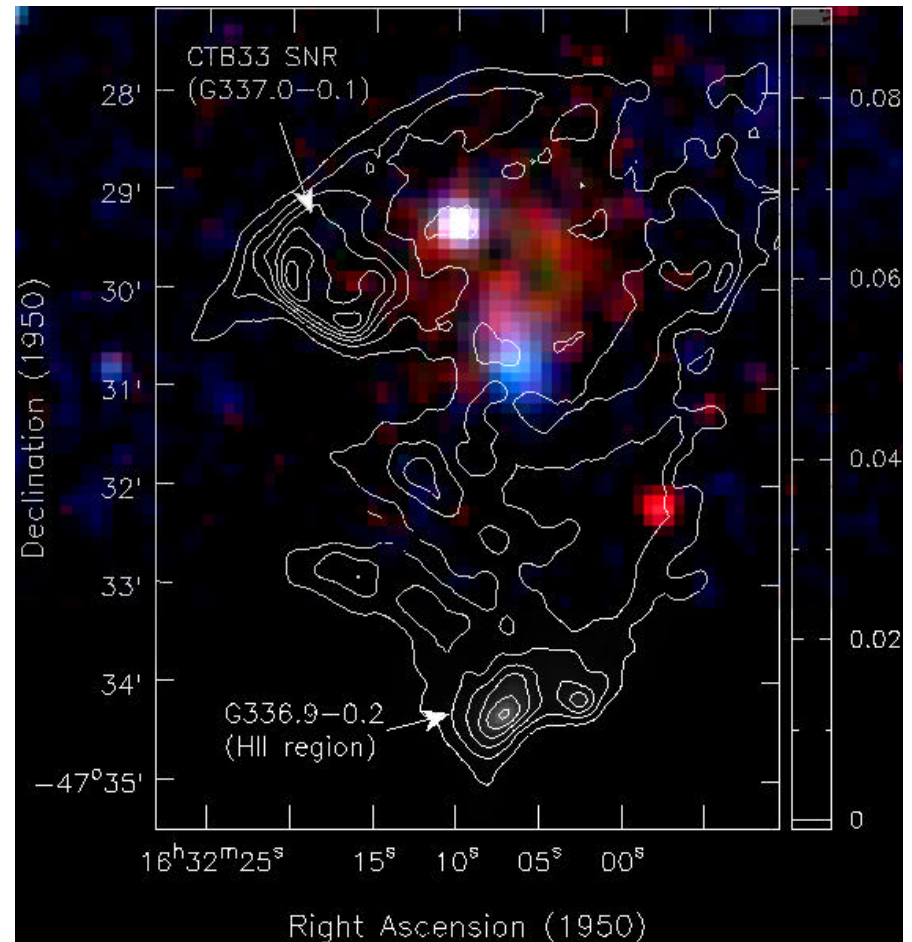
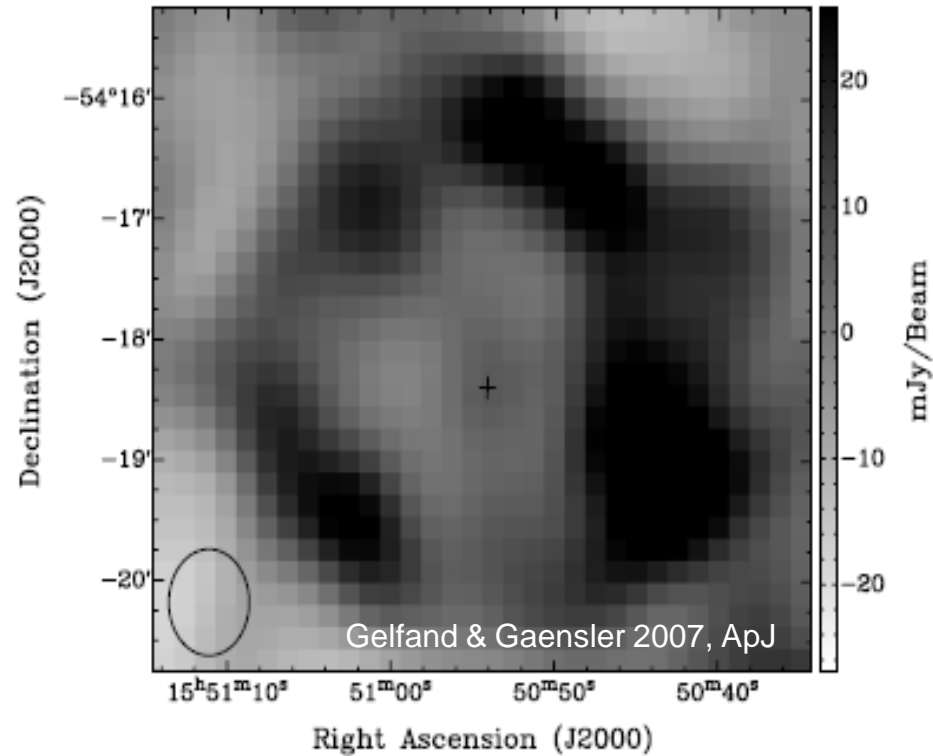
Similar periods
(the shortest)

