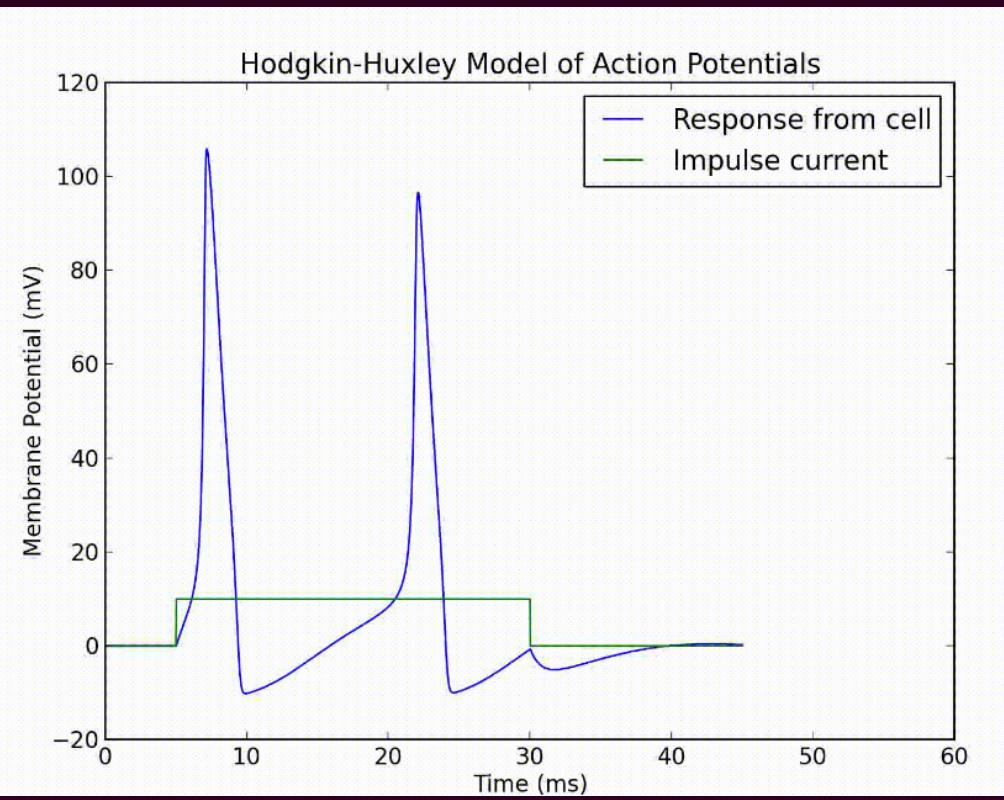
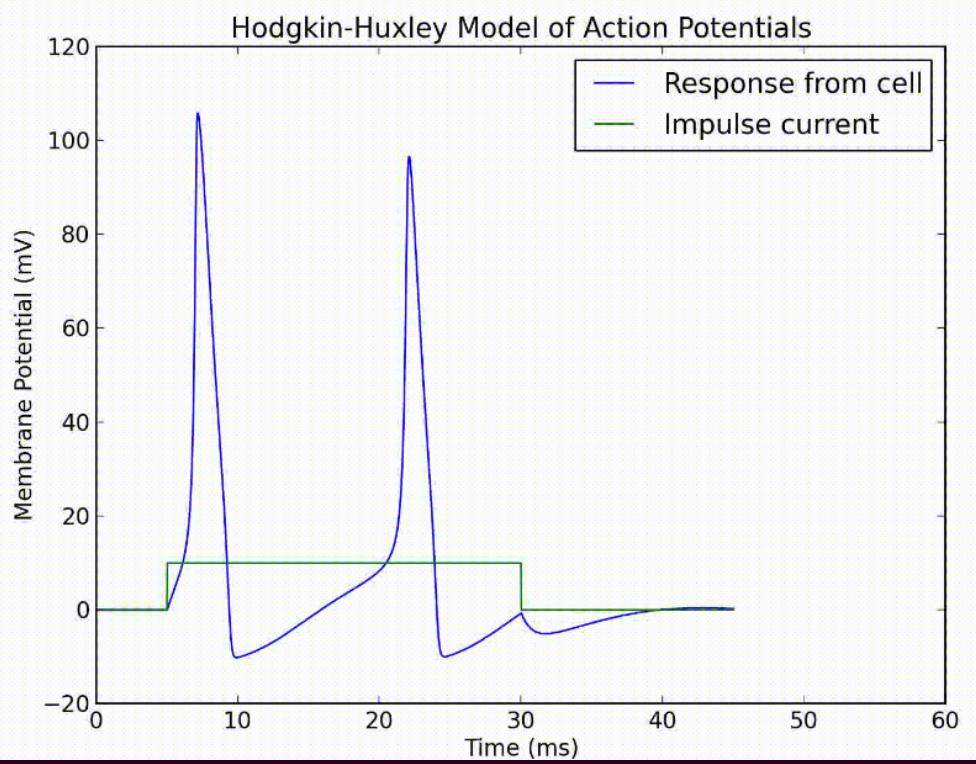


What's at the Center of SNR RCW103? Unresolved since 1974

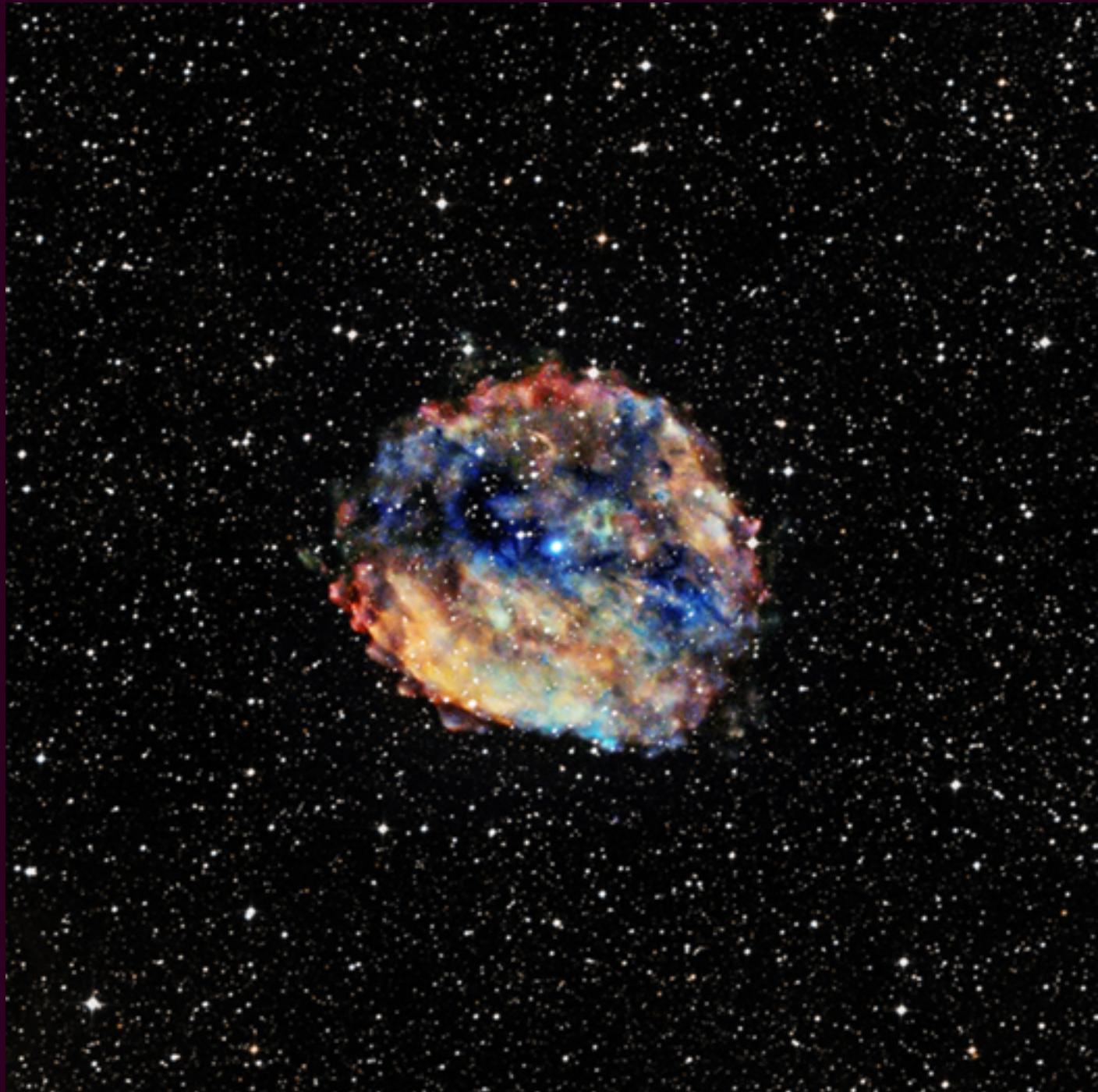
Based on
A D'ai et al. 2016
N. Rea et al. 2016

Mohammed Chamma
Supervisor: Dr. Martin Houde
Oct. 14 2016

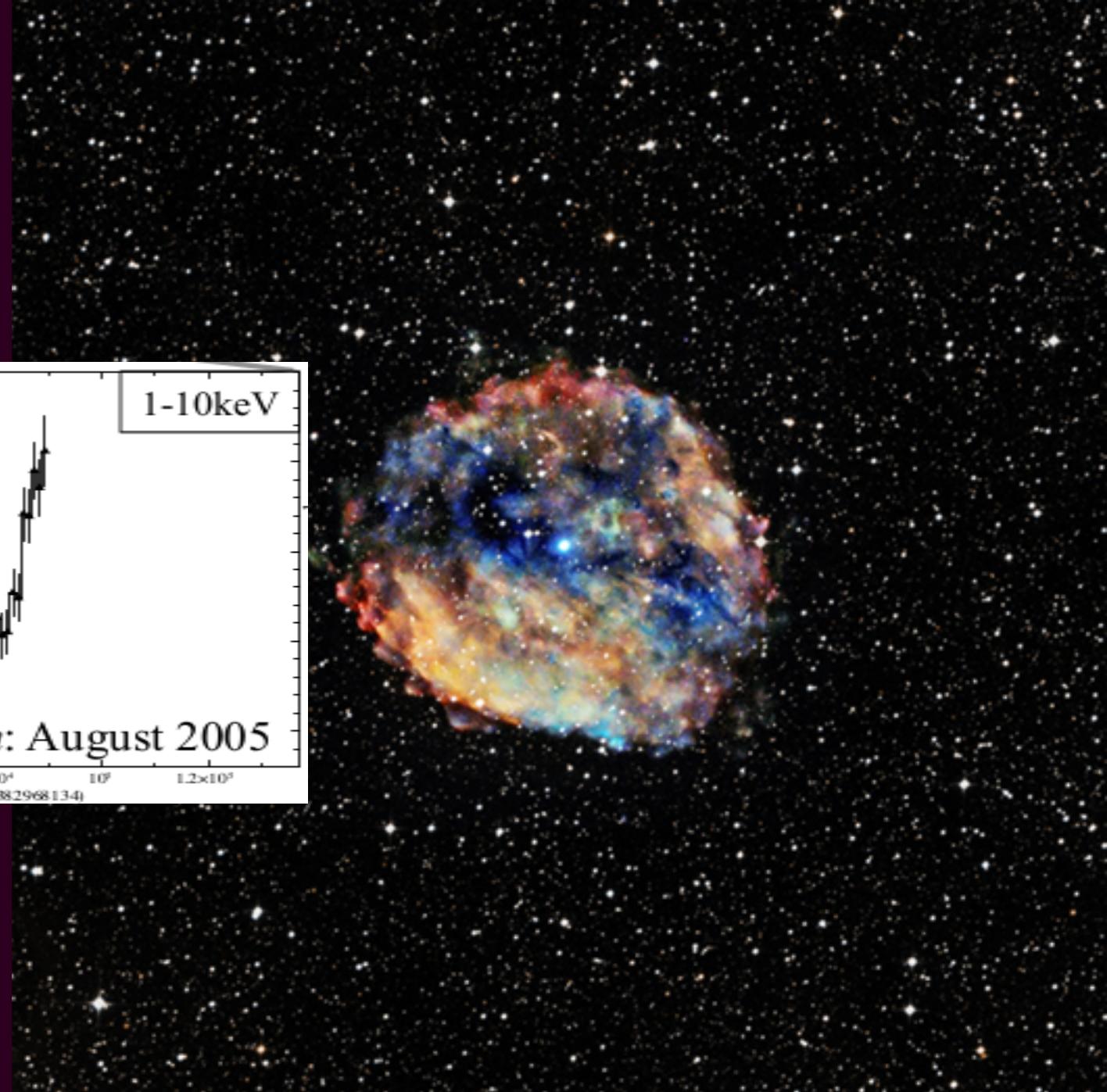
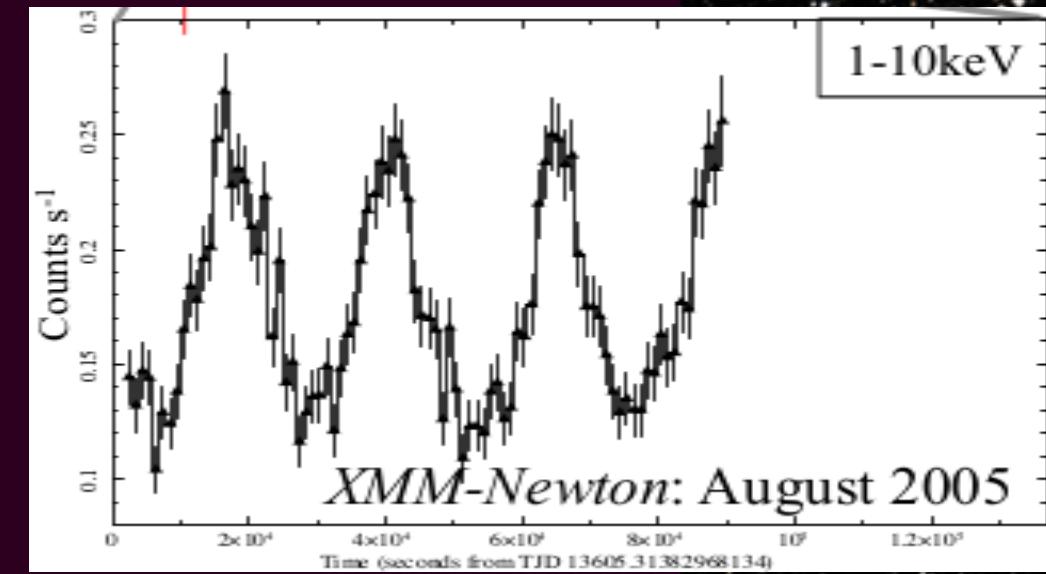




