

# **X-ray Vision: A Different View of the Universe**

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## Our Place in The Universe

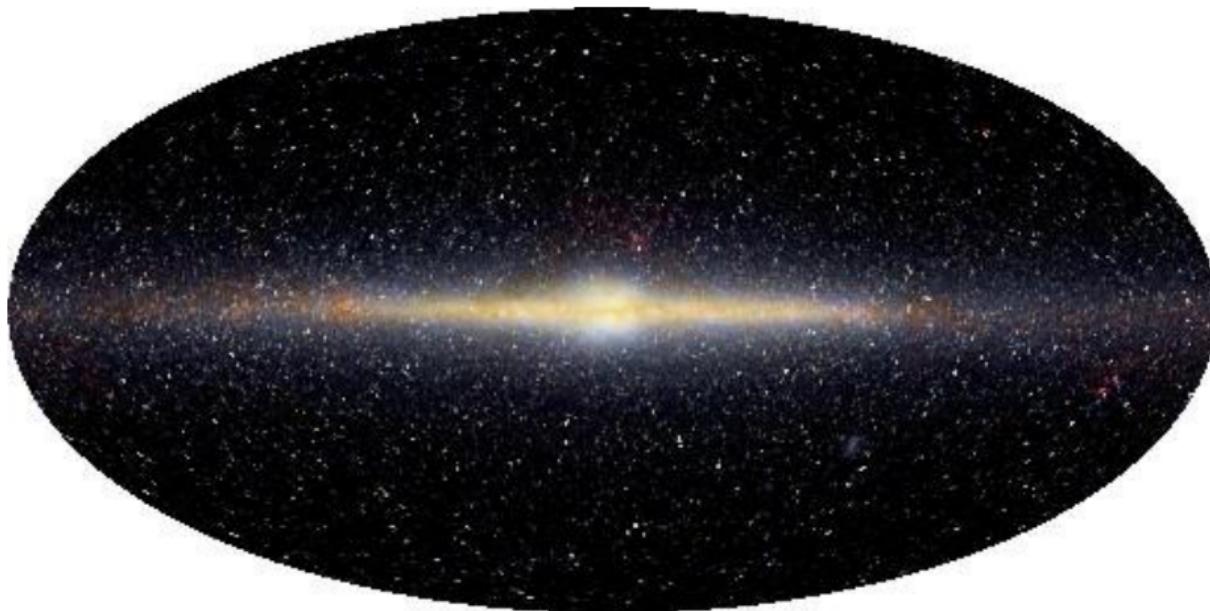
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Where Earth is located in the Milky Way Galaxy.

## Our View of The Universe

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View of the Galaxy using the Galactic Coordinate System.

## What if we could see X-rays?

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- Steady X-Ray Stars
- X-Ray Bursters
- X-Ray Pulsars
- Soft Gamma Repeaters