Similar directions
in the sky

Both are in Supernova Remnants

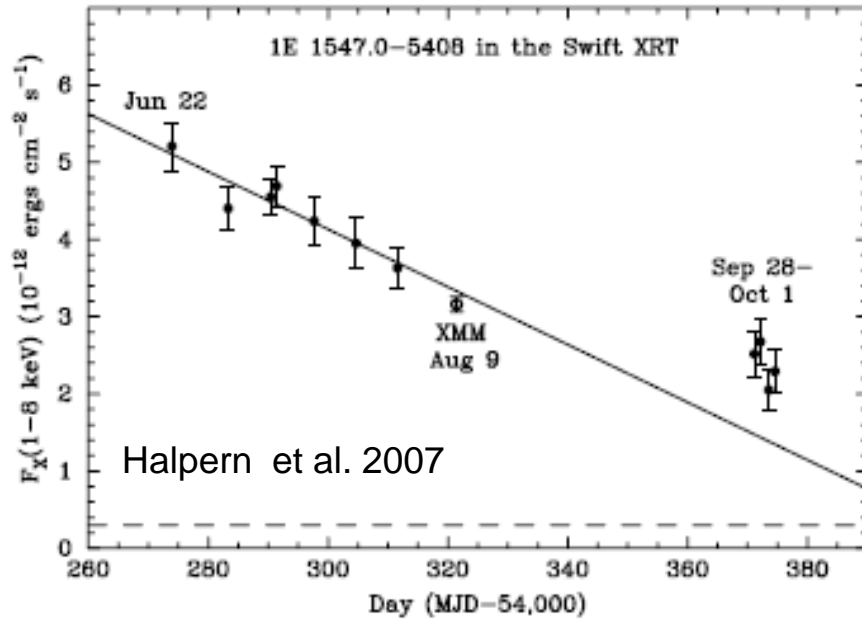
1E 1547-54
SNR G327.24-0.13

SGR 1627-41
SNR G337.0-0.1

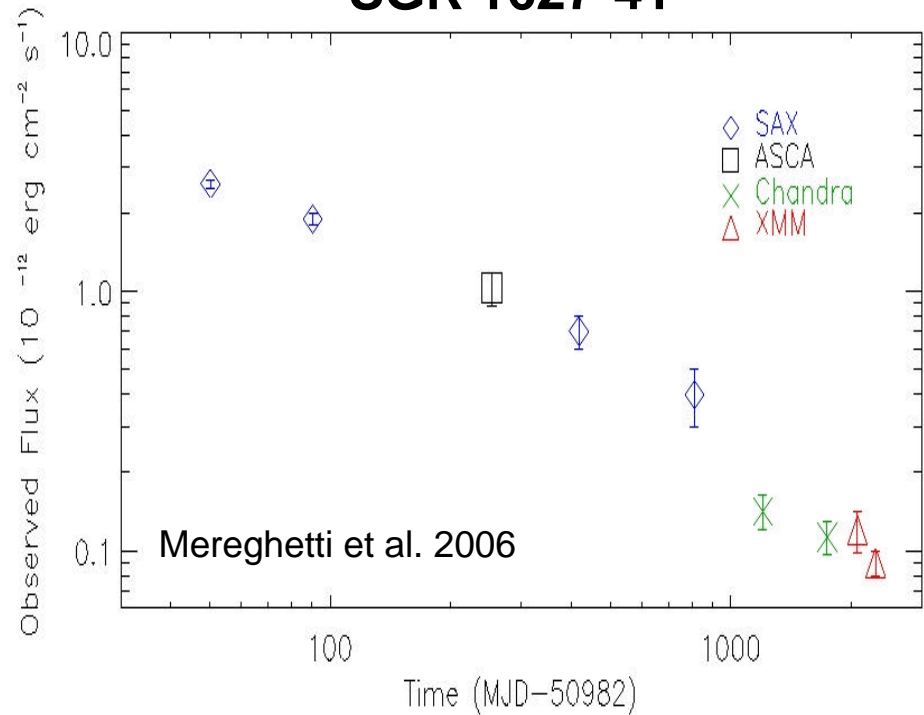


Both are transient sources

1E 1547-54

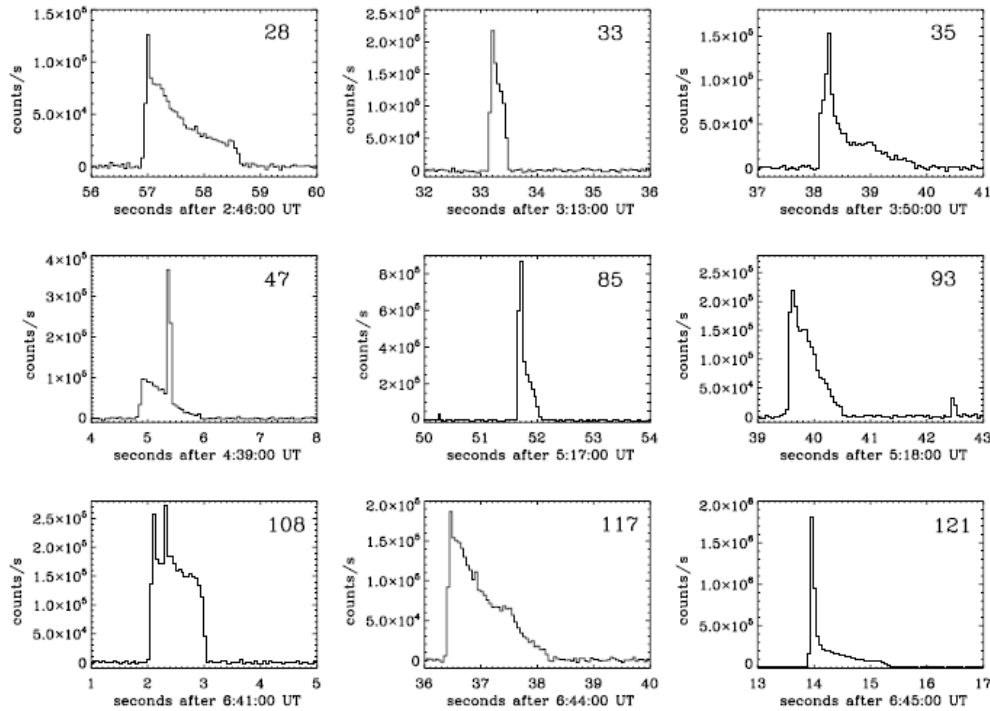


SGR 1627-41

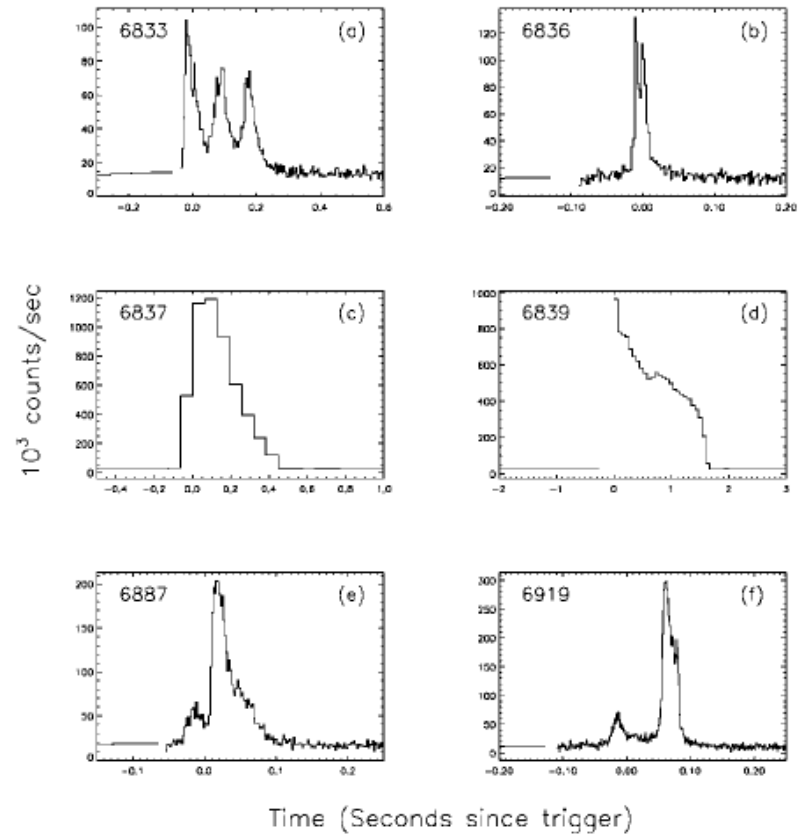


Both emitted bursts

1E 1547-54
(Mereghetti et al 2009)

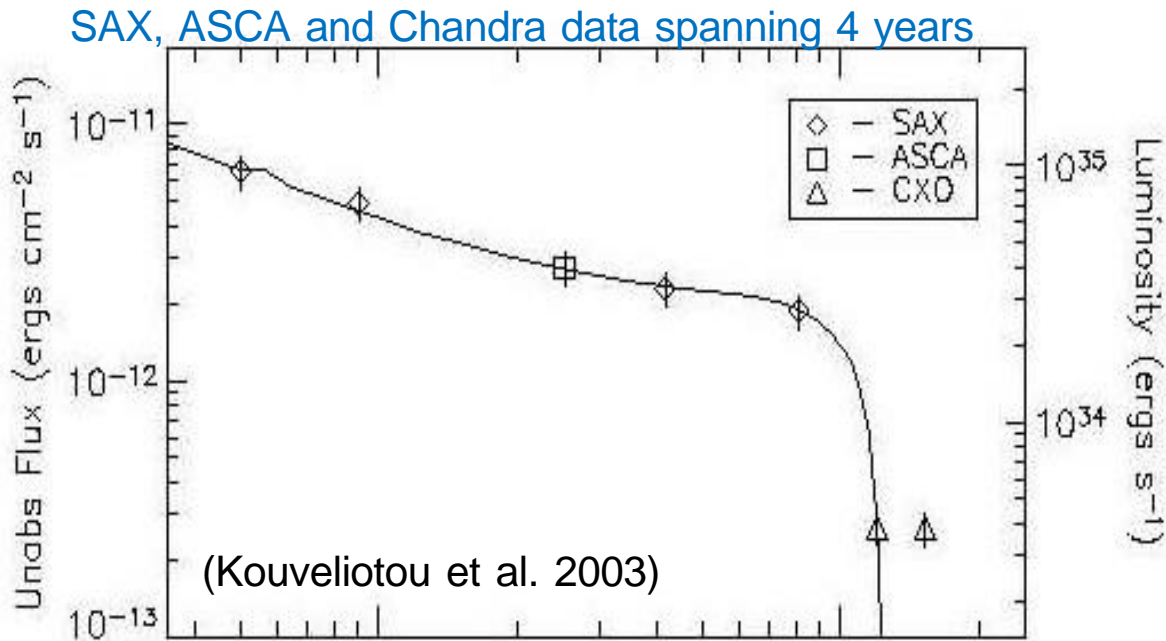


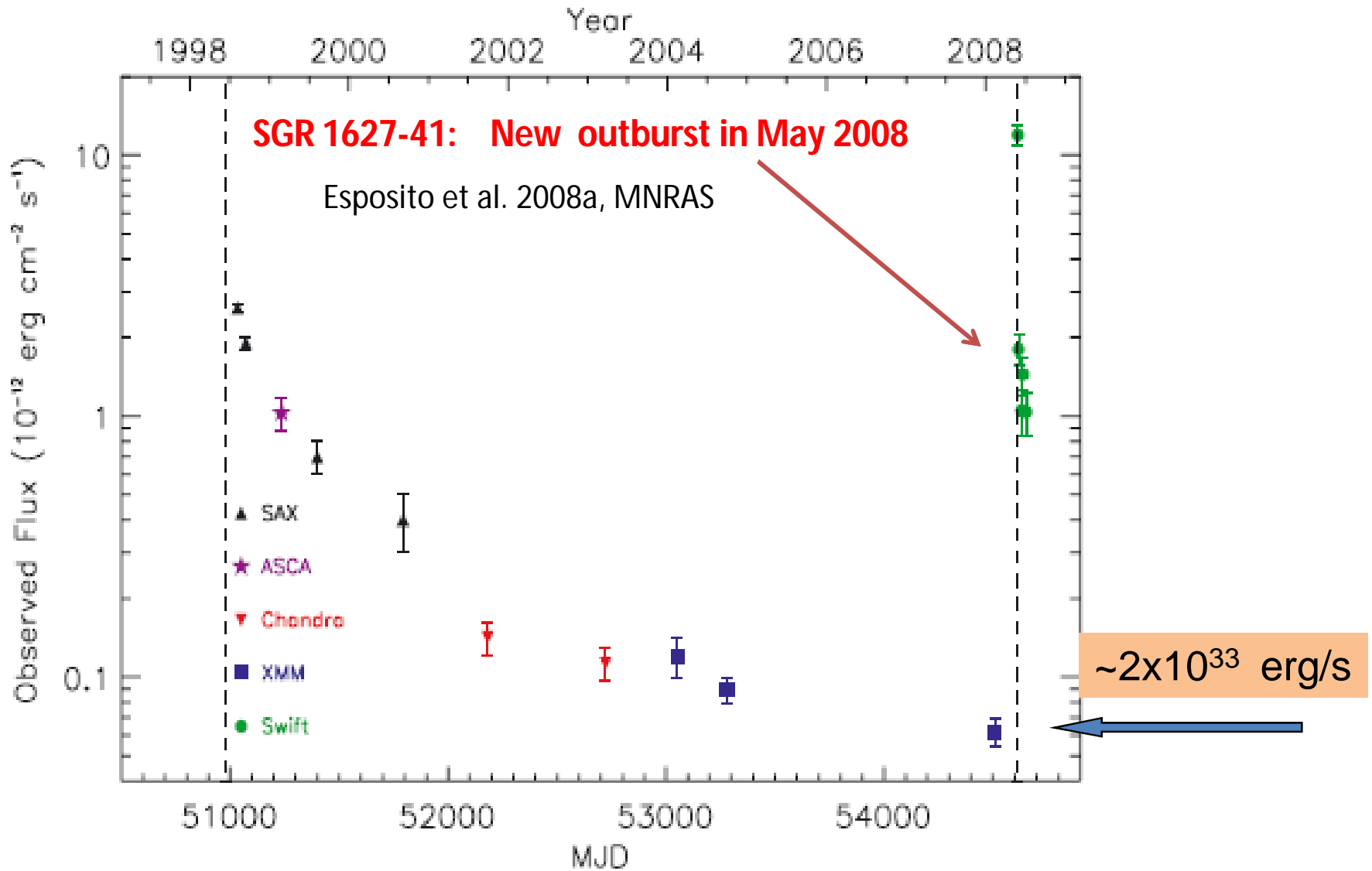
SGR 1627-41
(Woods et al. 1999)