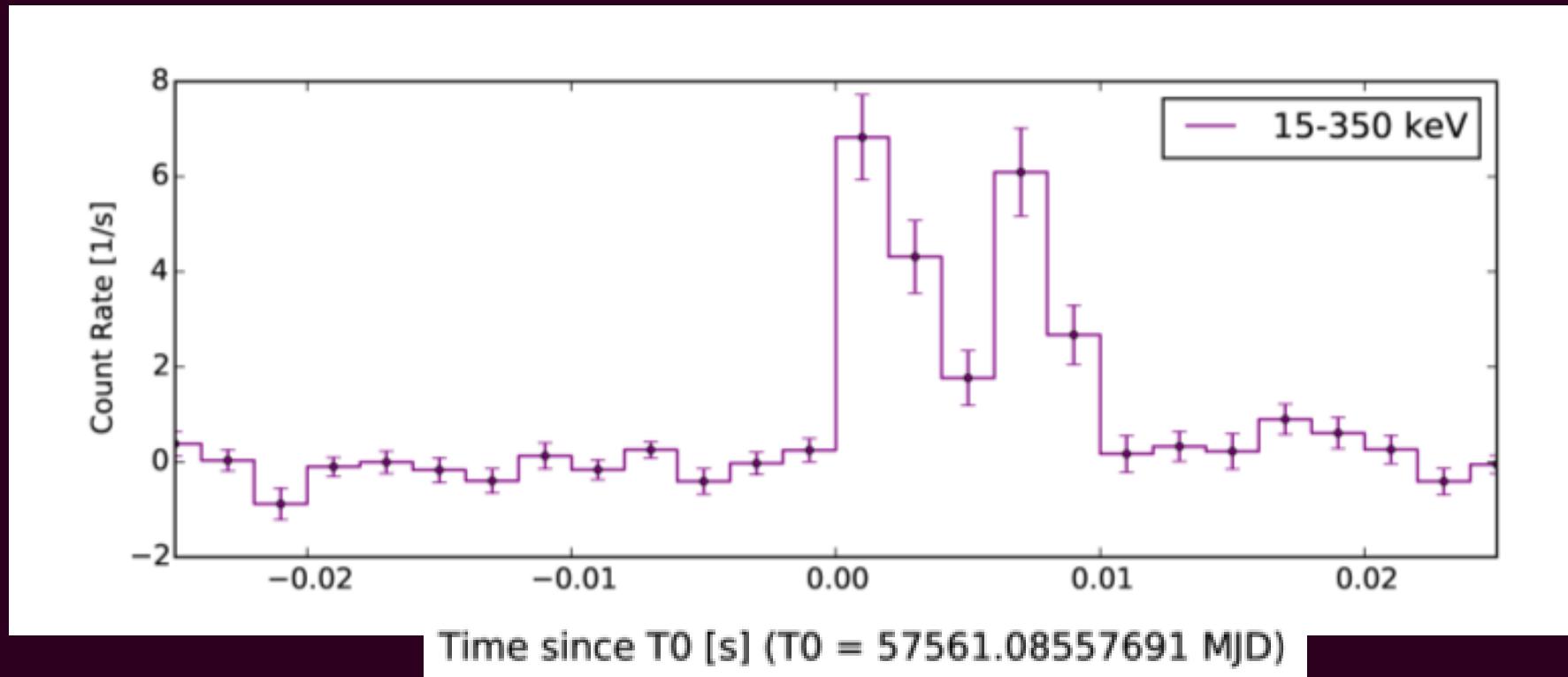
RCW103

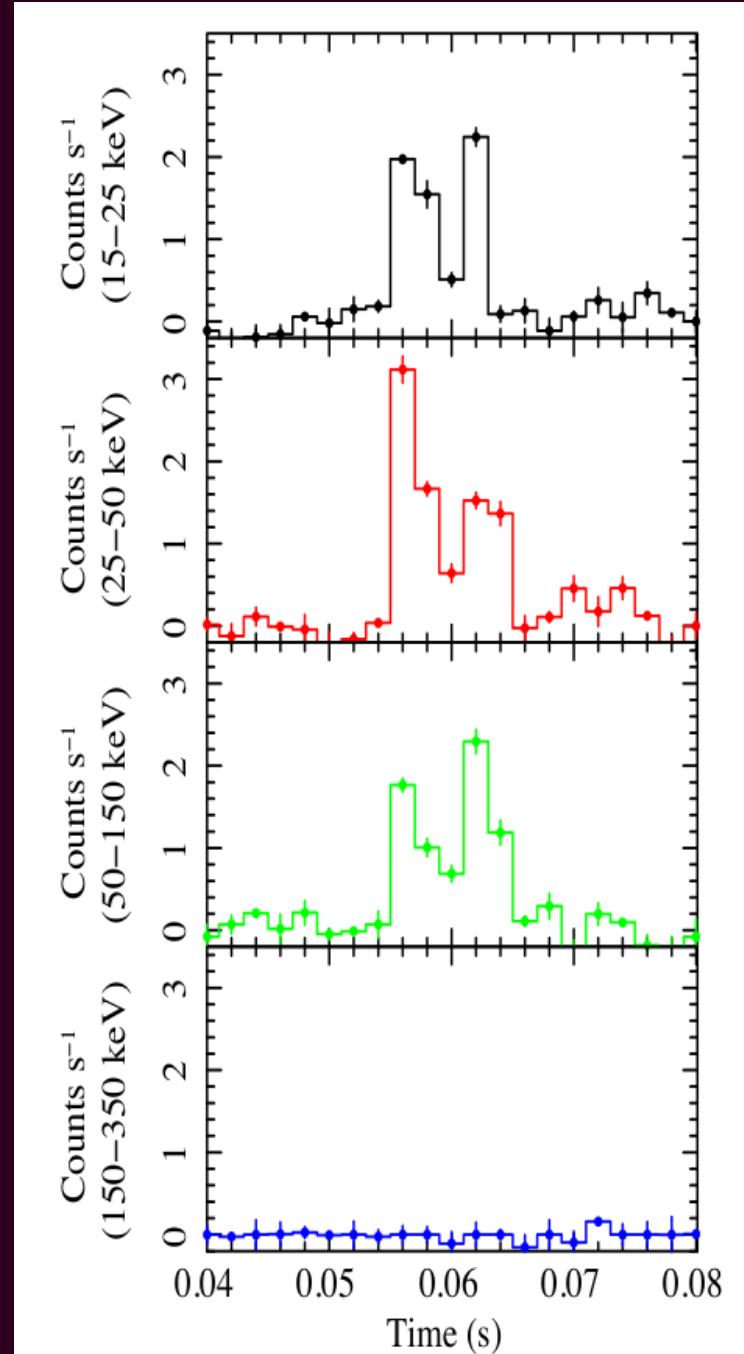


RCW103



So what new evidence would shed light on how to classify this object (1E 1613)?





How is this lightcurve collected? Is there really
a burst here?