## Neutron Stars

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### Formation

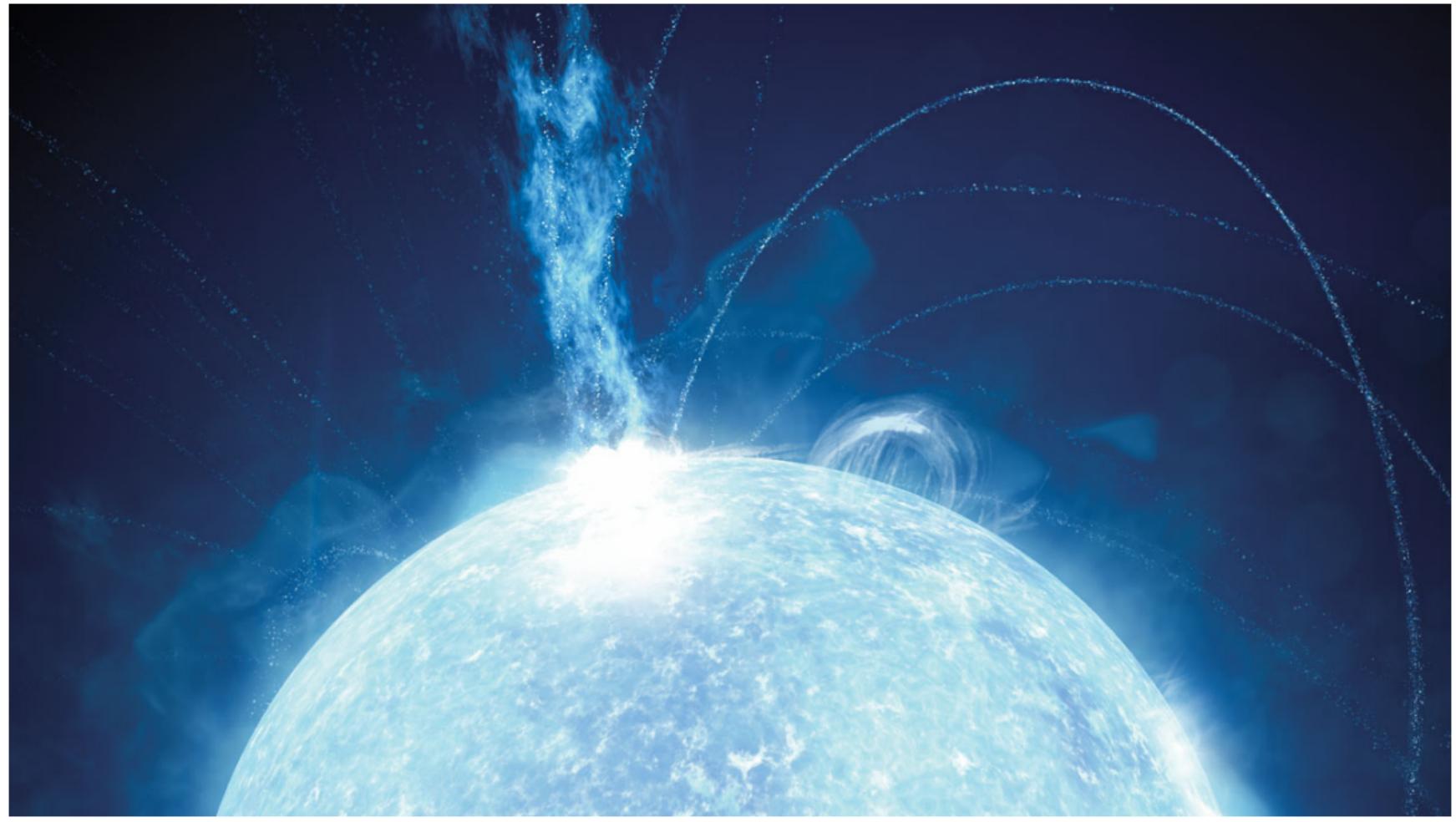
Are formed through a supernova, when a giant star collapses in on itself. They are about 12 miles in diameter.

### Magnatars

- Magnetic field of  $10^{13}$  -  $10^{15}$  gauss.
- Rotational period is about 2 - 10 seconds.

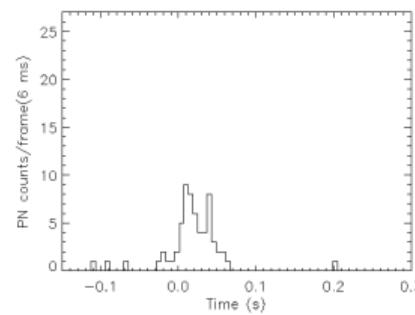
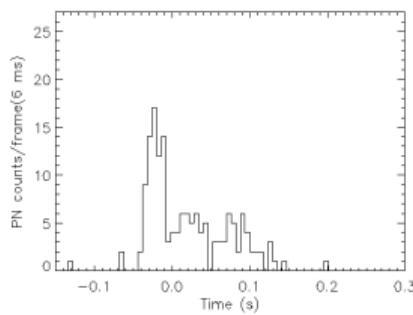
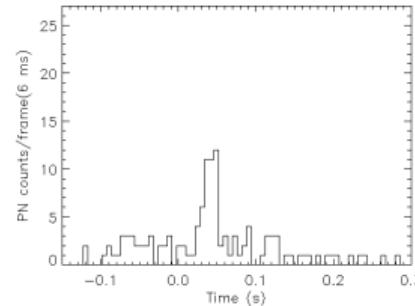
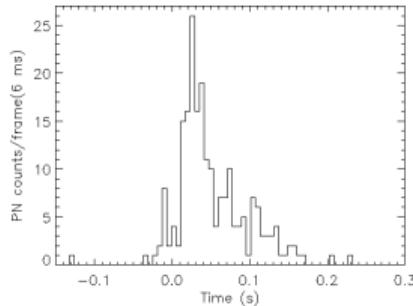
### Pulsars

- Rotational period ranging from milliseconds to seconds.