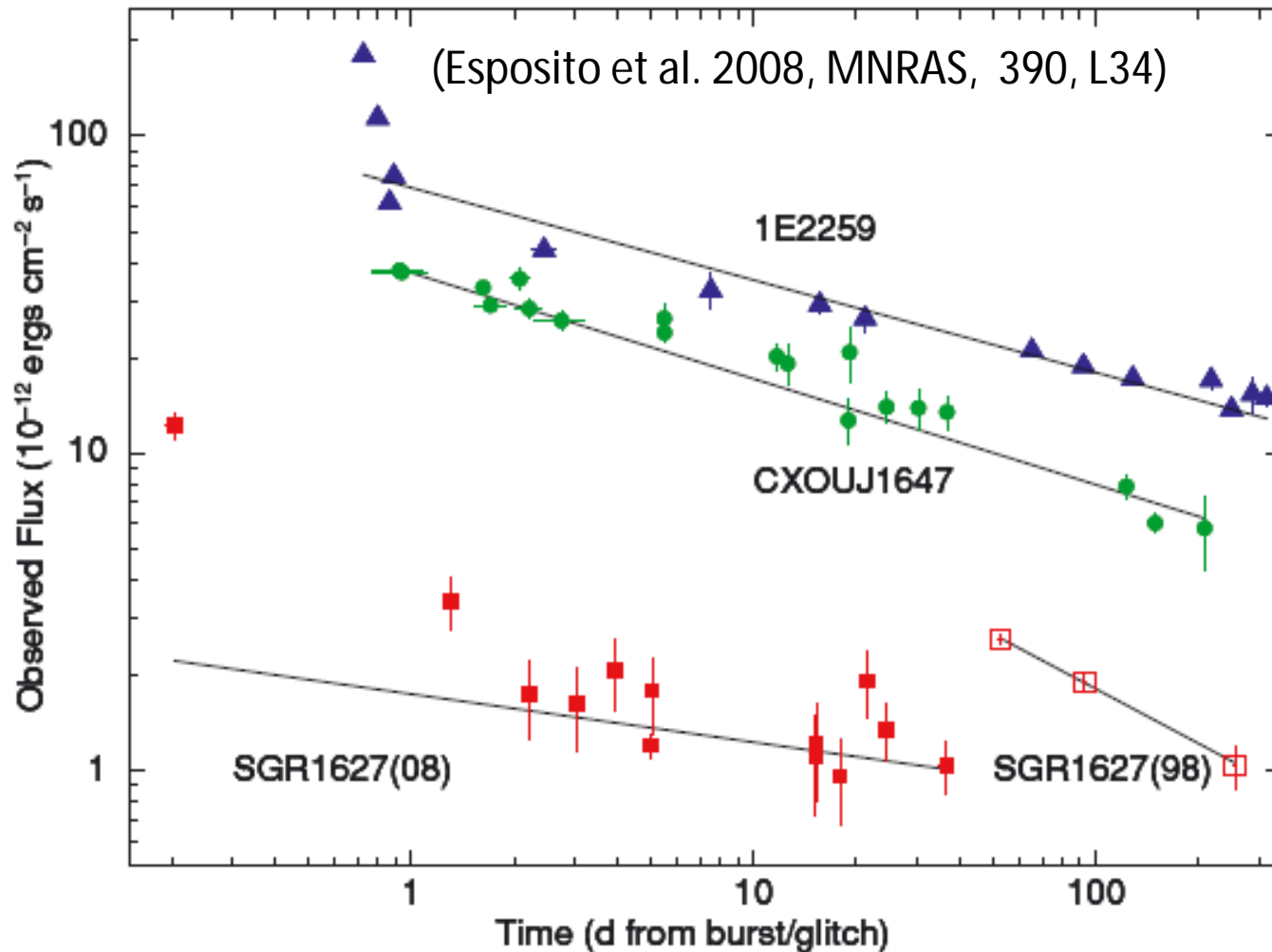
SGR 1627-41

- Discovered in 1998 (Woods et al. 1999); active only a few weeks and quiescent since then
- Spin period could not be found because source faded
- No identified optical/NIR counterparts (Wachter et al 2004)
- Long term decrease in X-ray luminosity interpreted as cooling after crust heating by the bursts (Lyubarsky, Eichler & Thompson 2002)



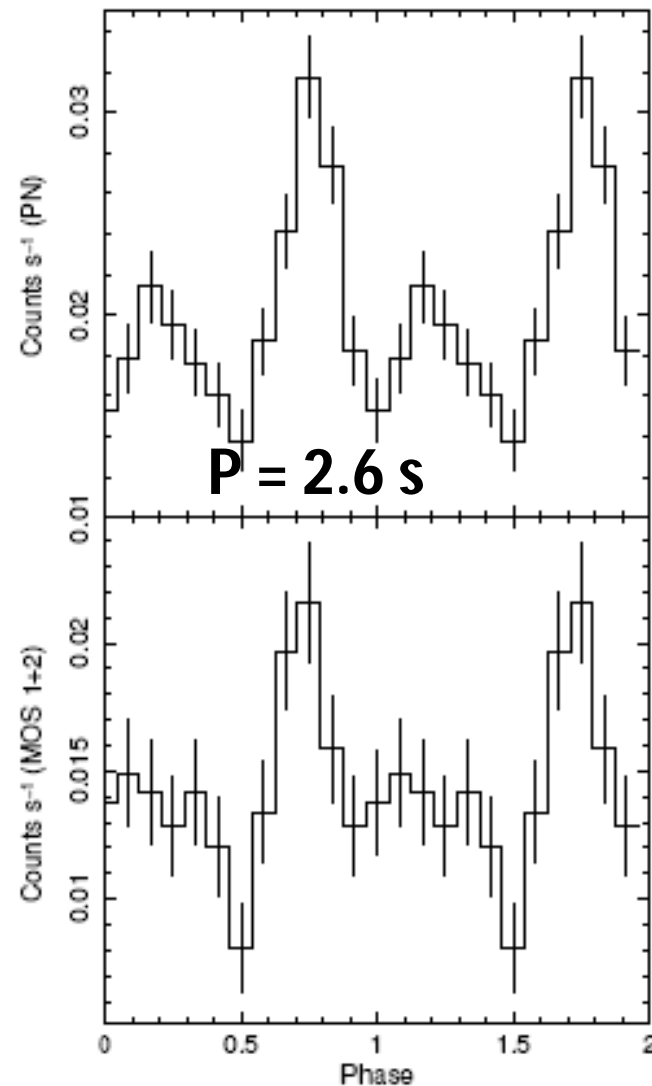
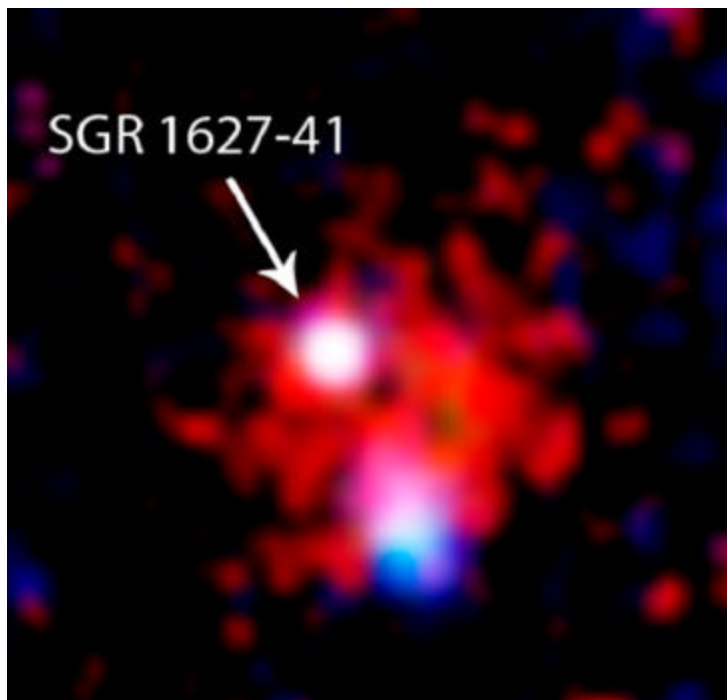


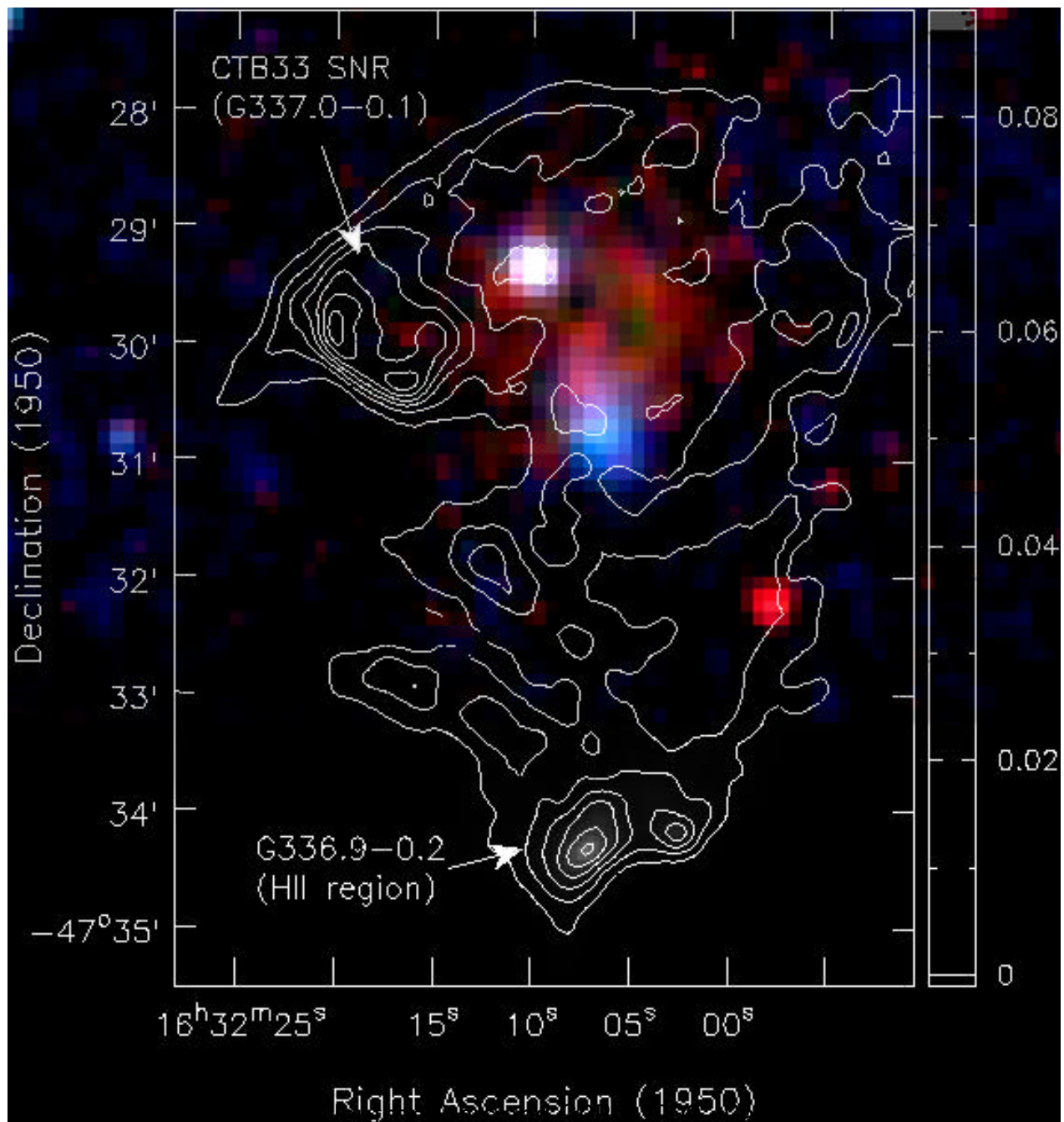
Comparison of X-ray flux decays after strong bursting episodes in different magnetars