Xray Astronomy

Xray Astronomy

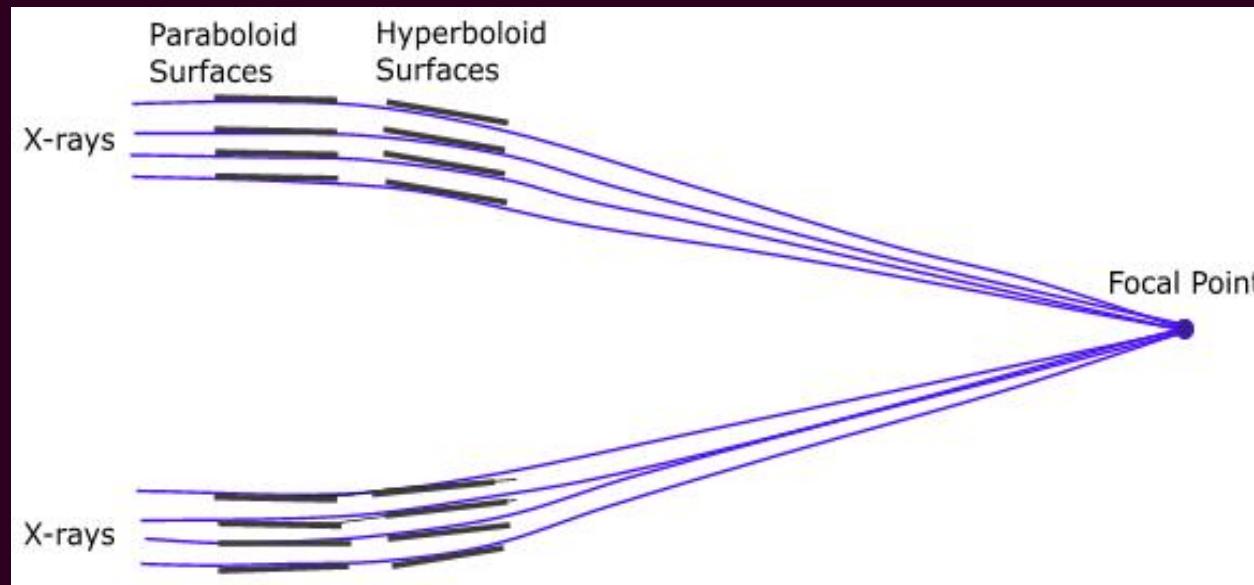
- Opaque to Atmosphere

Xray Astronomy

- Opaque to Atmosphere
- Pass through lenses at normal incidence

Xray Astronomy

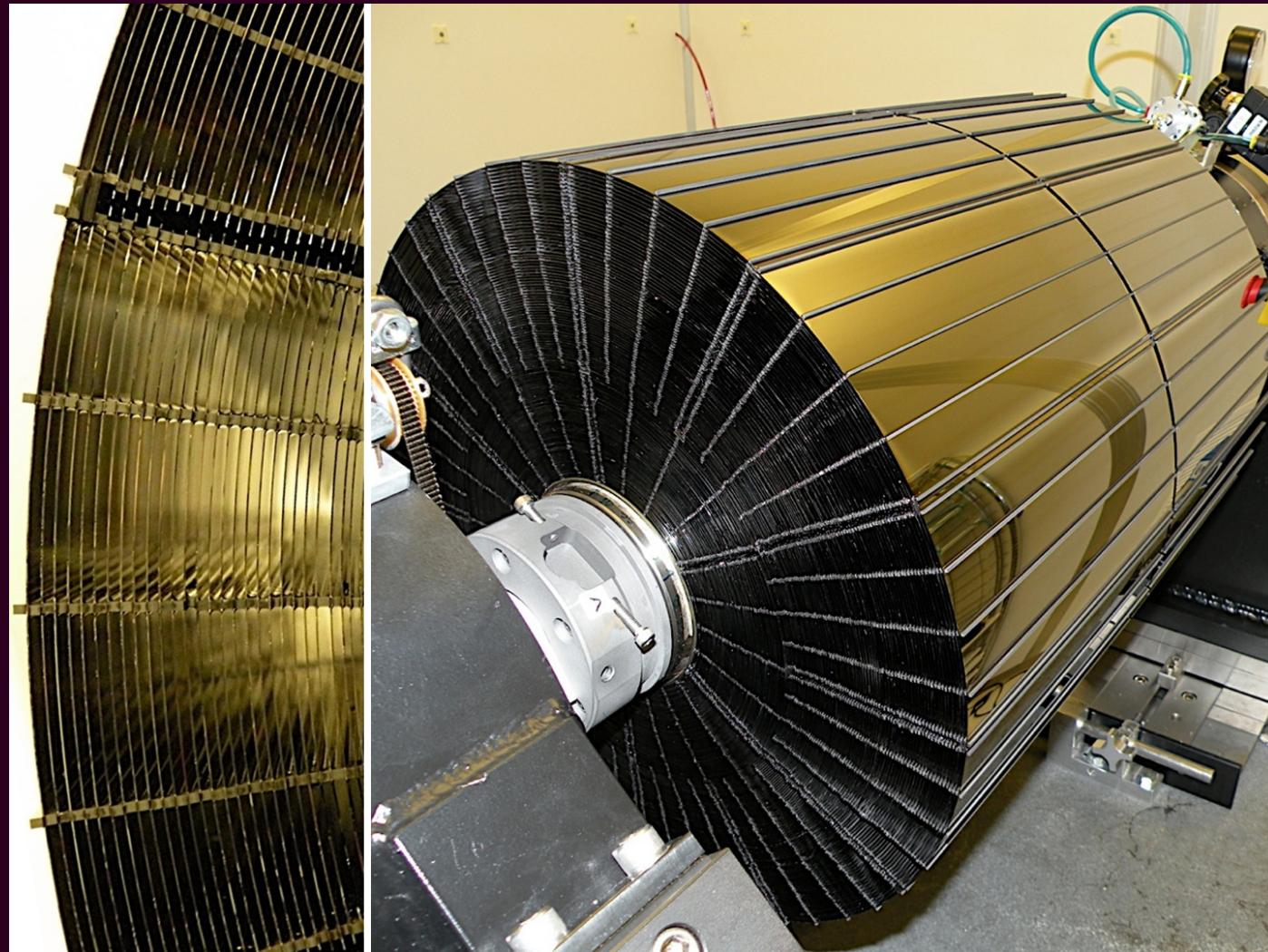
Grazing Incidence Optics



Wolter Type Telescope

Xray Astronomy

NuSTAR

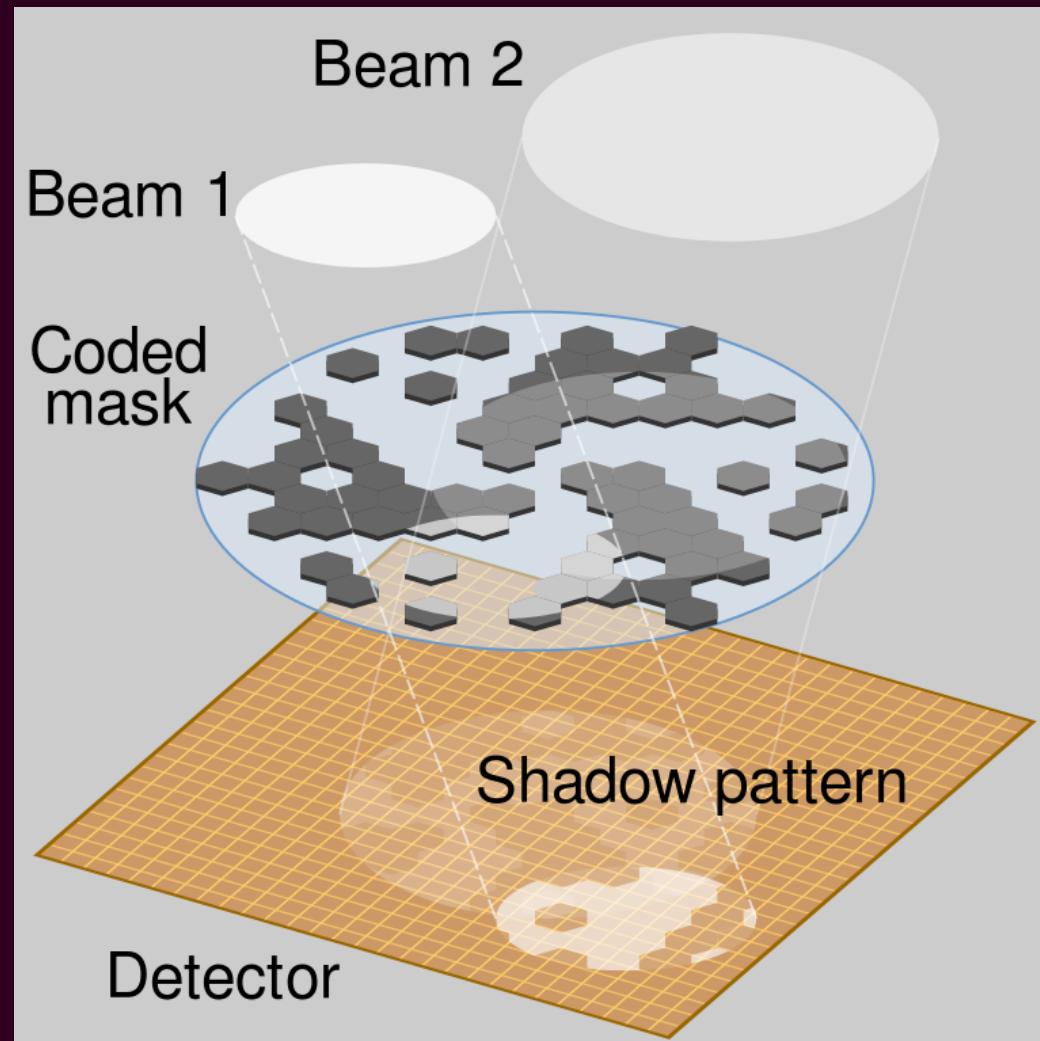


Xray Astronomy

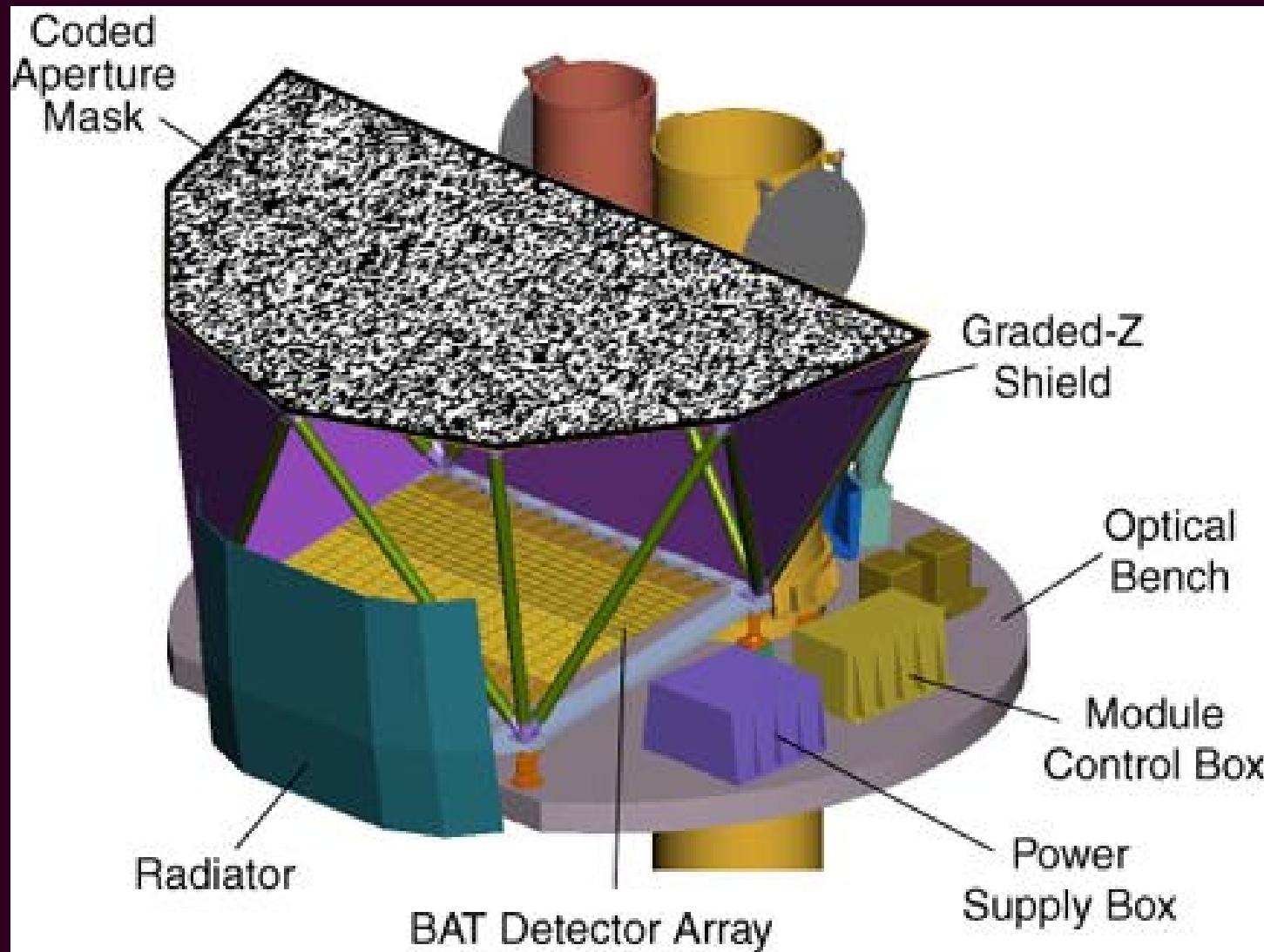
CCDs + Coded Mask Aperture

Xray Astronomy

CCDs + Coded Mask Aperture



Xray Astronomy



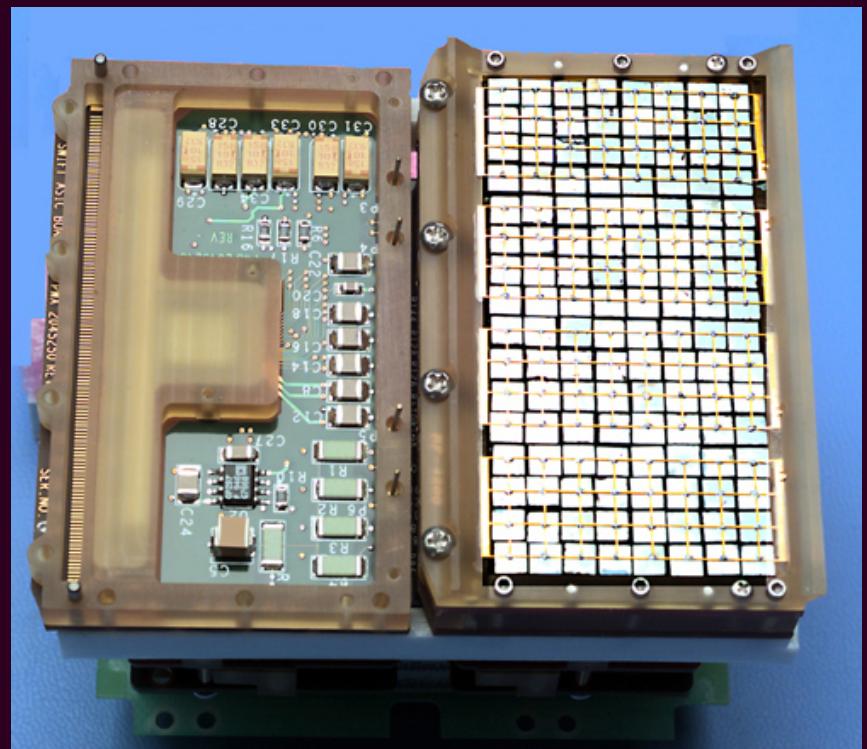
Xray Astronomy



Xray Astronomy



Array of Detectors (1 of many)

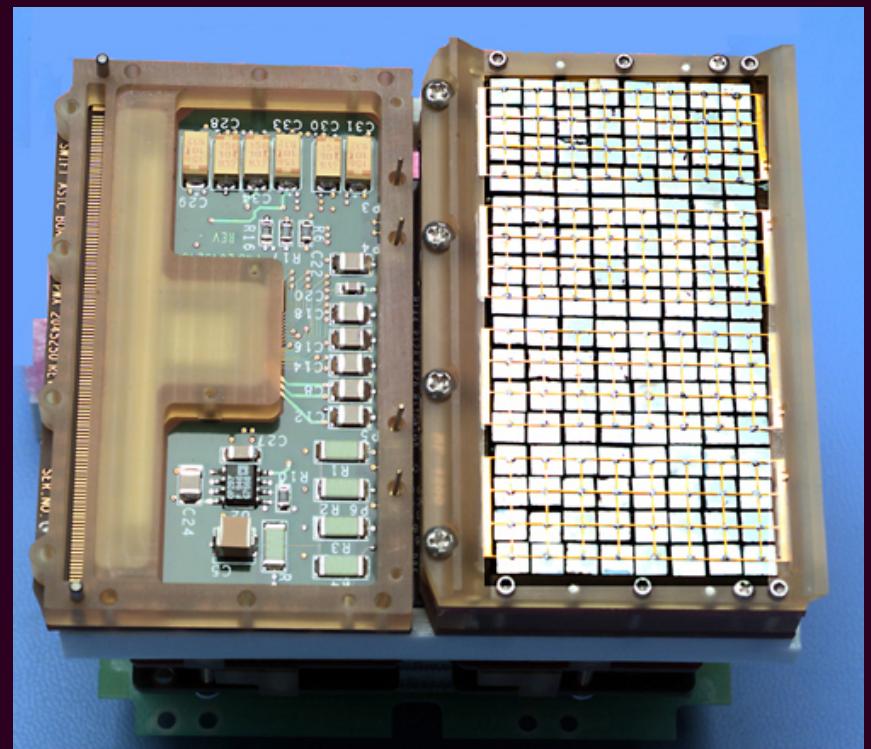


Xray Astronomy



$2^{15} = 32,768$ Detectors

Array of Detectors (1 of many)



We now know

Photons pass through a mask aperture and fall on an array of at most 32768 working detectors.

Software does raytracing to find the source.

Astronomy beta

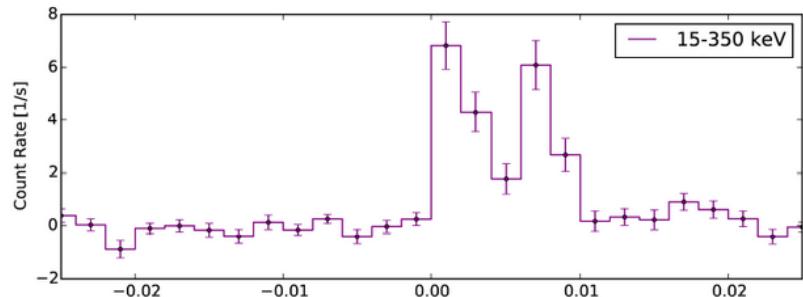
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What does less than one count from an x-ray detector mean? (Swift BAT detector)

I'm reading a paper about a recent x-ray burst from a suspected magnetar (A. Dai et al 2016) where they show a light curve of a burst that lasted about 10ms. (Their figure 1). The value of count rate for the peak of the burst from the graph is 6 counts/s over a timespan of less than 0.01s. This corresponds to about $6 * 0.01 = 0.06$ counts for that time period. What does this mean? Is it not counts of photons? What is 0.06 photons? Is there a step in the data analysis I'm missing?



1



(Fig. 1 Swift/BAT mask-weighted light curves in different energy bands)

[photometry](#) [photons](#) [x-ray](#)

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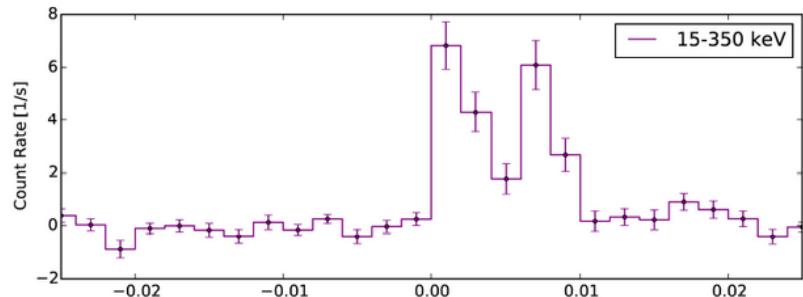
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NAME

batmasktaglc - Compute background subtracted light curves from raw BAT mask tagged counts

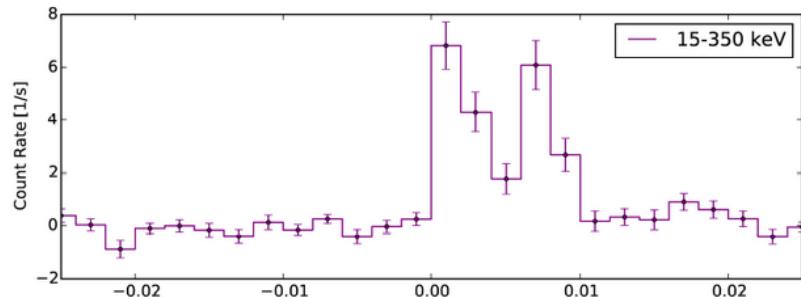
Astronomy beta

Questions Tags Users Badges

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1
▼
★



(Fig. 1 Swift/BAT mask-weighted light curves in different energy bands)

photometry photons x-ray

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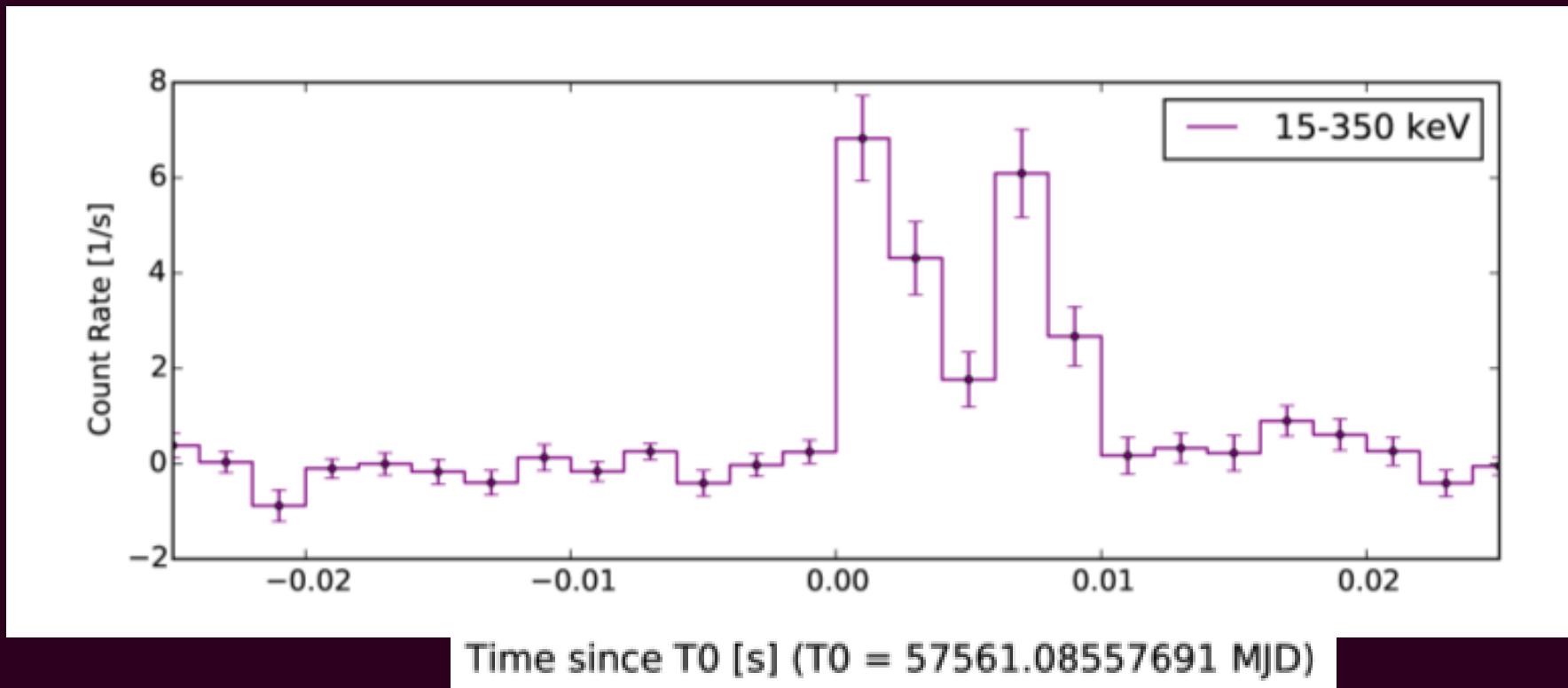
Related

NAME

batmasktaglc - Compute background subtracted light curves from raw BAT mask tagged counts

(detdiv = "YES") [string]

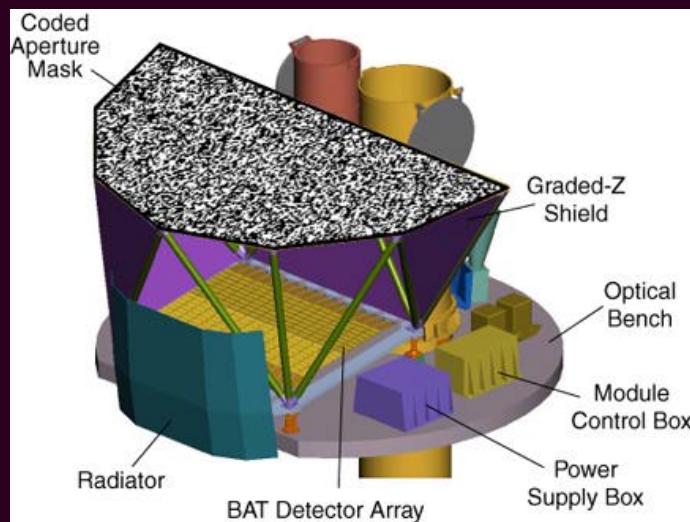
Set to YES if you want the rate to be per detector (detdiv="YES") or for the whole array (detdiv="NO"). The division is only applied if the corrections parameter includes "ndets". Note that if no detector mask is supplied, then the rate will be divided by the total number of detectors (32768).