# Soft Gamma Repeaters

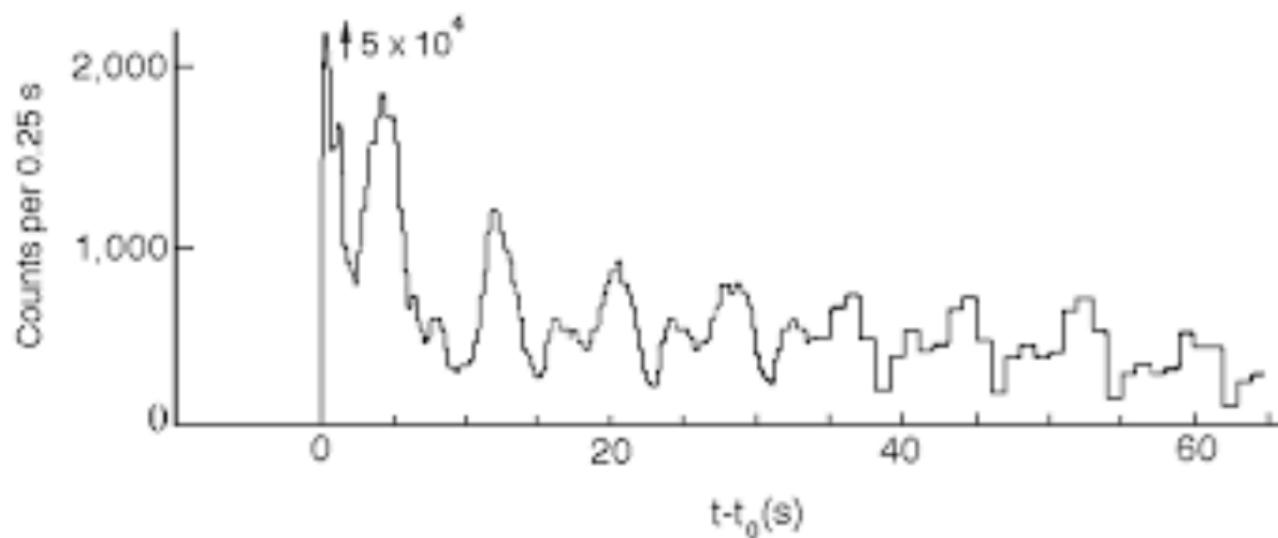
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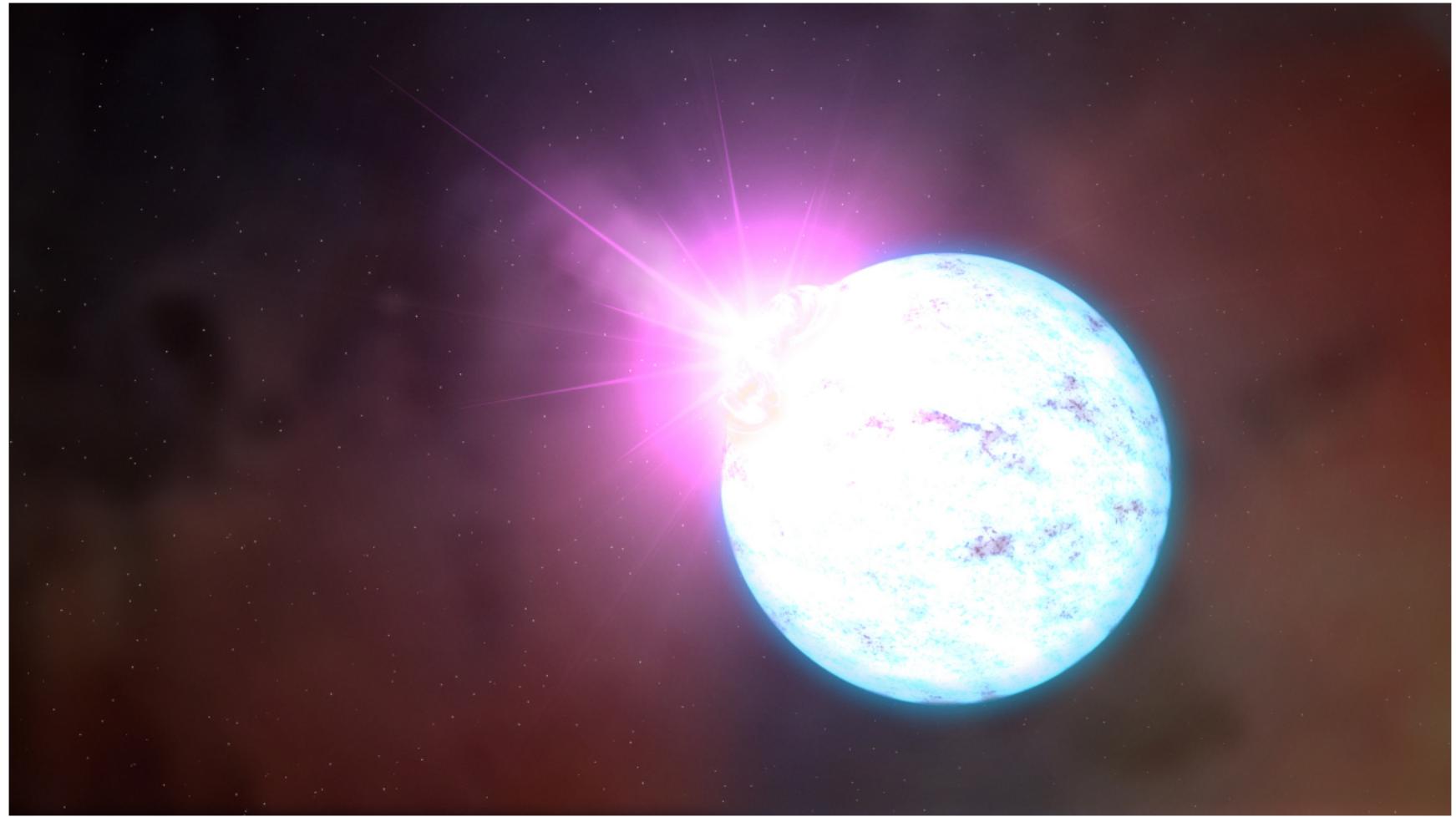
- Occur on Magnetars
- Caused by Starquakes
- The rapid spinning of star causes pulsation.