XMM Target of Opportunity performed as soon as visibility constraints allowed it (Esposito et al. 2009, ApJ 690, L105)

Discovery of the long-sought pulsations..... and diffuse soft X-ray emission from the SNR

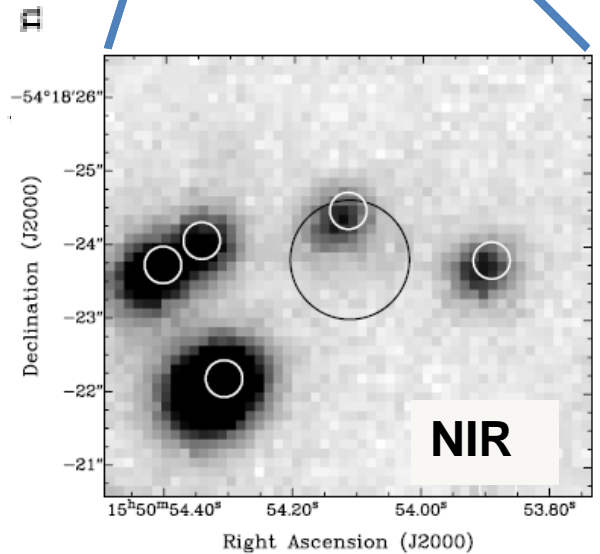
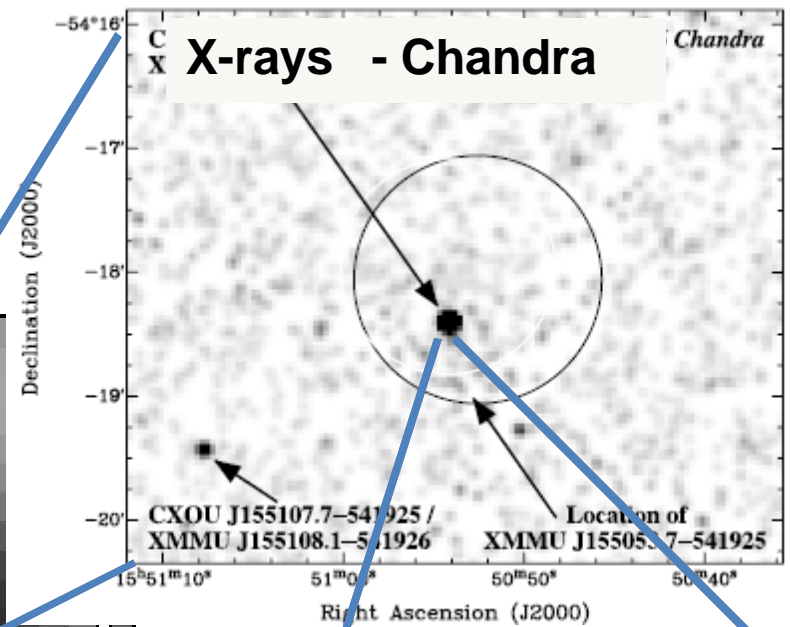
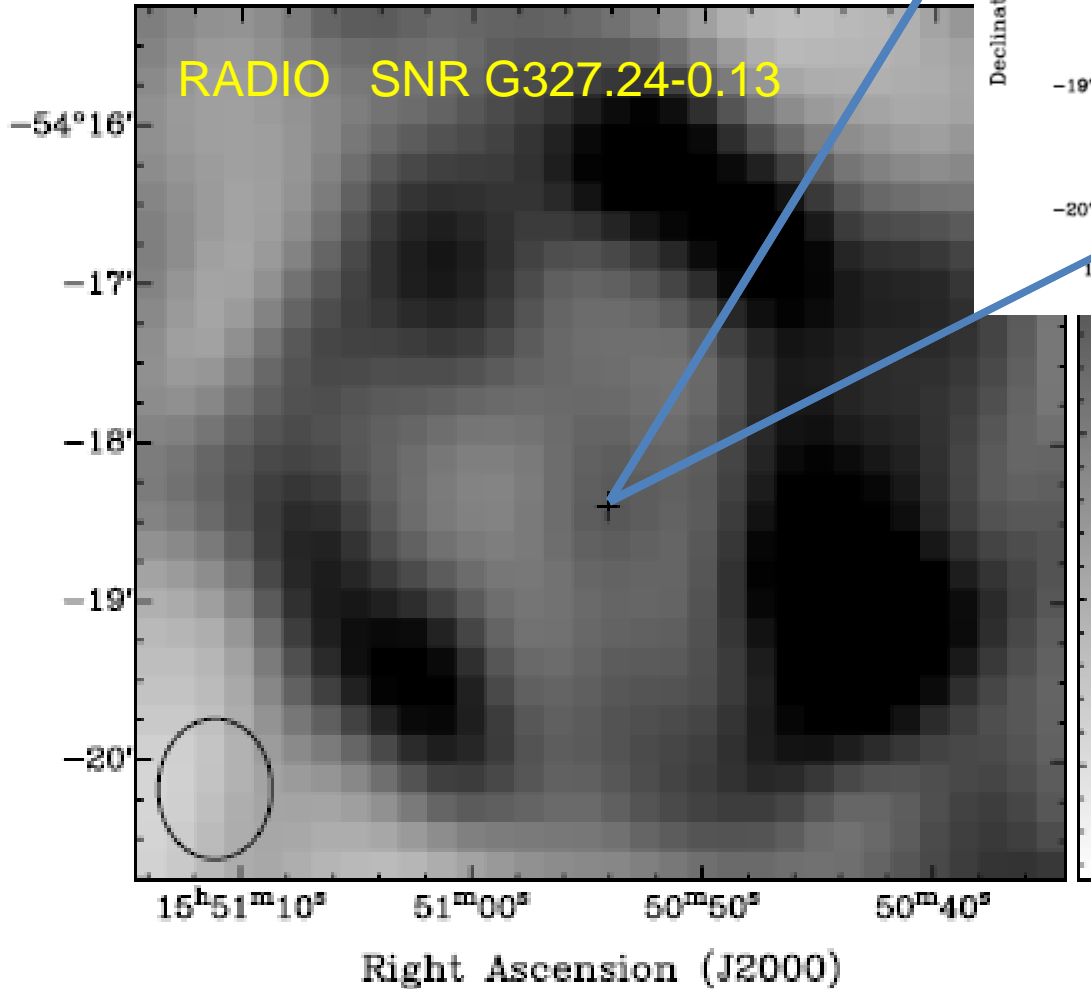




AXP 1E1547-5408

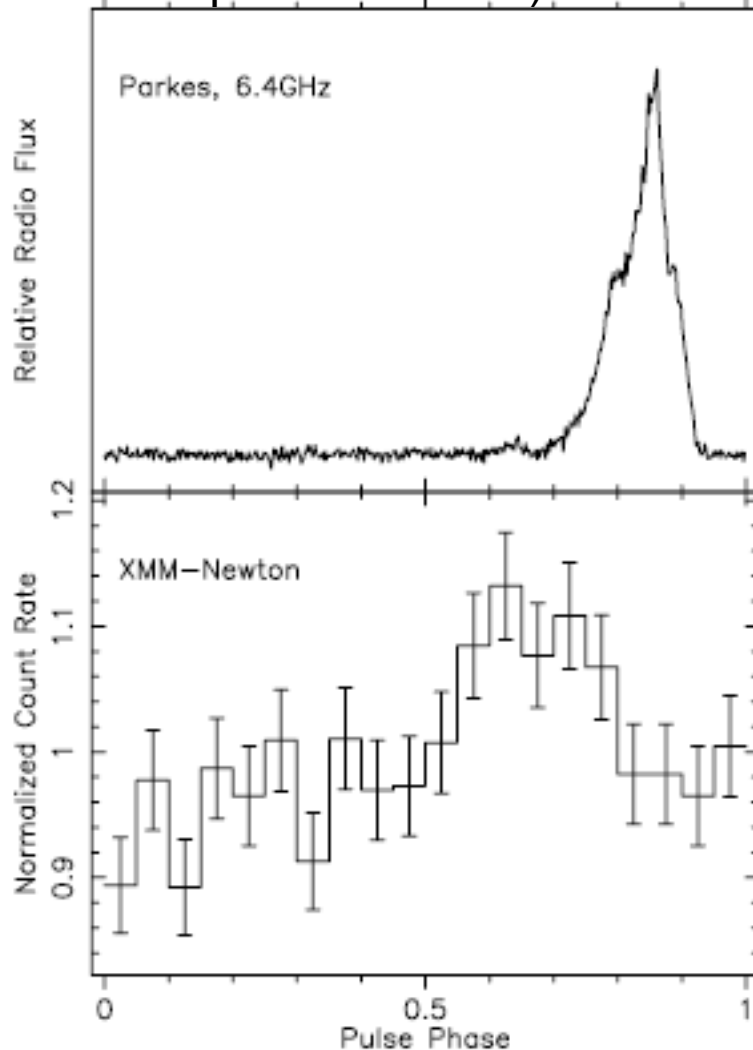
1E 1547-5408

(Gelfand & Gaensler 2007)



1E 1547-5408

Halpern et al 2007)