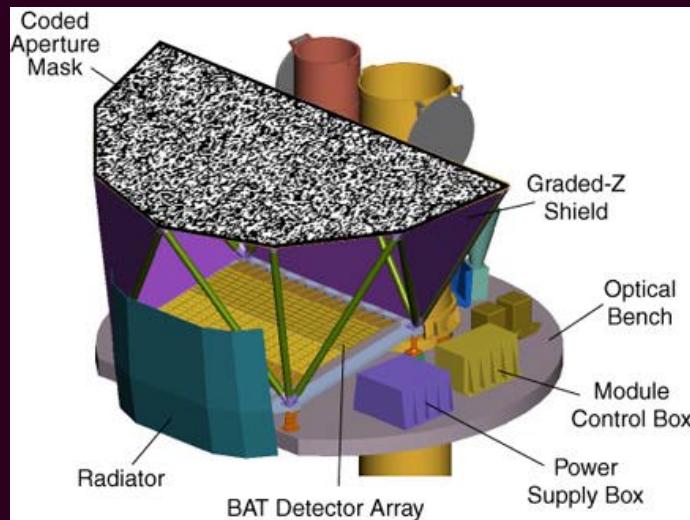
Fine, the data seems real.

What are the rest of the observations?

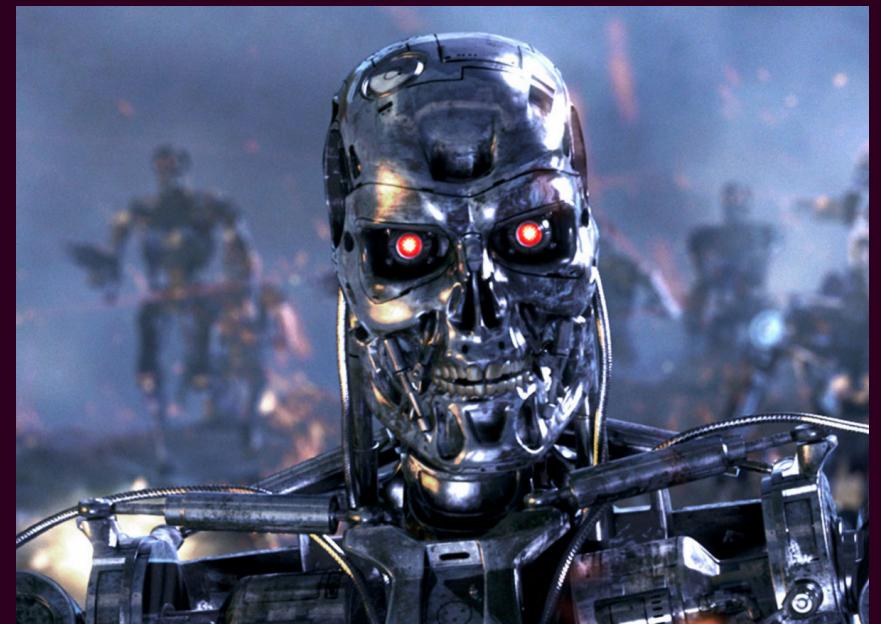
Fine, the data seems real.
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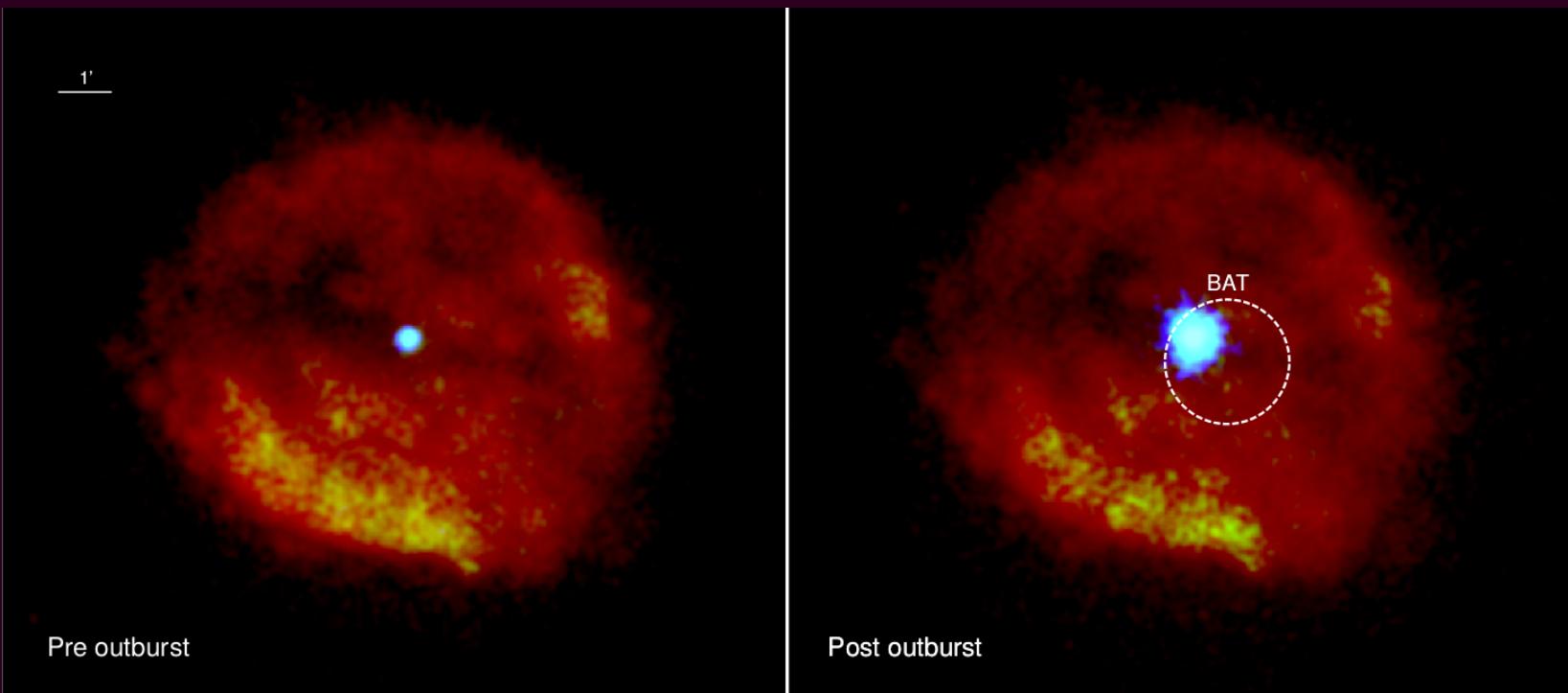


Fine, the data seems real.
What are the rest of the observations?



=





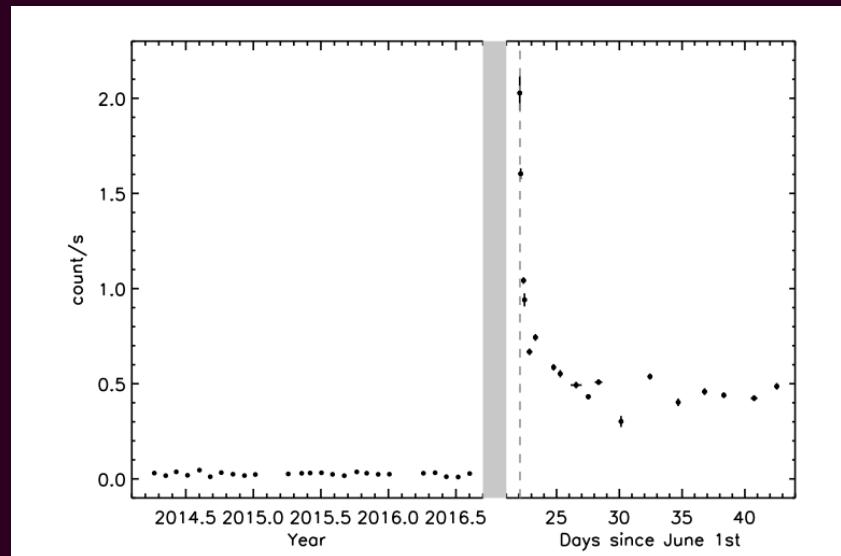
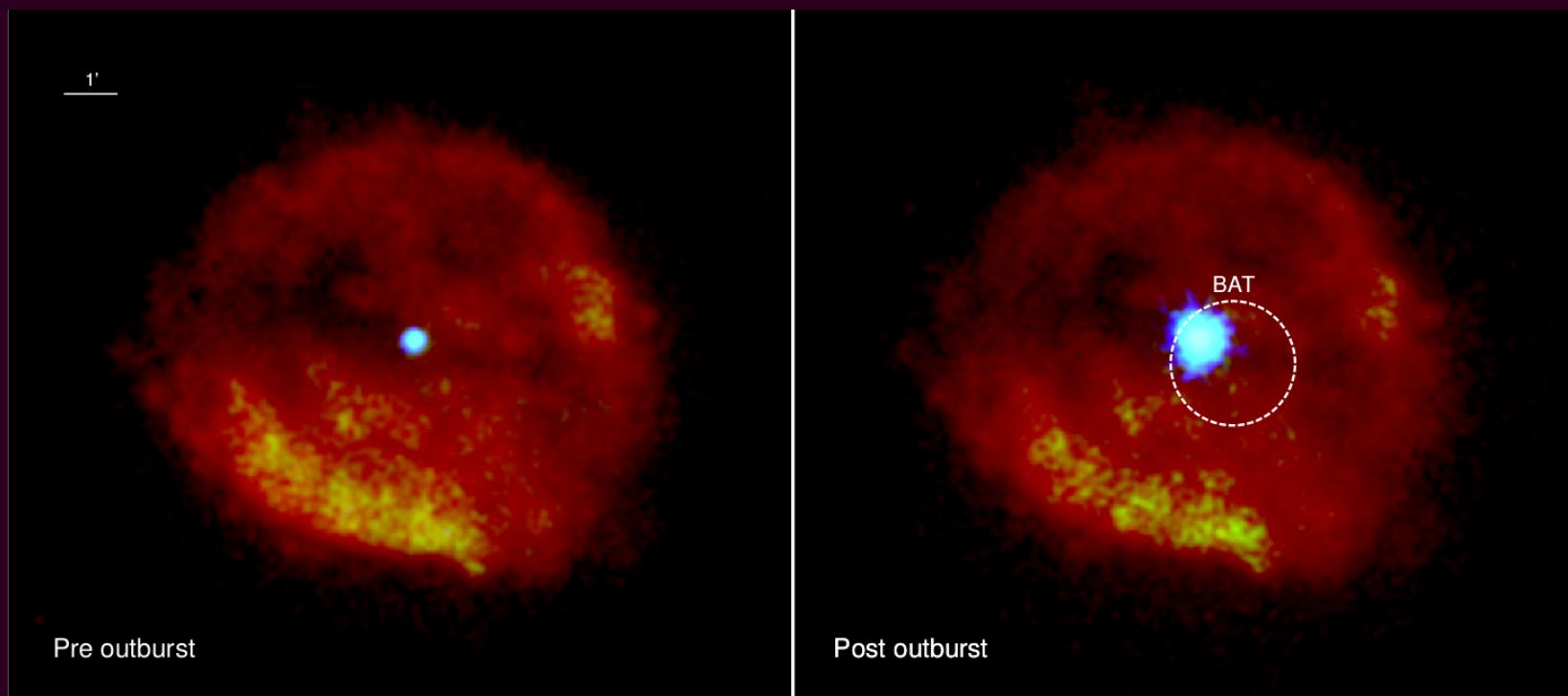
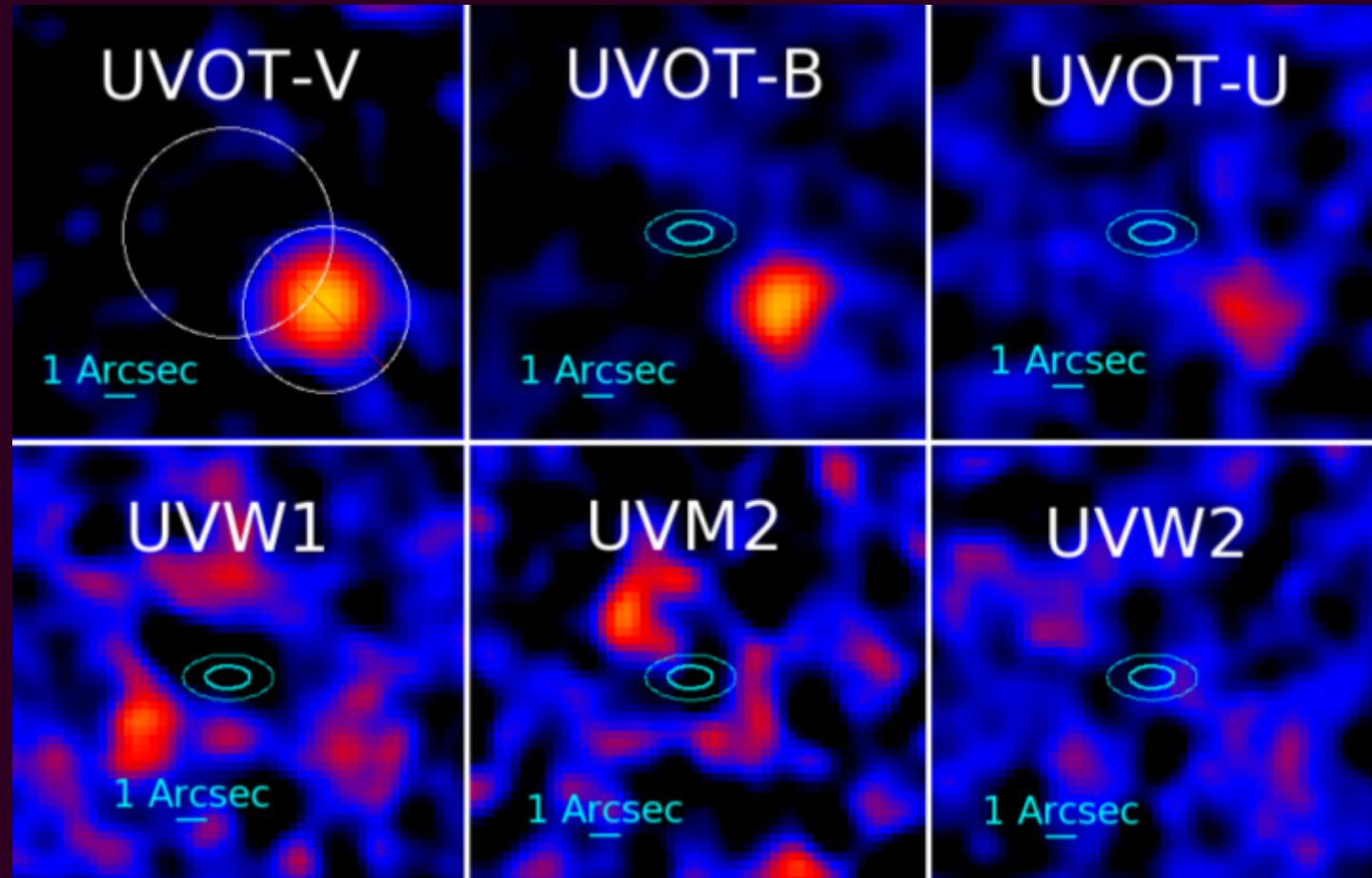
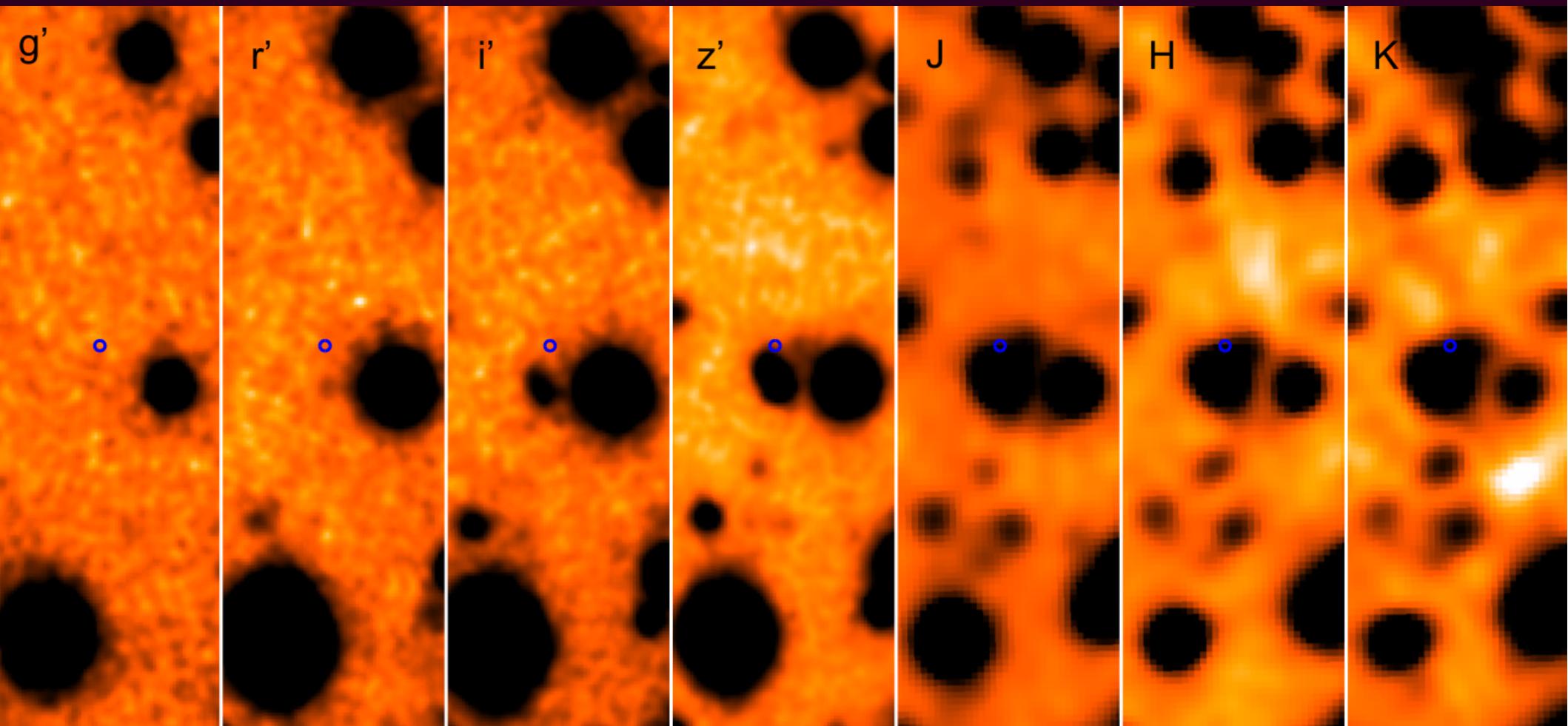