## Soft Gamma Repeaters

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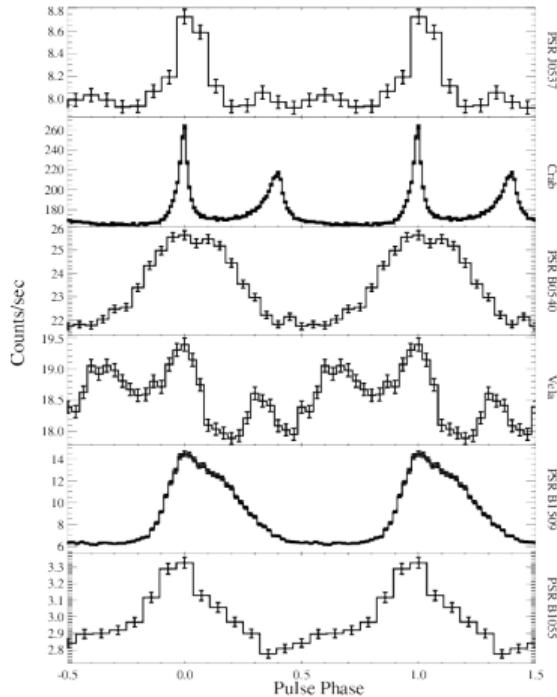


Flare observed March 5th, 1979.