Pulsations and spin-down [discovered in radio] confirm that 1E1547 is an AXP

(Camilo et al 2007)

on Jan 22 many bursts were detected from 1E 1547-5408 by ~all satellites

Swift - Gronwall et al. GCN 8833

Fermi - Connaughton GCN 8835,
von Kienlin & Connaughton GCN 8838,

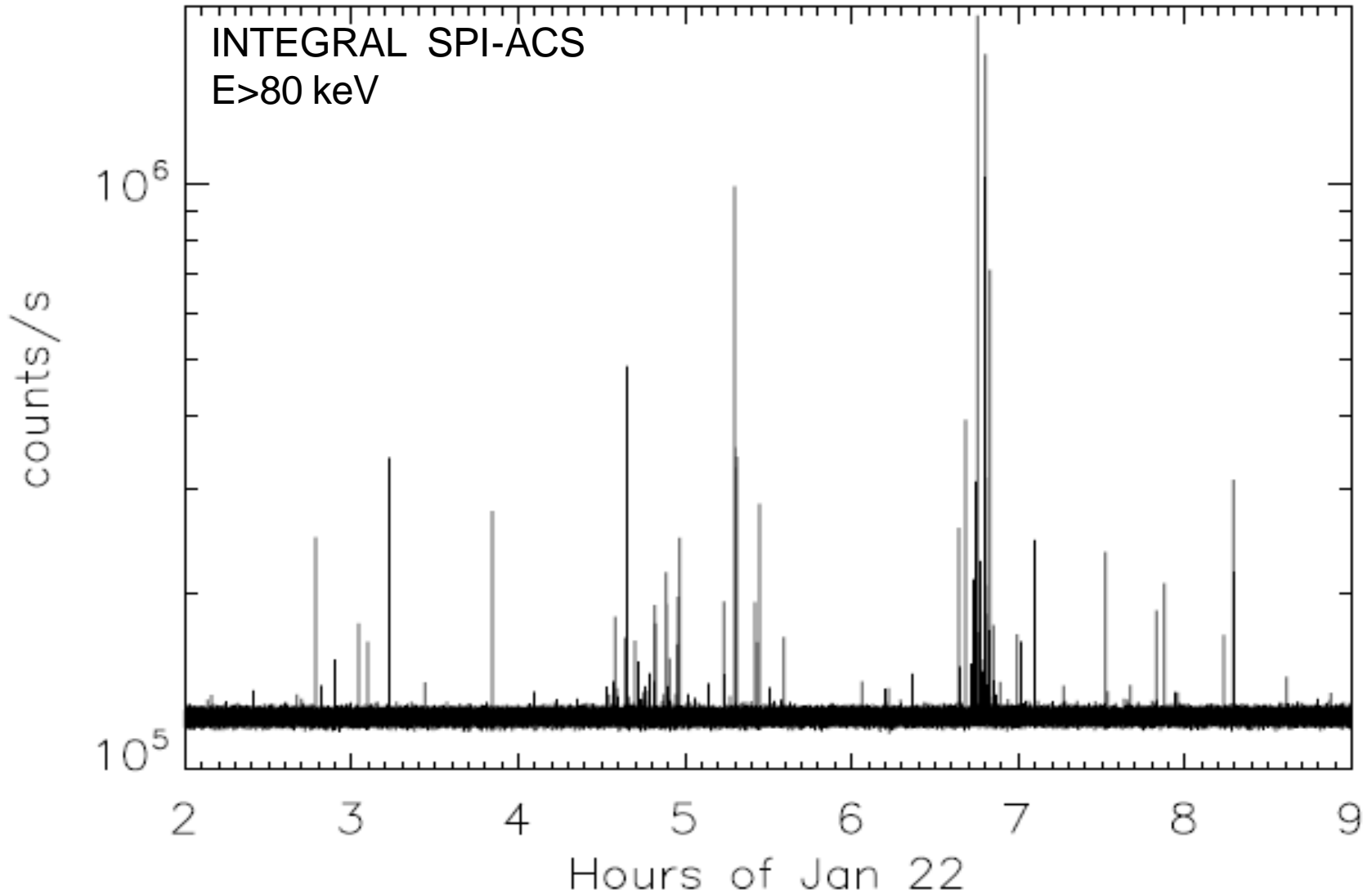
INTEGRAL - Savchenko et al. GCN 8837,
Mereghetti et al. GCN 8841

Suzaku - Terada et al. GCN 8845,

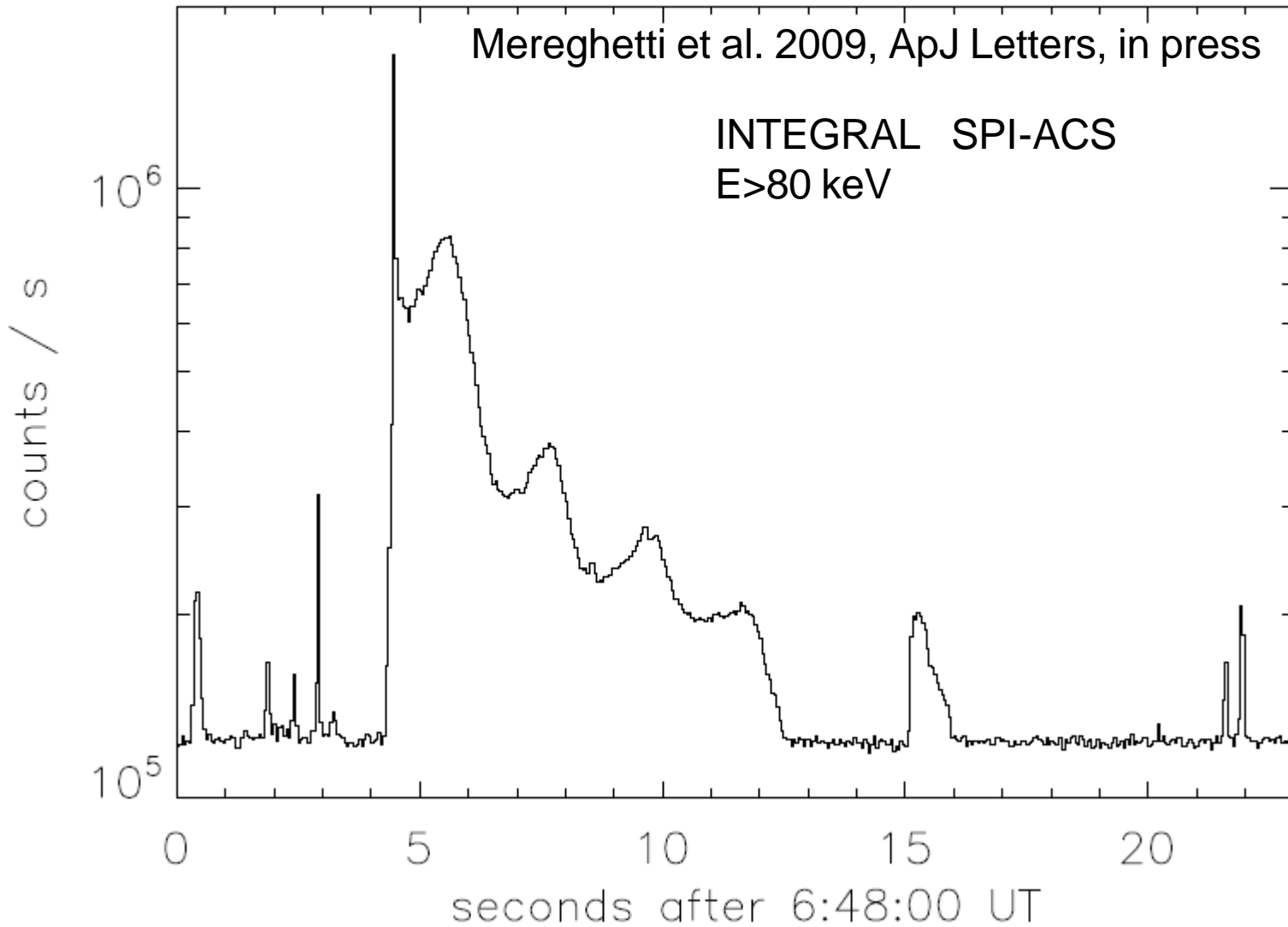
Konus-WIND - Golenetskii et al. GCN 8851,

RHESSI - Bellm et al. GCN 8857

1E 1547-5408 - "SGR-like" bursts on Jan 22



1E 1547-5408 - a new Giant Flare ??



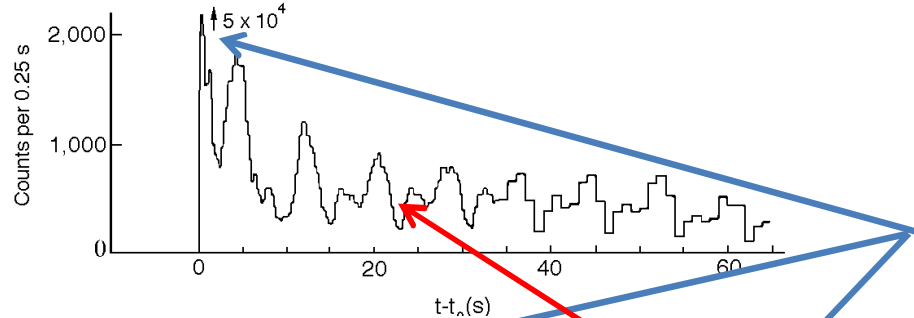
The three famous Giant Flares from SGRs:

1979 March 5

SGR 0526-66

$L_{\text{peak}} \sim 4 \cdot 10^{44}$ erg/s

$E_{\text{TOT}} \sim 5 \cdot 10^{44}$ erg



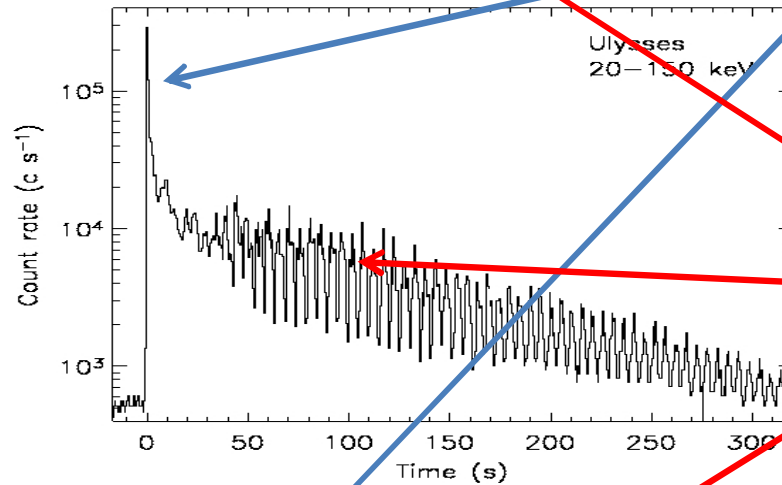
Short hard spikes

1998 August 27

SGR 1900+14

$L_{\text{peak}} > 8 \cdot 10^{44}$ erg/s

$E_{\text{TOT}} > 3 \cdot 10^{44}$ erg



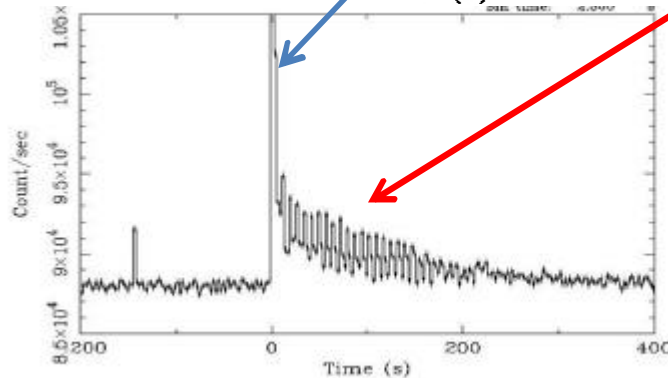
Long pulsating tails

2004 December 27

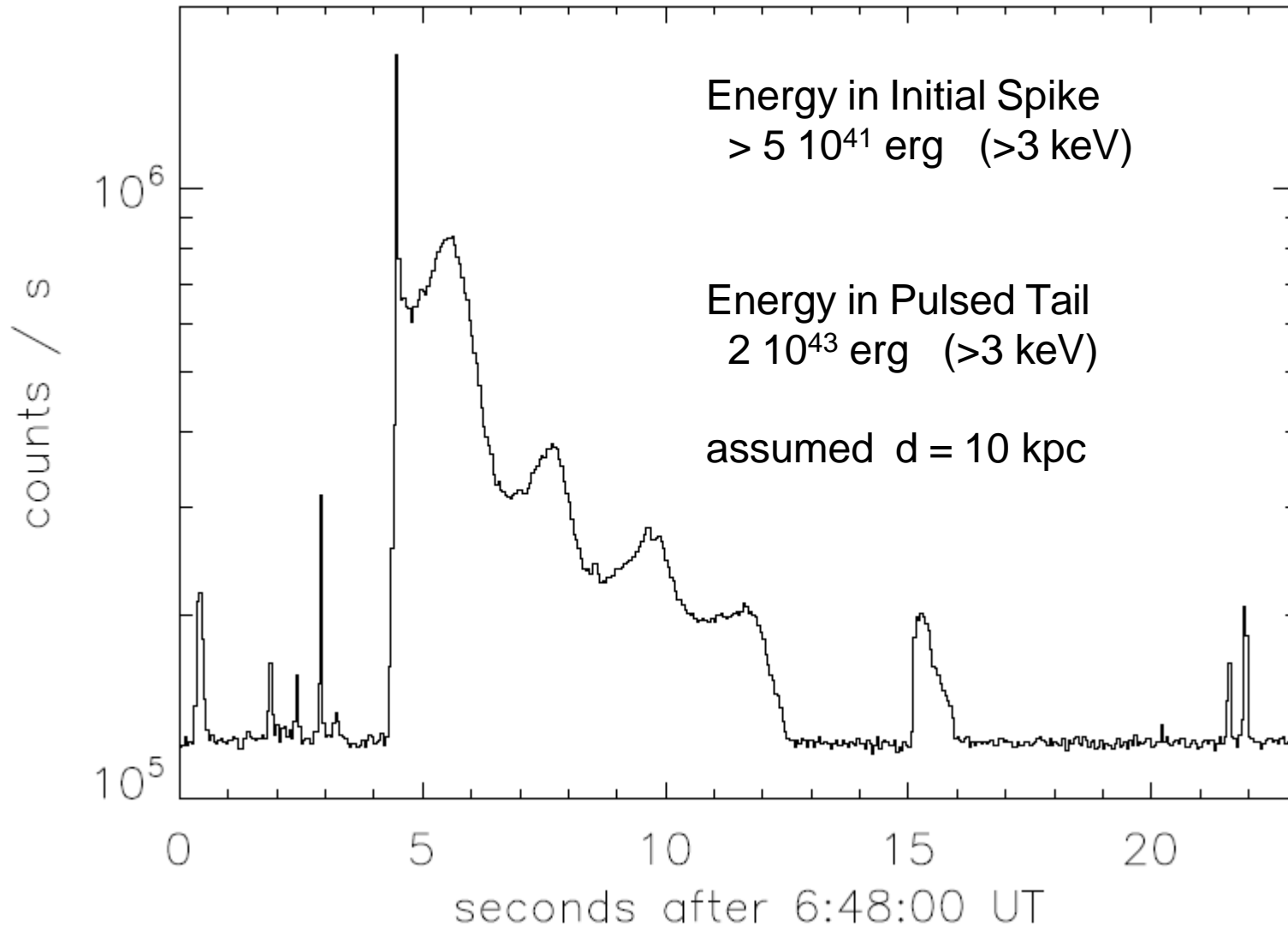
SGR 1806-20

$L_{\text{peak}} \sim 2\text{-}5 \cdot 10^{47}$ erg/s

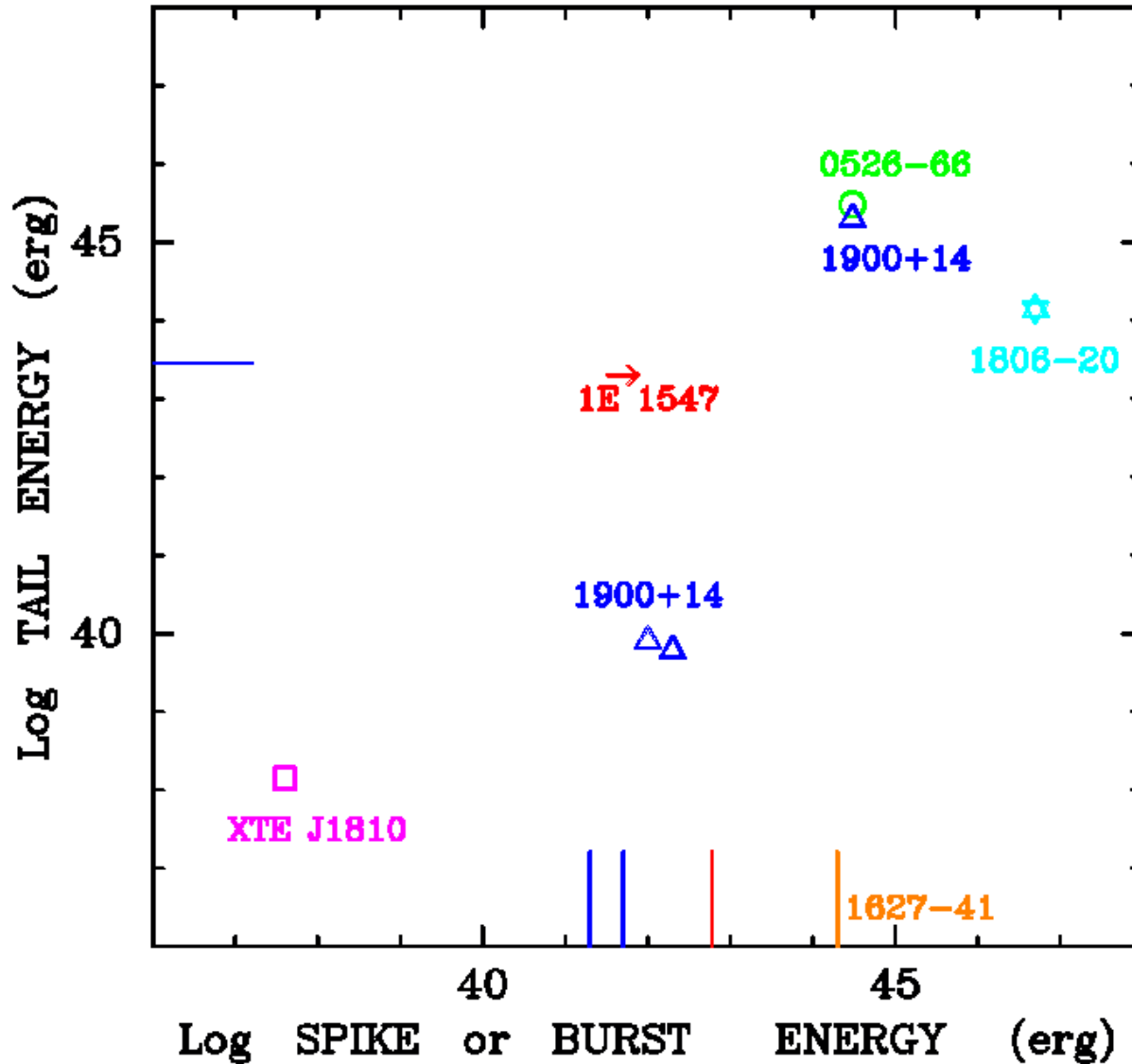
$E_{\text{TOT}} \sim 2\text{-}5 \cdot 10^{46}$ erg