Figure 4. Light curve (2–10 keV range) of the *Swift*/XRT observations performed between 2014 January 15 and 2016 July 12. The grey-shaded line indicates a change in the X-axis scale, the dotted line indicates the time of the BAT burst.



GROND Data (from Earth)



What do we know about Supernovae and their remnants? What kinds of objects can we expect 1E to be?

BOOM SUPERNOVA

BOOM SUPERNOVA



Black Hole

BOOM SUPERNOVA

Black Hole

Neutron Star

BOOM SUPERNOVA

Black Hole

Neutron Star

White Dwarf

Binary System?

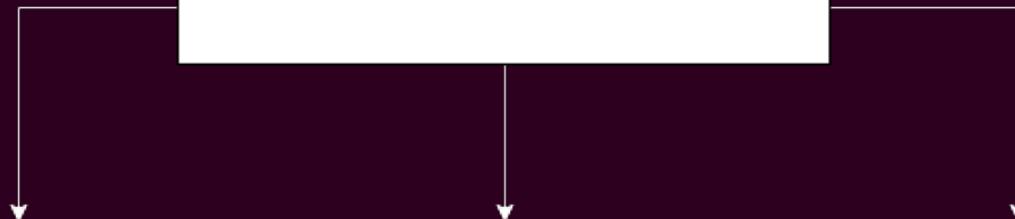


BOOM SUPERNOVA

Black Hole

Neutron Star

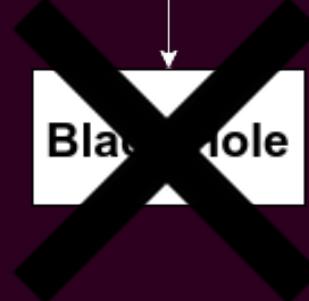
White Dwarf



Binary System?



BOOM SUPERNOVA



Neutron Star

White Dwarf

Binary System?



BOOM SUPERNOVA

Black Hole

Neutron Star

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Binary System?



BOOM SUPERNOVA

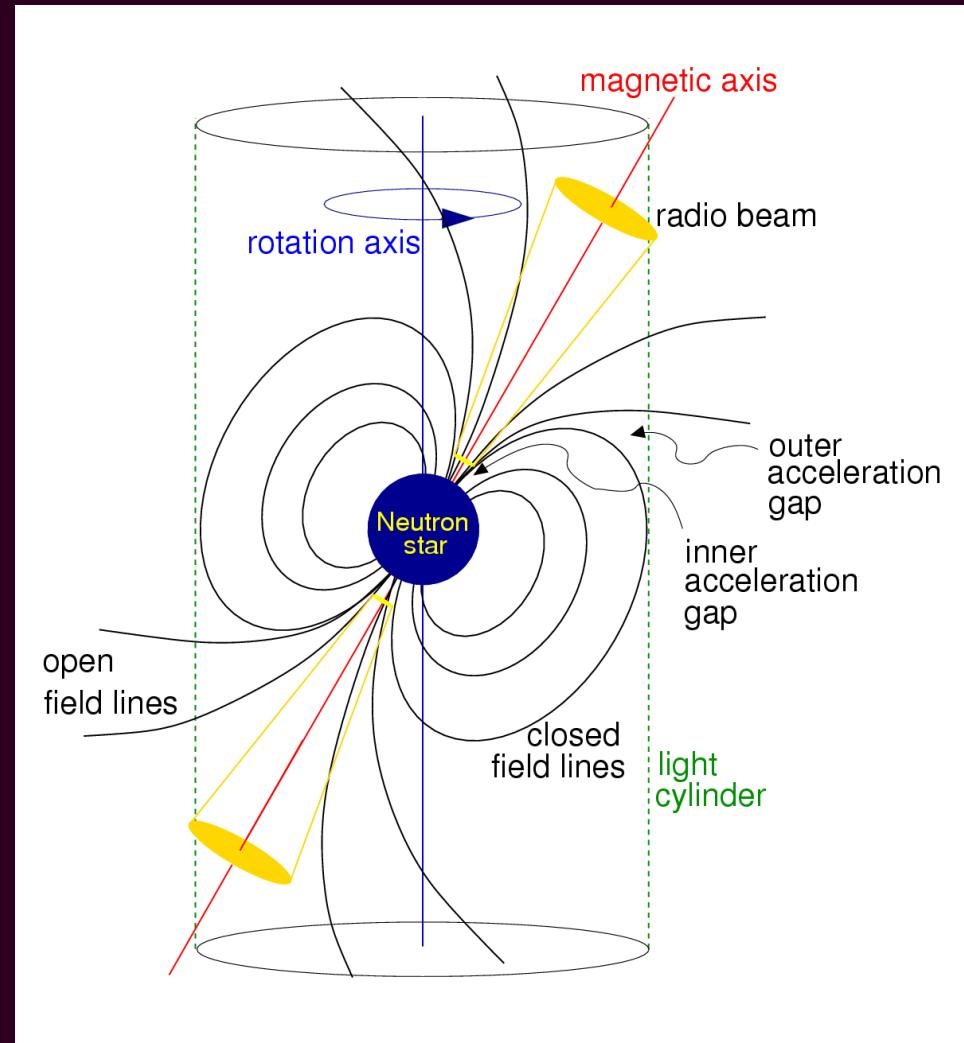
Black Hole

Neutron Star

White Dwarf

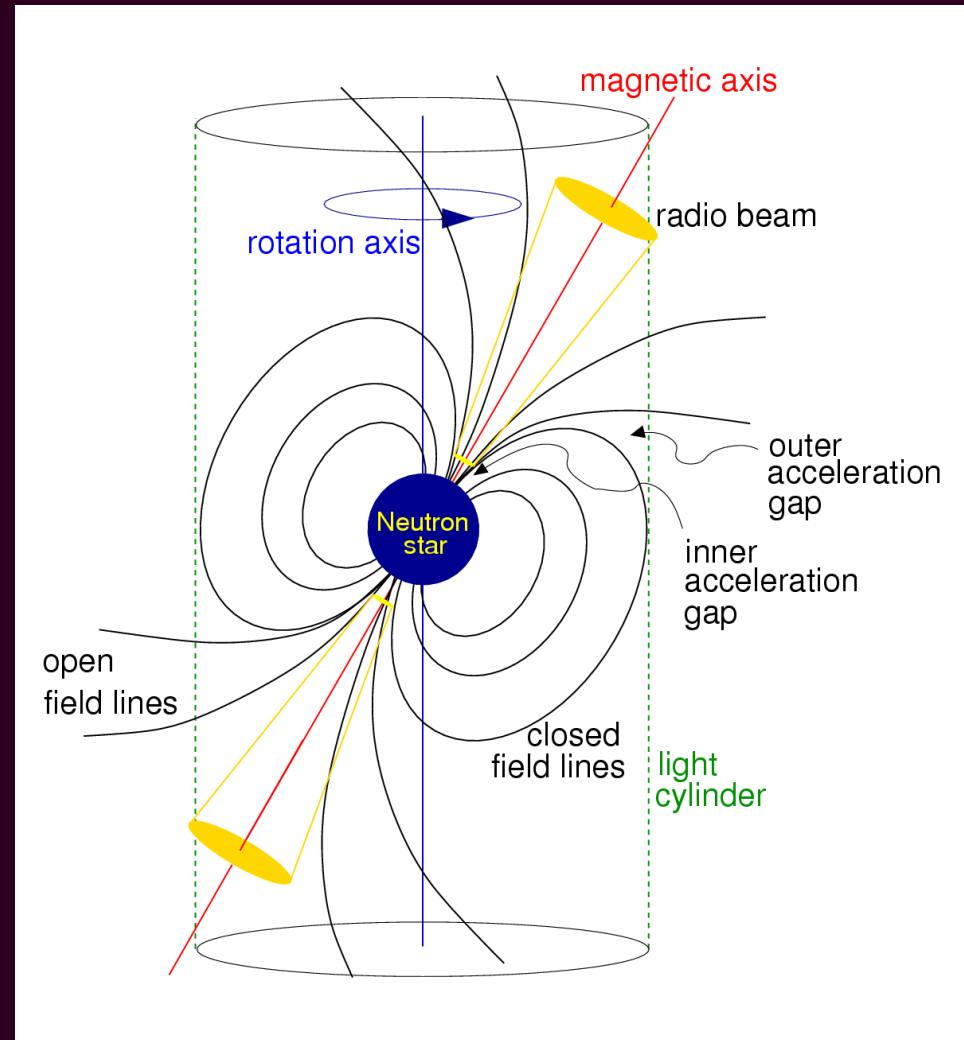
Almost want to rule this out too because of the slow period. Need to look more closely at pulsars.