# X-Ray Pulsars

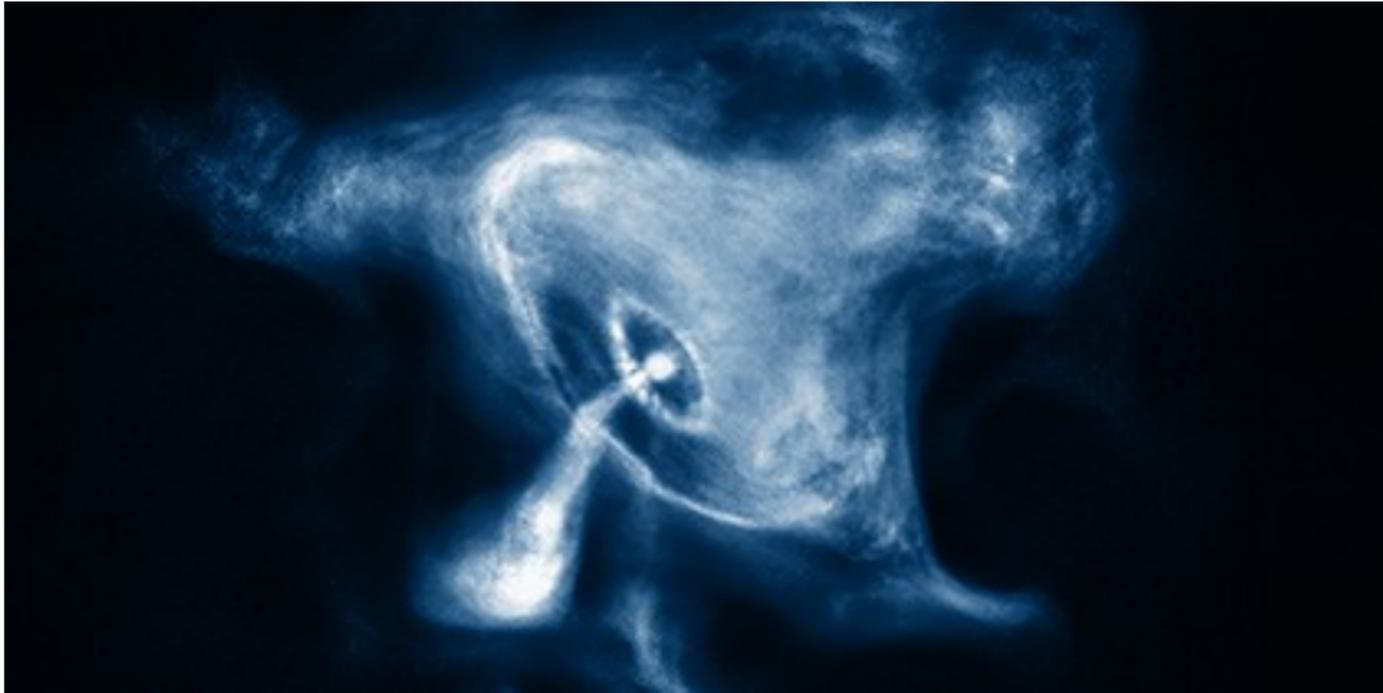
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Pulsar profiles can all look very different from each other. The charts on the right show XMM-Newton pulse profiles of the different pulsars. From top to bottom the pulsars have periods ranging from 16ms to 197ms.

## Crab Nebula

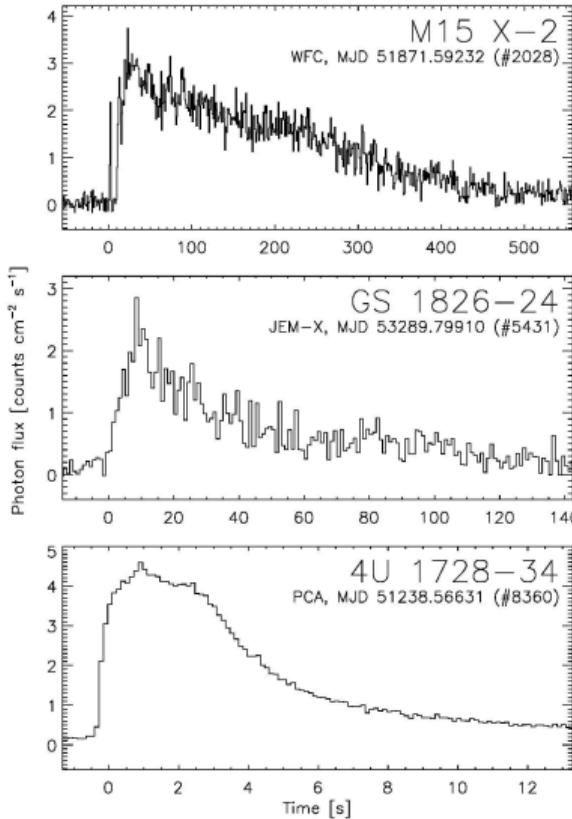
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The Crab Nebula Observed in X-rays