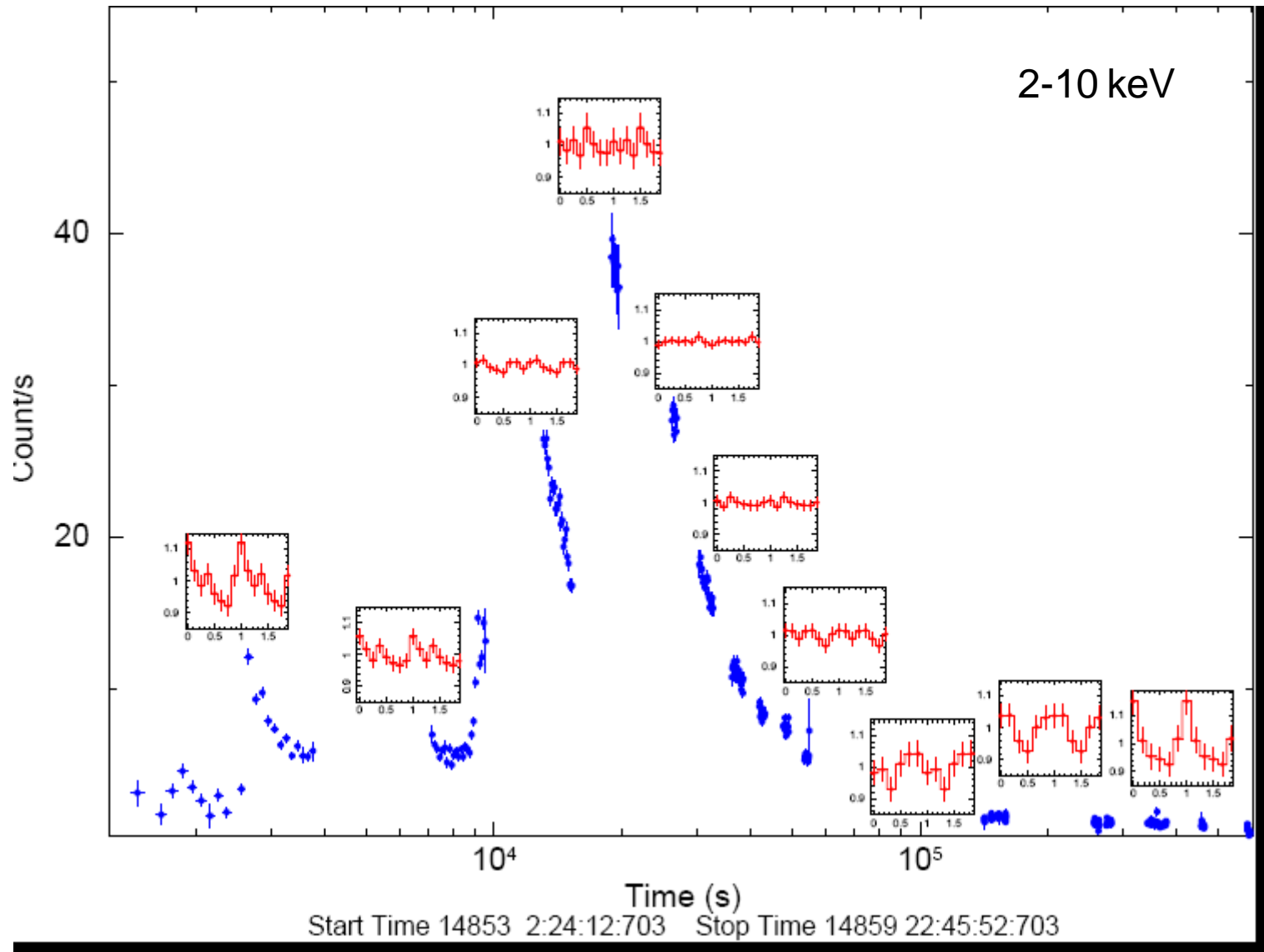
1E 1547-5408 - a new Giant Flare ?? → NO !!