Pulsars



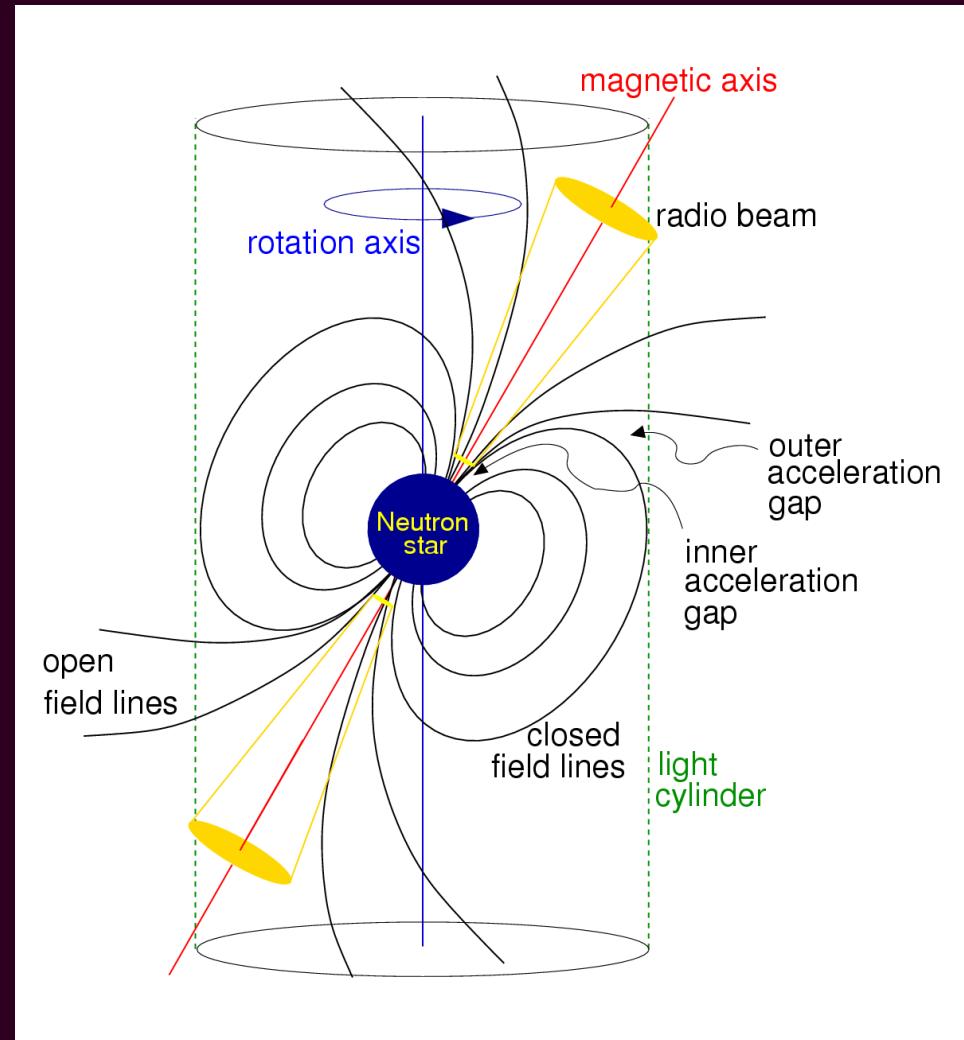
Pulsars

- Known pulsars fall in spin periods between ~ms and 11 minutes

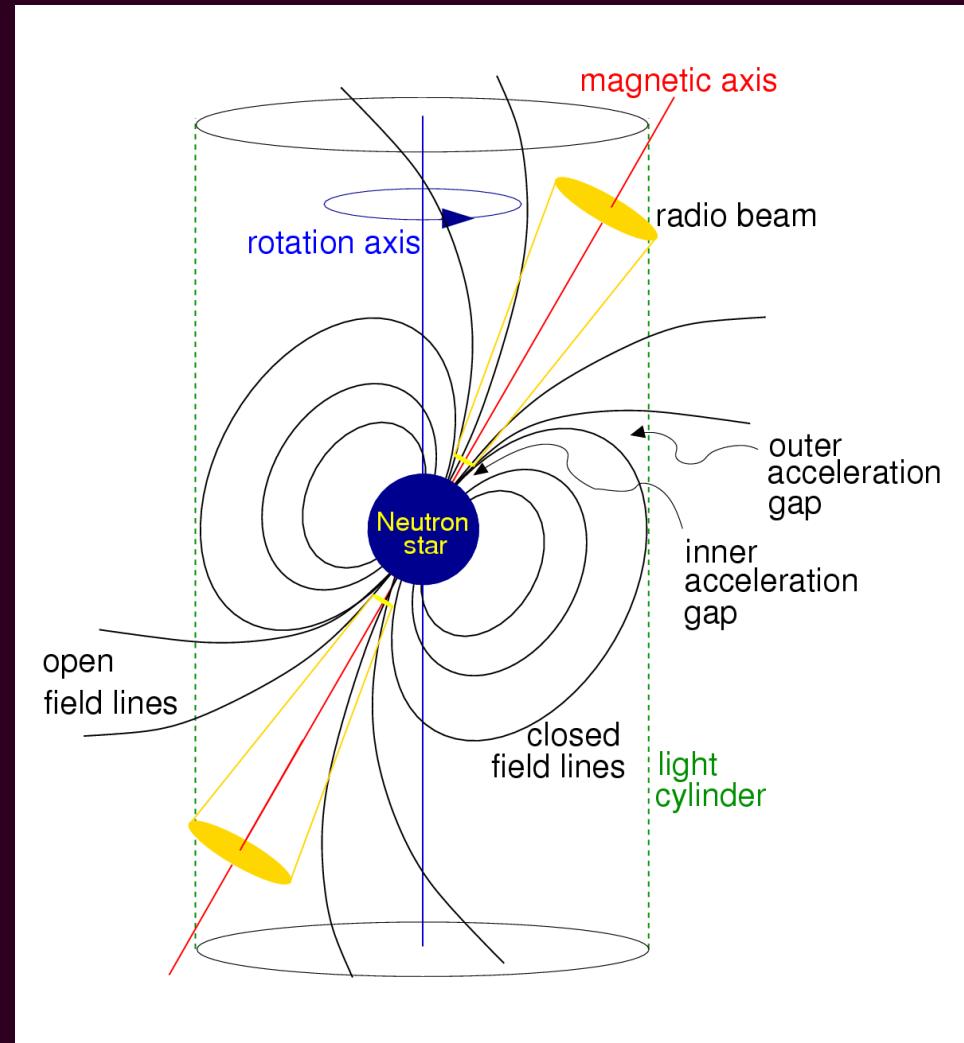


Pulsars

- Known pulsars fall in spin periods between ~ms and 11 minutes
- Our object (1E 1613) would definitely be an outlier