## X-Ray Bursters

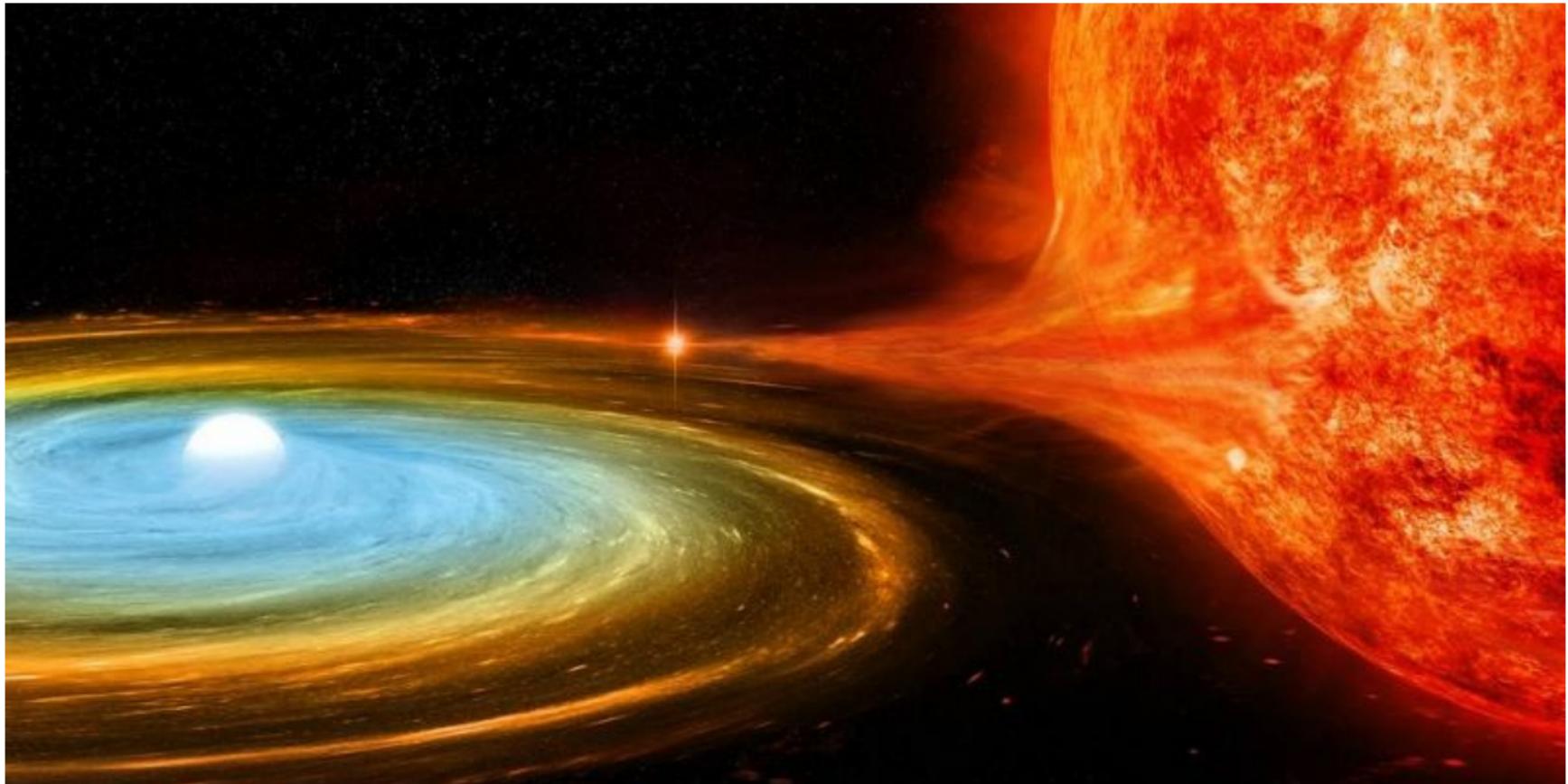
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X-Ray bursts are caused by the accretion of matter on the surface of the Neutron Star. The figure on the left shows time profiles of typical X-ray bursters.