Energetics of flares and bursts

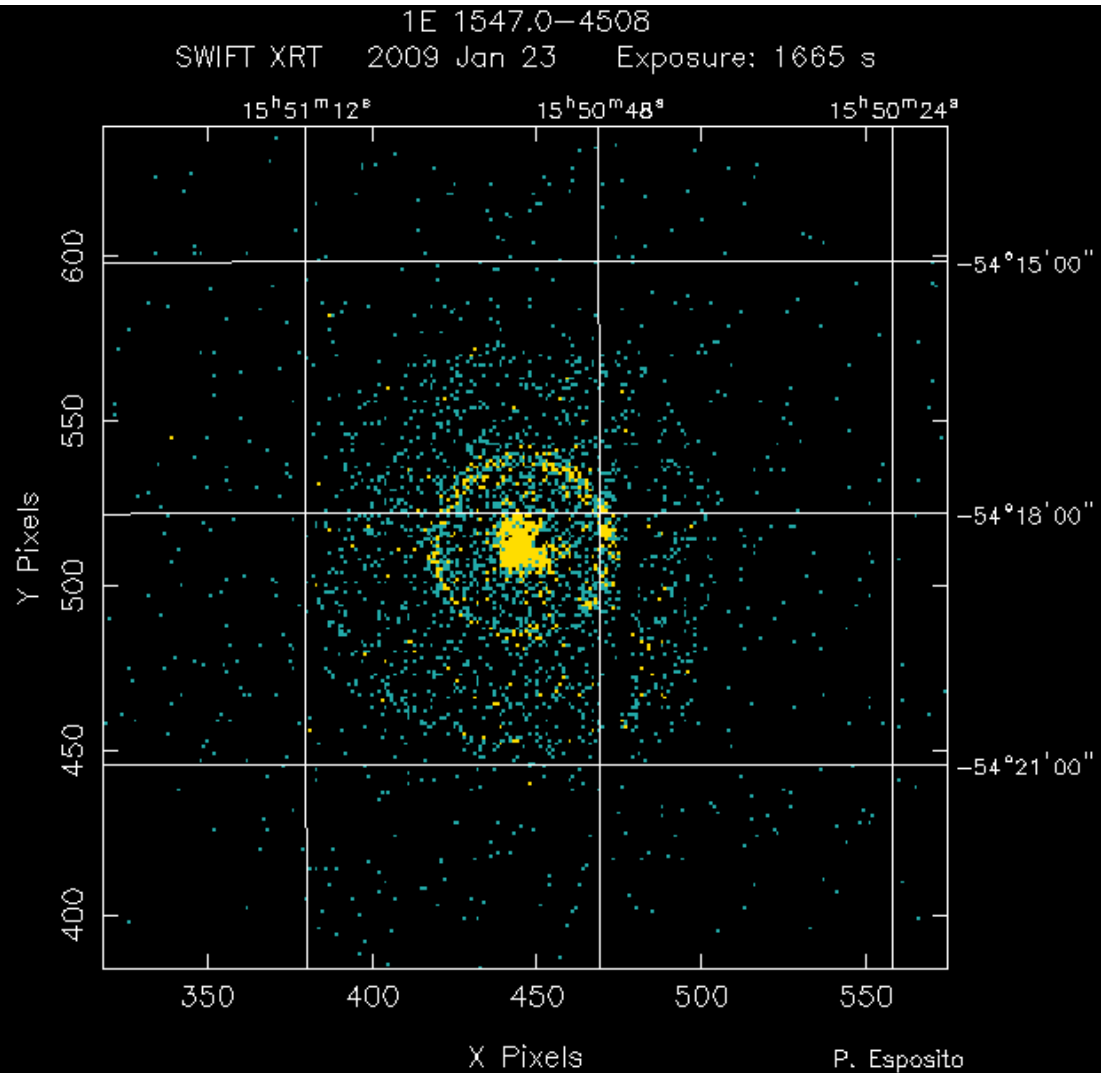


1E 1547-5408 - Swift/XRT follow-up

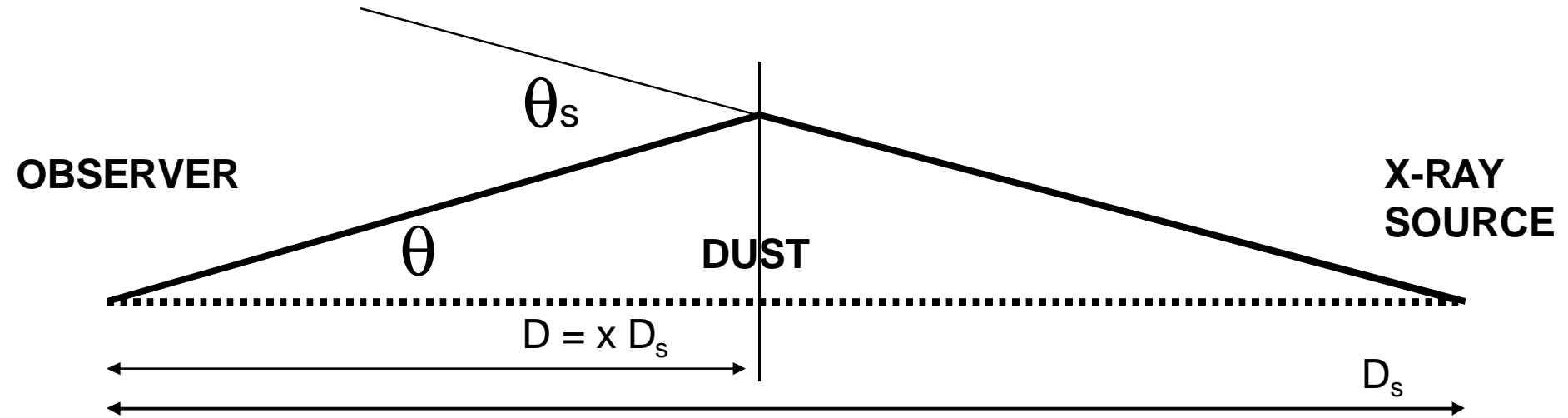


Expanding X-ray rings

Tiengo, SM, et al. GCN 8848



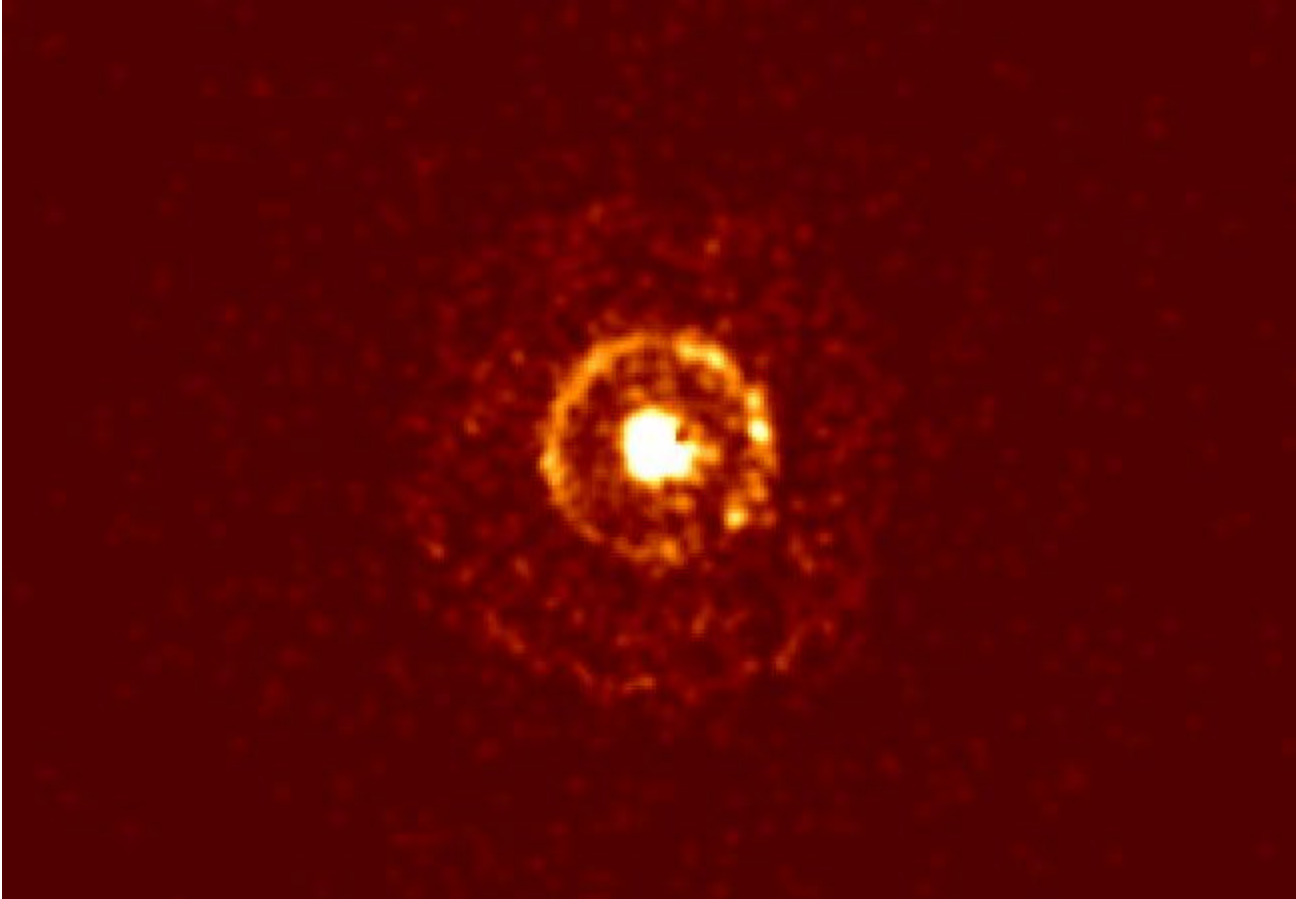
X-ray halos from interstellar dust scattering



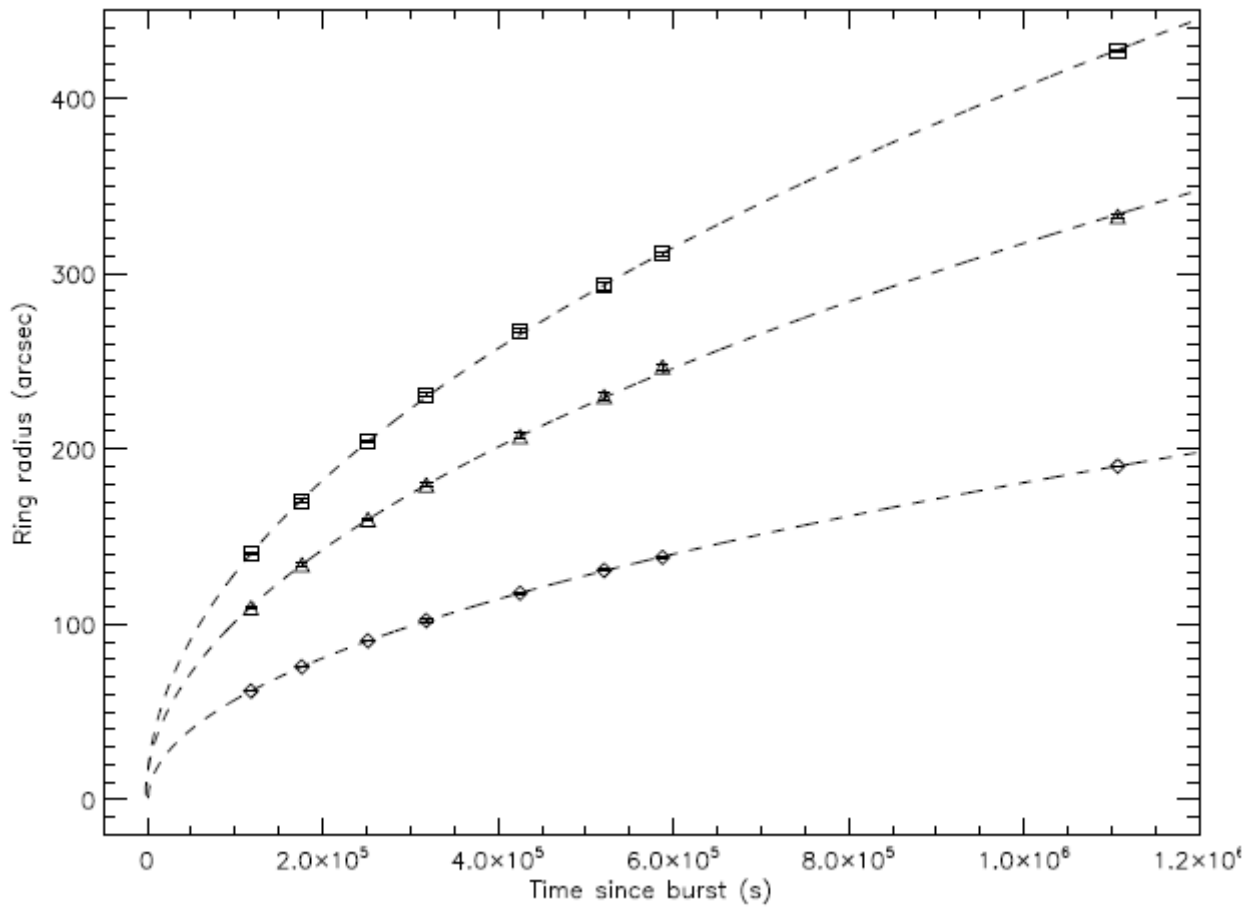
$$\text{TIME DELAY} = \frac{x}{1-x} \frac{D_s \mathbf{q}^2}{2c}$$

$$\text{SIZE OF HALO} \approx \frac{10 \text{ arcmin}}{E [\text{keV}] \ a [0.1 \text{ mm}]}$$

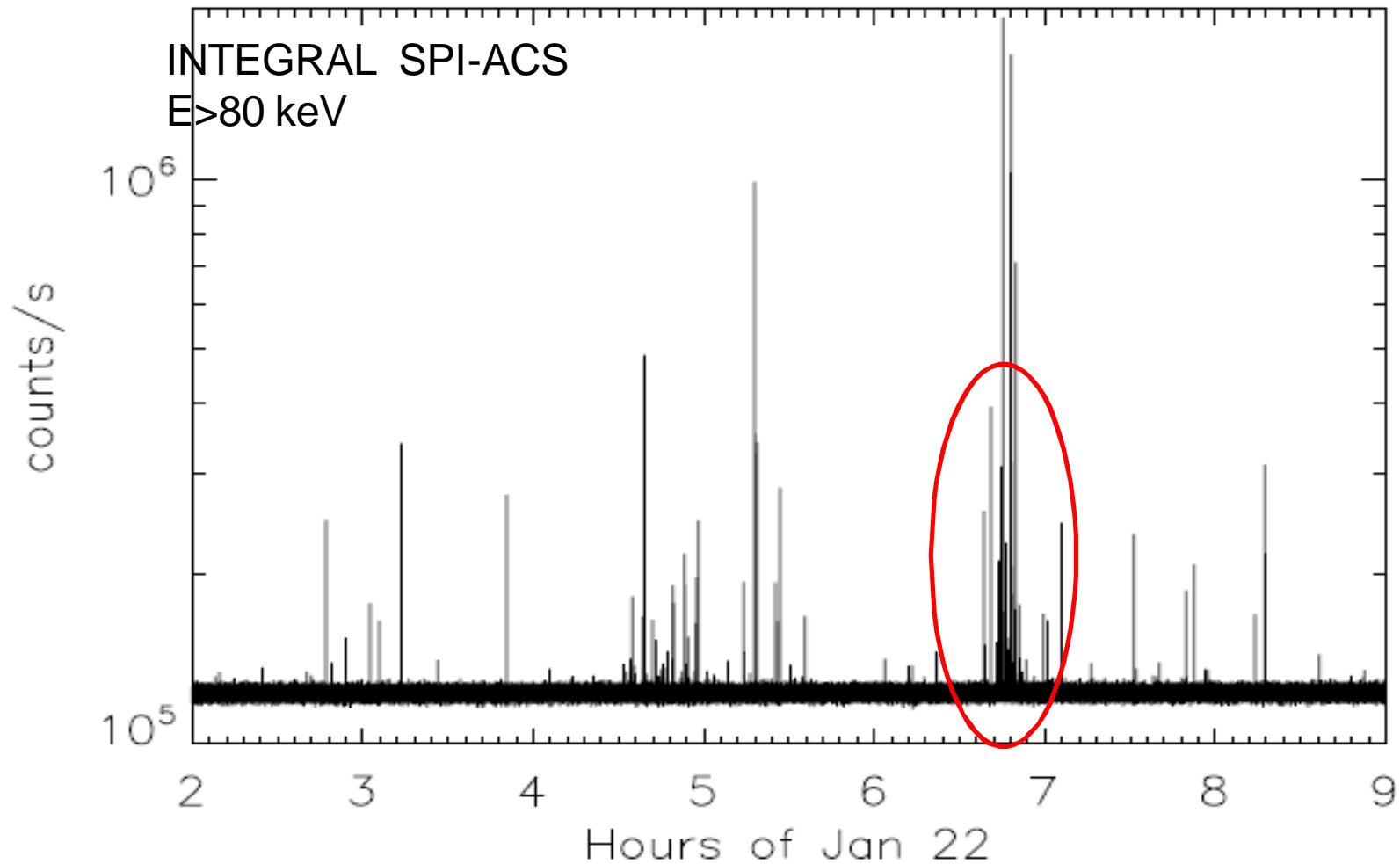
3 concentric rings → 3 dust layers at different distances



Fitting of expansion rate gives the time of the burst with precision of ksec order



The strong bursts at ~6:45 of Jan 22 are responsible for the dust scattering rings



Conclusions

- **Reactivation of SGR 1627 after ten years**
 - discovery of $P=2.6$ s (2nd fastest magnetar)
 - discovery of X-ray emission from CTB 33
- **AXP 1547-58 strong activity in 2009**
 - strong bursts with pulsed tail (but less energetic than the GFs)
 - Expanding dust scattering rings → precise source distance (work in progress...)
- **Effect of dust scattering on light curves after strong bursts could be important**
- **One “AXP” and one “SGR” with very similar properties**
→ more evidence for a single class of objects