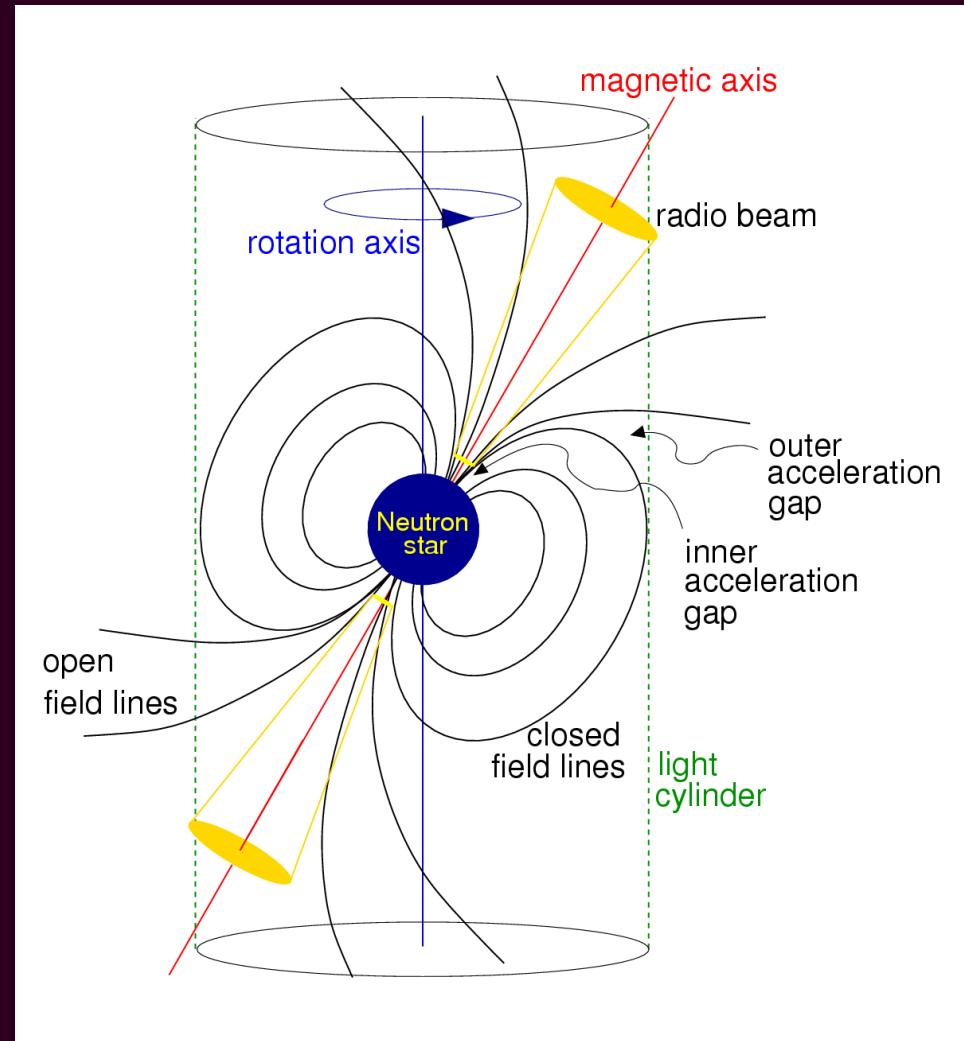


Magnetars = Pulsars + Strong B Field



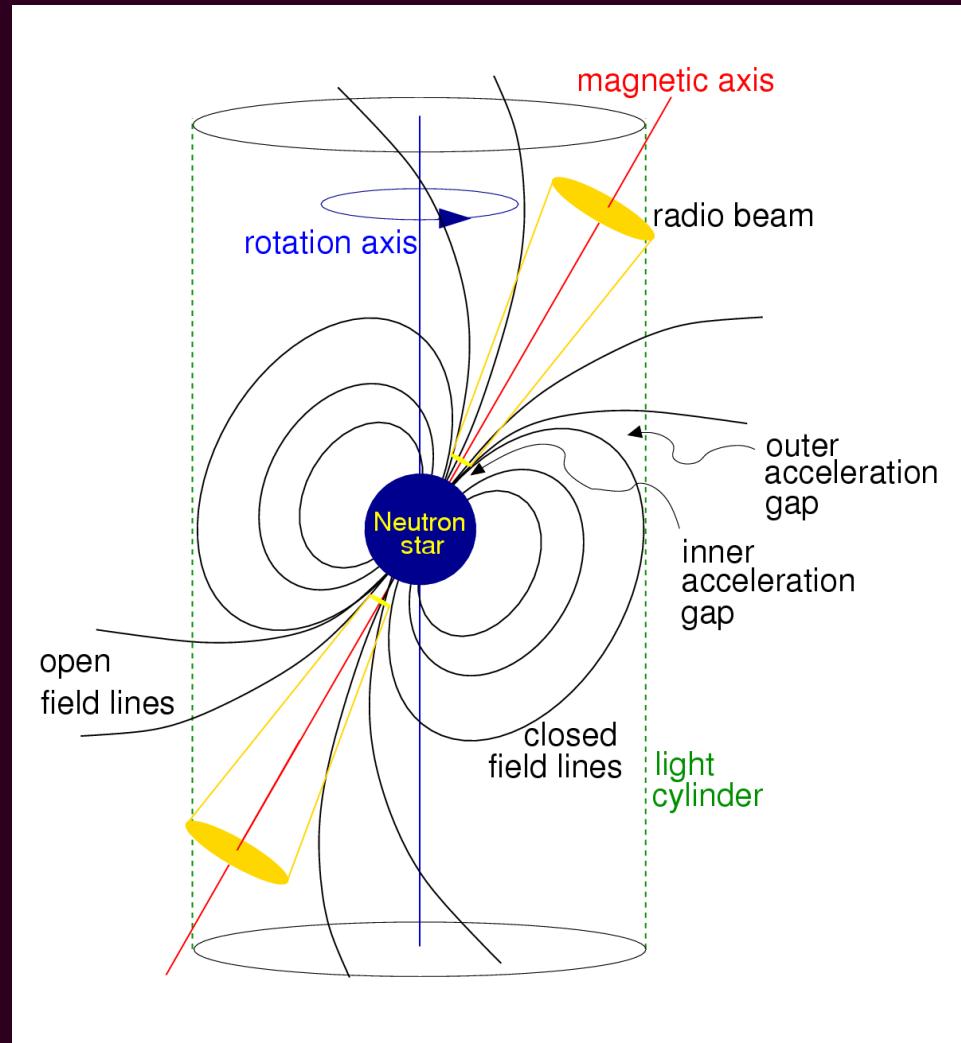
Magnetars = Pulsars + Strong B Field

10^{14} - 10^{15} G



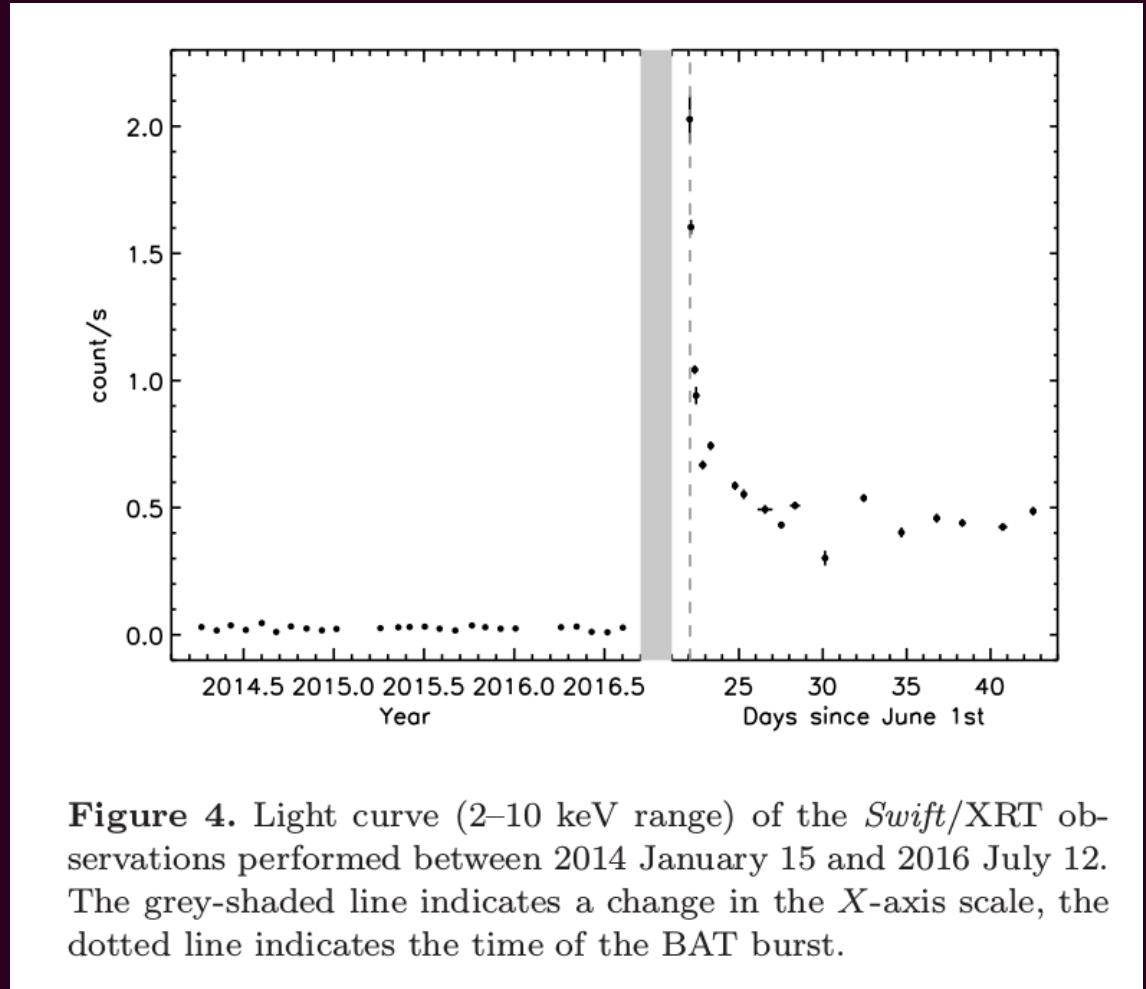
Magnetars = Pulsars + Strong B Field

10^{14} - 10^{15} G > 10^{12} G



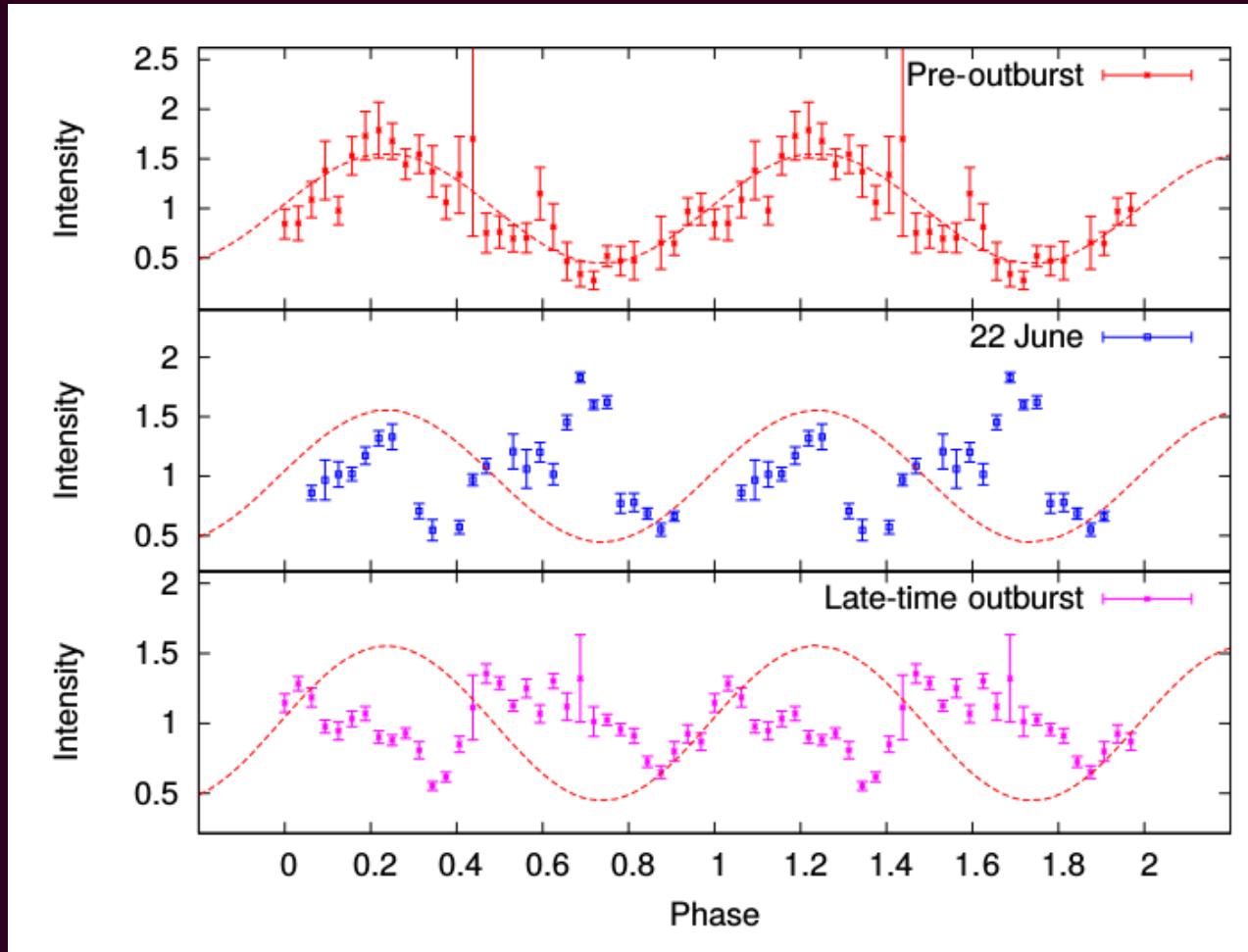
Magnetars = Pulsars + Strong B Field

$10^{14}\text{-}10^{15}\text{ G} > 10^{12}\text{ G}$

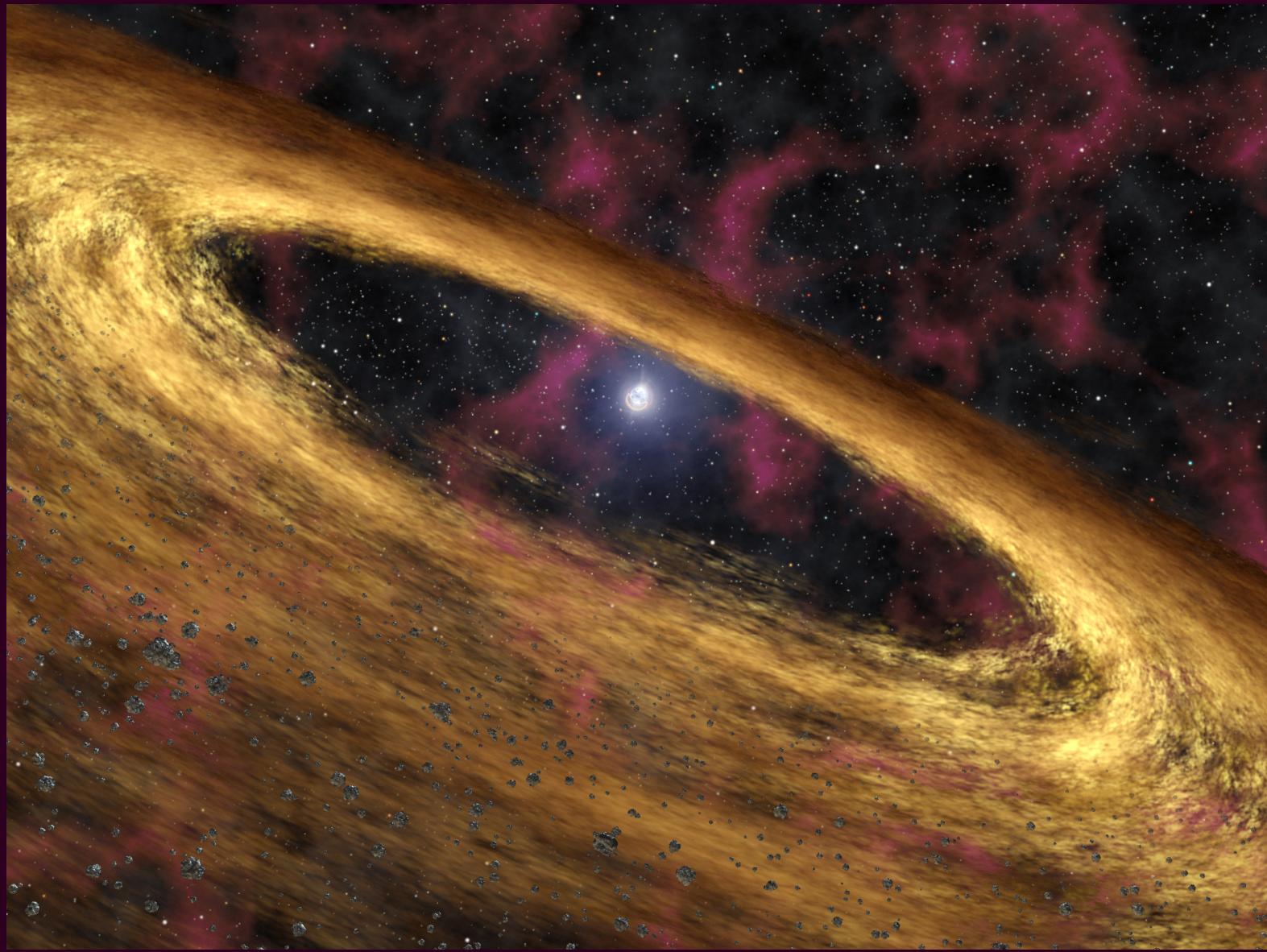


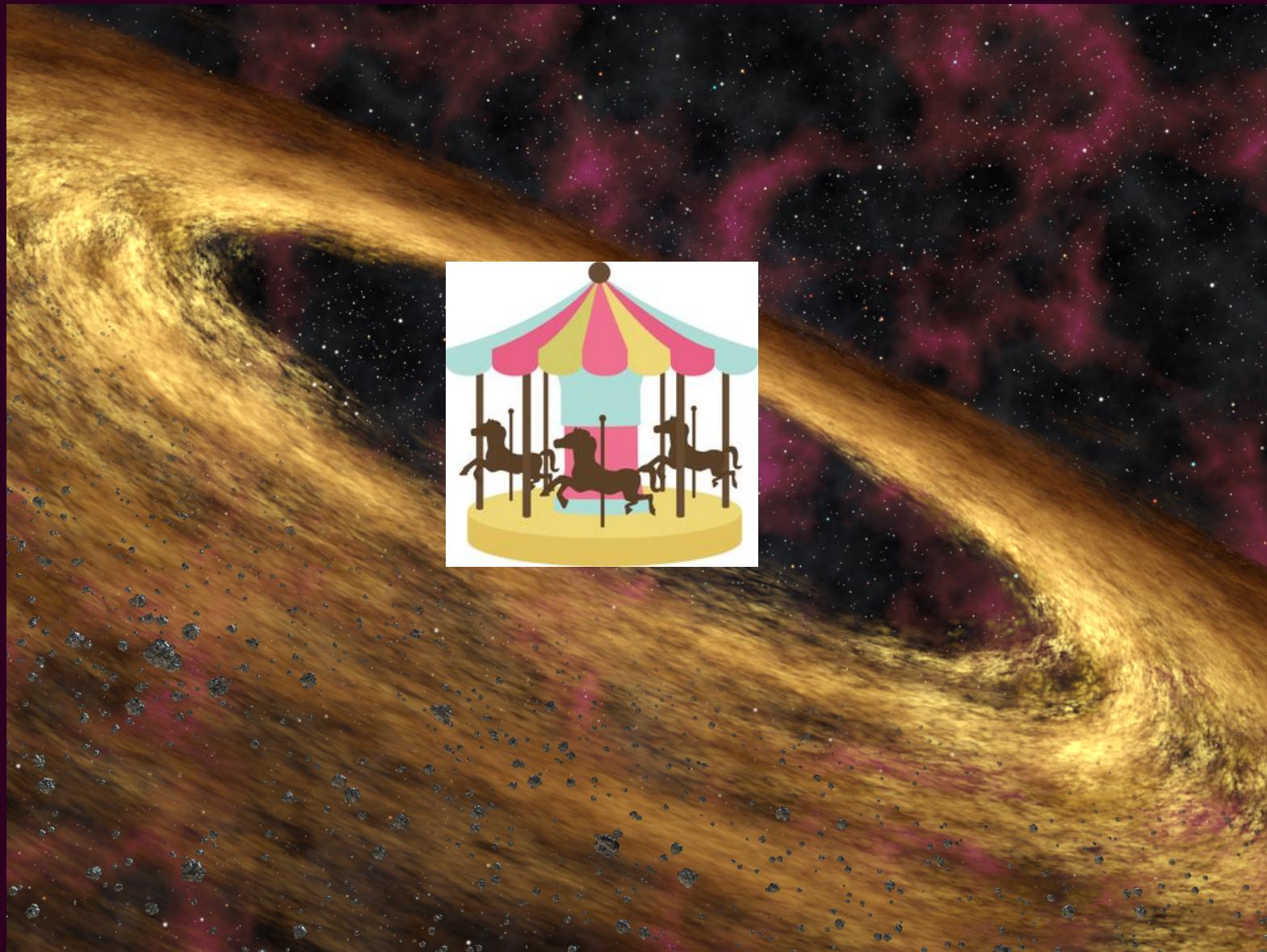
What about a binary?