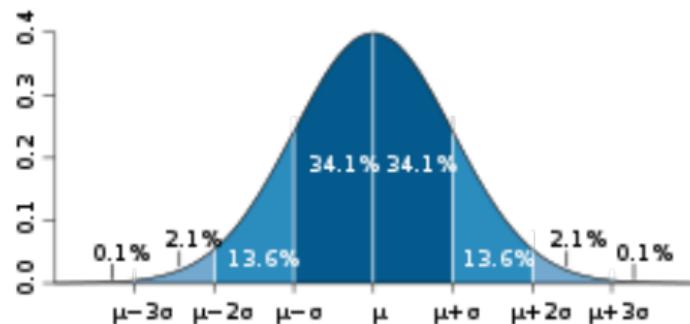
## X-Ray Bursters

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## Monte Carlo

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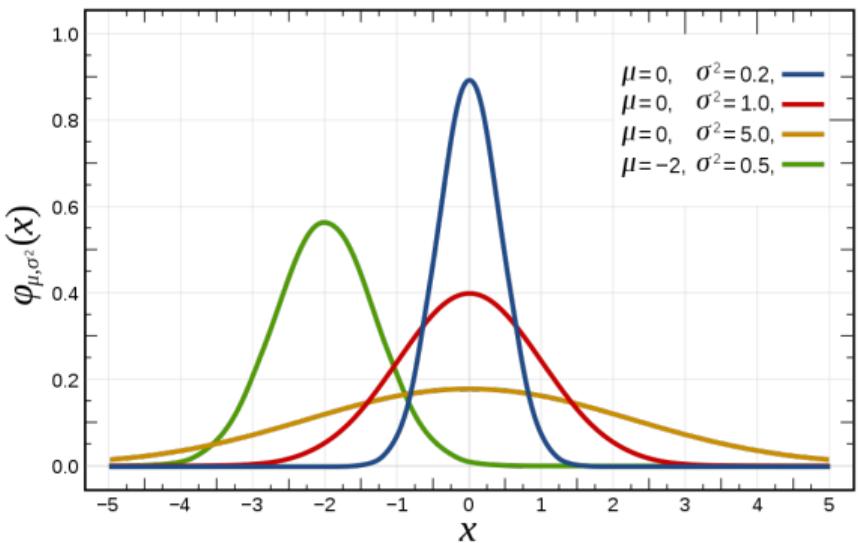


Monte Carlo modeling allows for us to model various results when there are random variable involved.

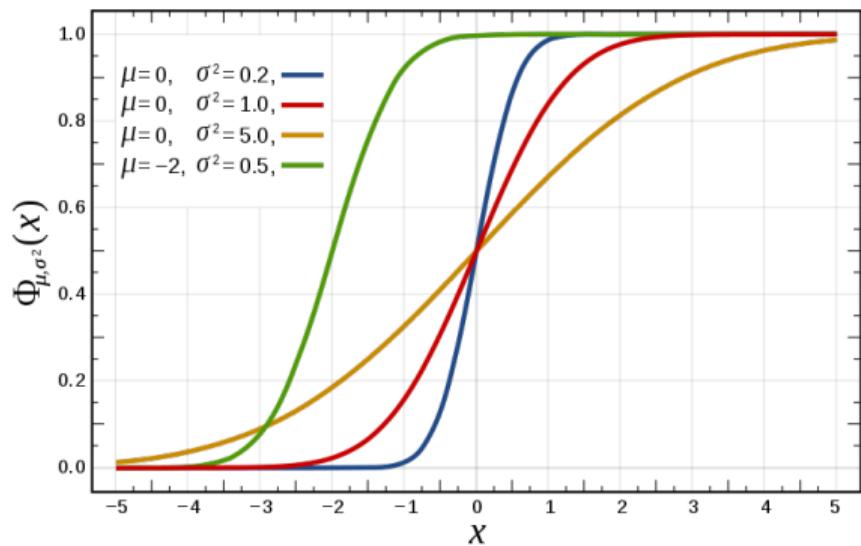
## Monte Carlo

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Let  $\sigma$  equal the standard deviation while  $\mu$  determine the mean.  
Depending on  $\mu$  and  $\sigma$  we can create different distributions.