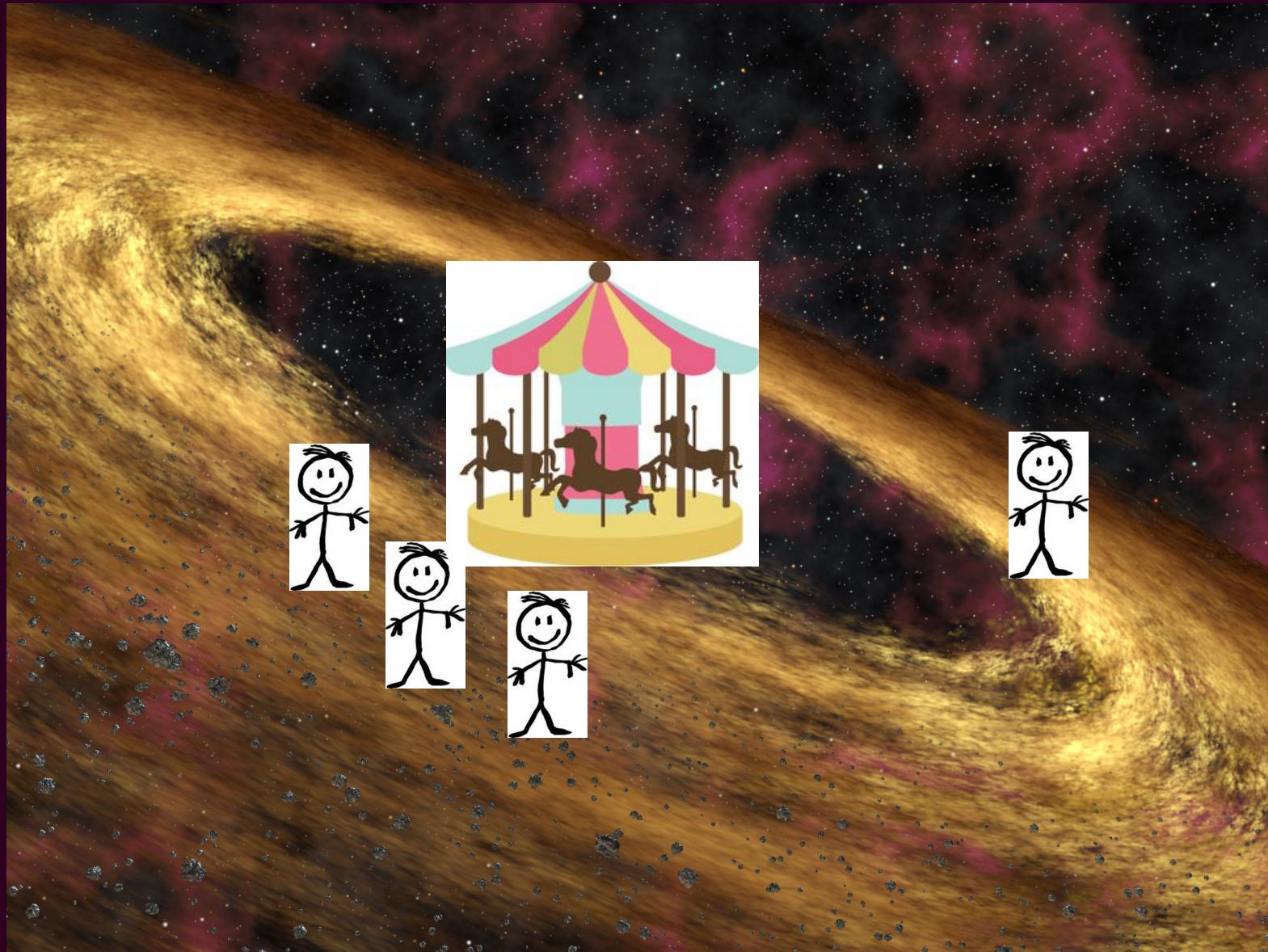
What about a binary? Nope

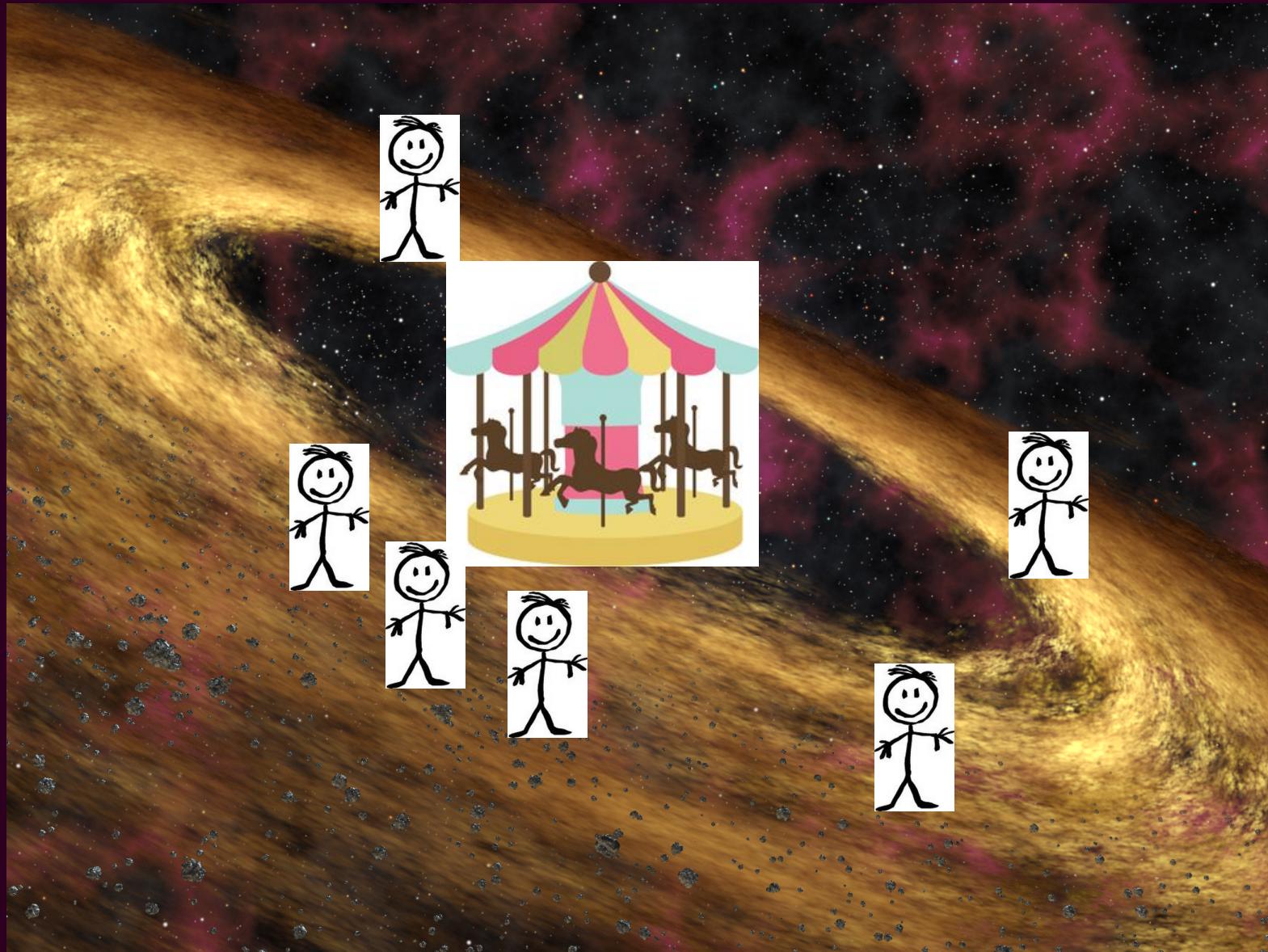


If we for a moment totally accept 1E1613 is a magnetar,
what physics explains the dramatic **spin-down** given
that the supernova is **2000 years old?**

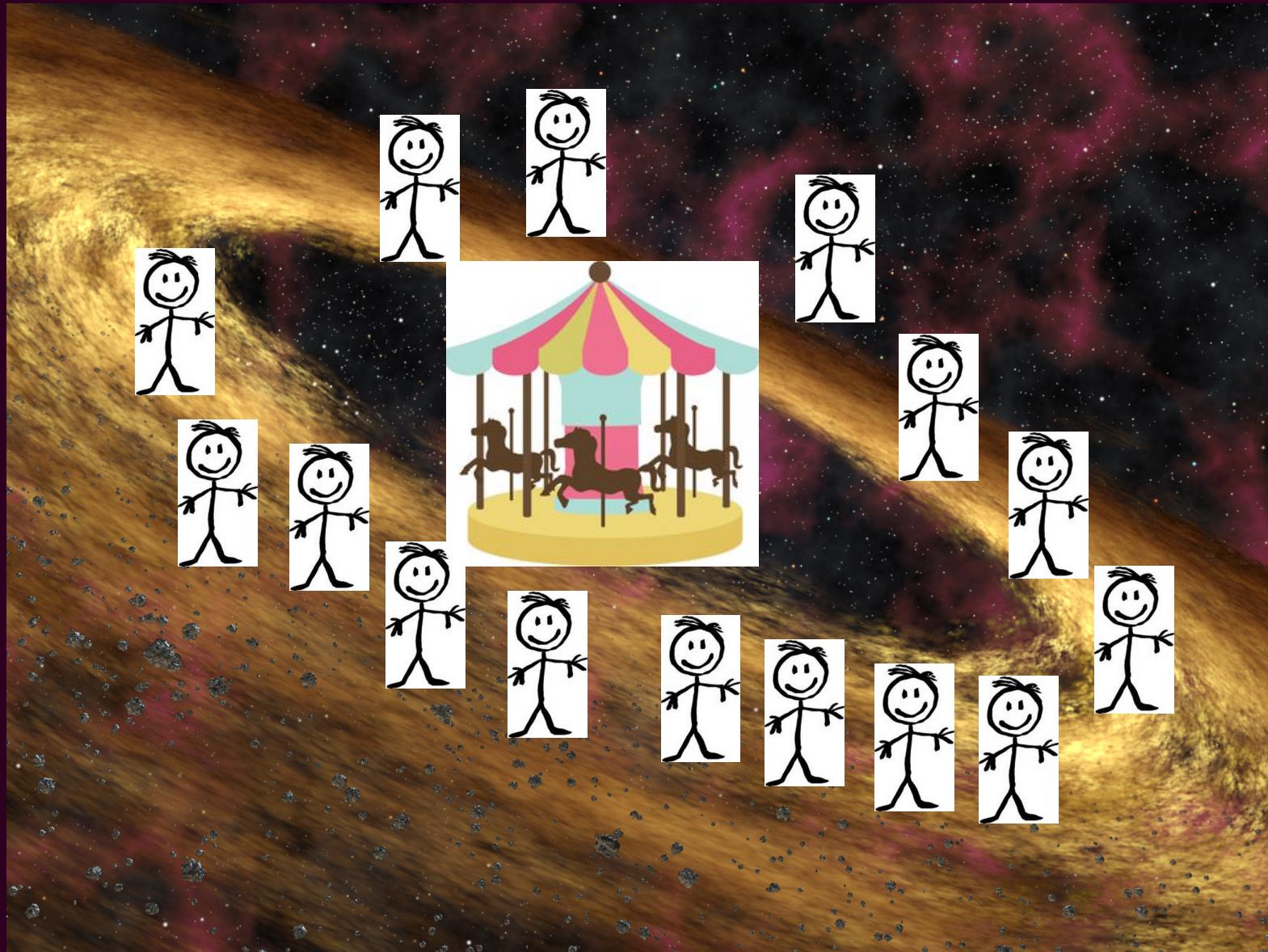














Therefore magnetars with fallback disks will slow down quickly.



Therefore magnetars with fallback disks will slow down quickly.
QED

The End

The End

- The object at the center is weird because of 6.67hr variability in soft xrays

The End

- The object at the center is weird because of 6.67hr variability in soft xrays
- Probably not a binary system since the phase of the variability changed after the burst

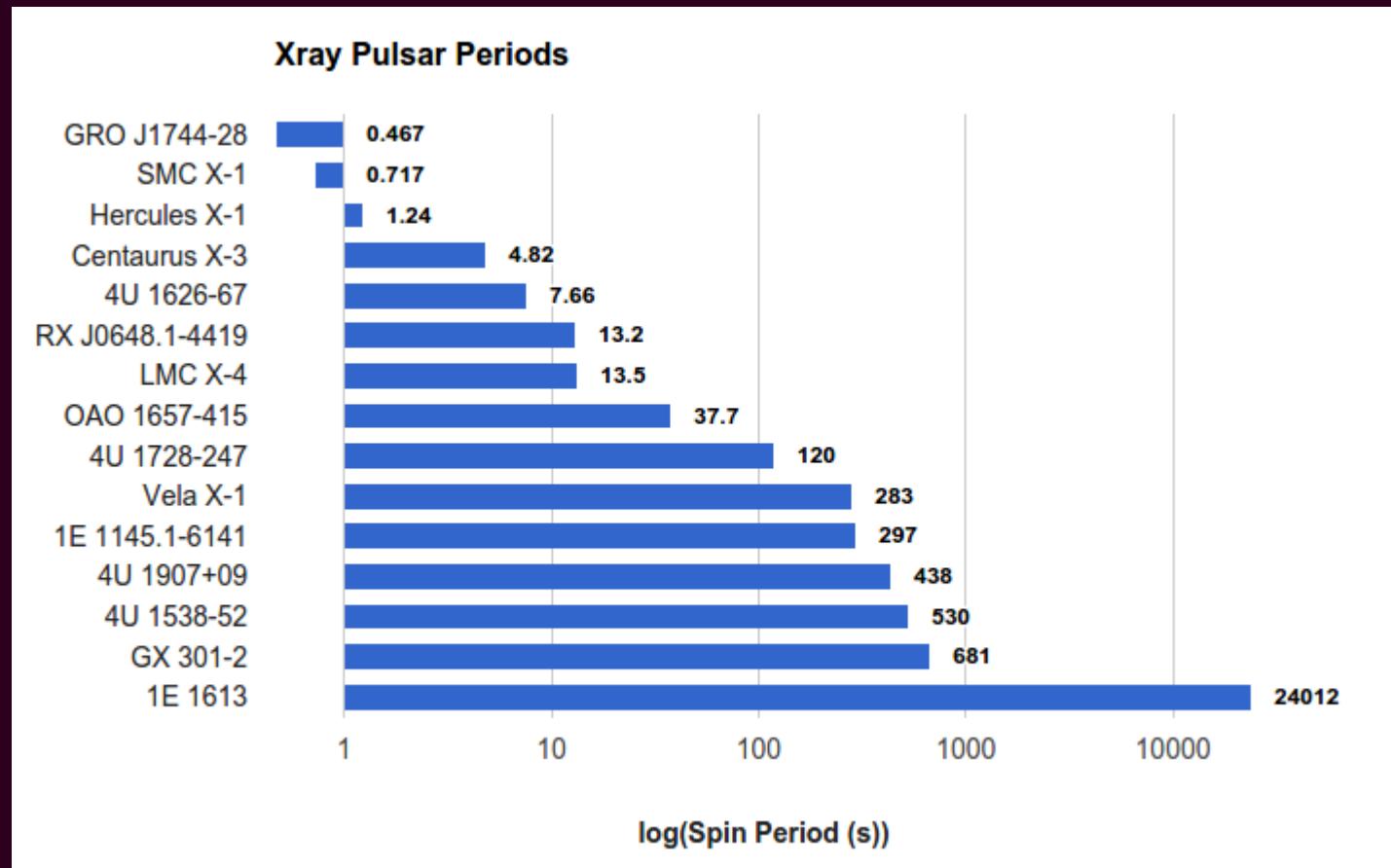
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- Spectrum and Post-burst behaviour fits with magnetar theory

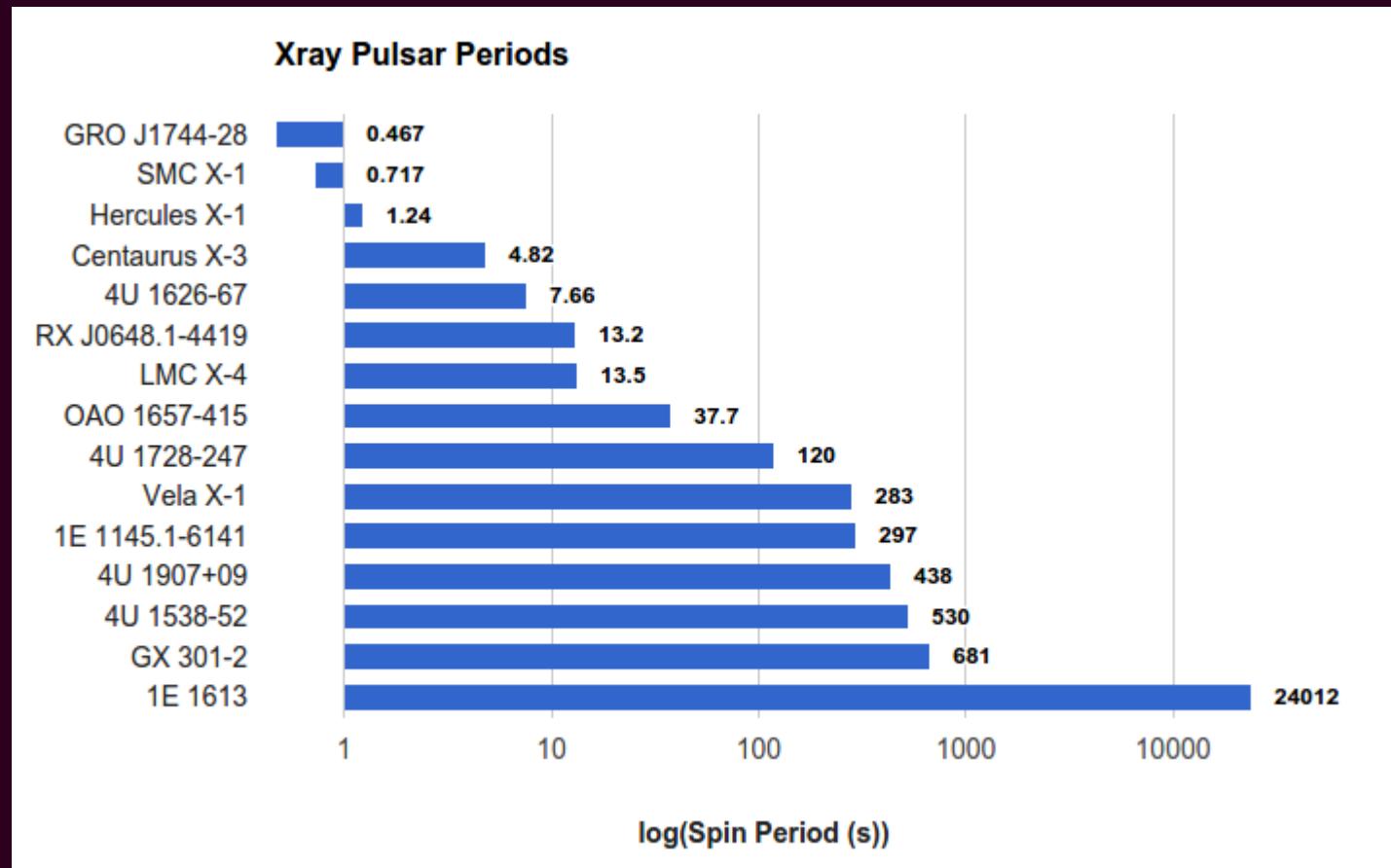
The End

- The object at the center is weird because of 6.67hr variability in soft xrays
- Probably not a binary system since the phase of the variability changed after the burst
- Spectrum and Post-burst behaviour fits with magnetar theory
- Slowed down because of presence of a fallback disk.

Probably the Slowest Pulsar Ever



Probably the Slowest Pulsar Ever



Thanks!

The End

- The object at the center is weird because of 6.67hr variability in soft xrays
- Probably not a binary system since the phase of the variability changed after the burst
- Seems to fit with magnetar theory
- Slowed down because of presence of a fallback disk.