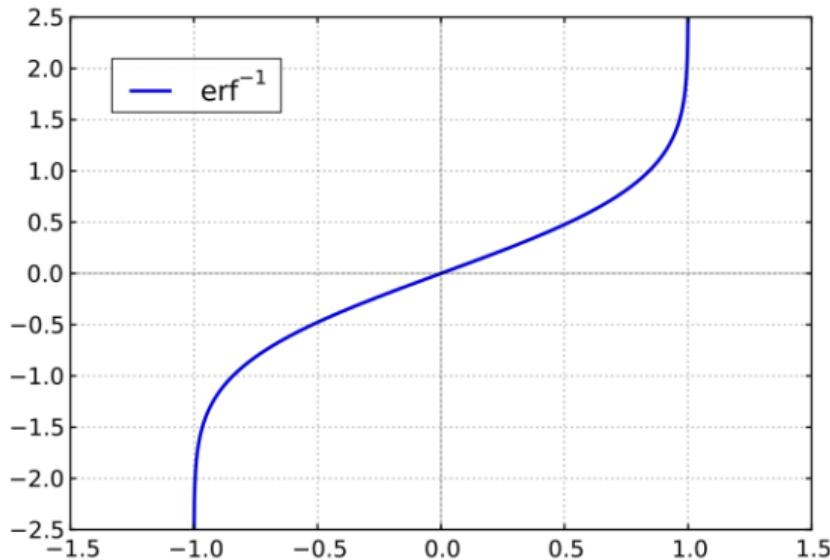
Probability Density Function



Cumulative Distribution Function

## Inverse Error Function

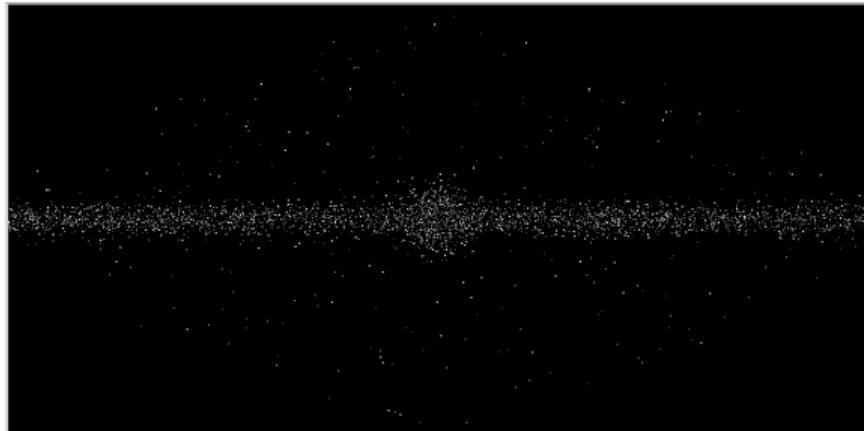
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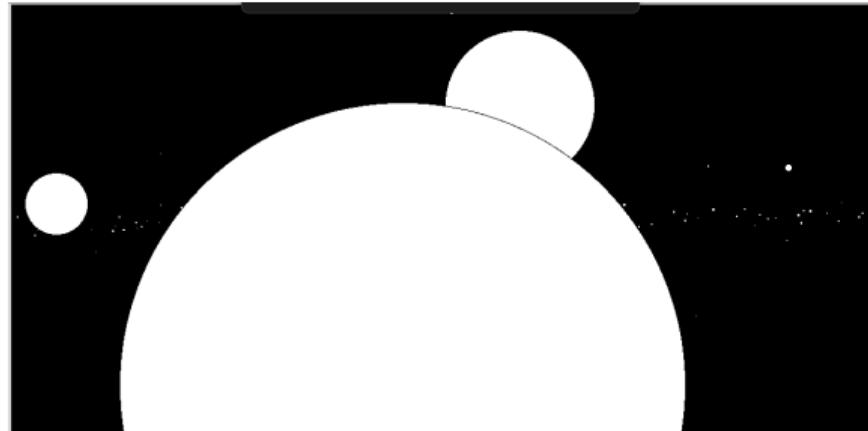
The inverse error function allows for generating a random number with a probability distribution.

## Summary

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Model of the optical sky.



Model of X-ray sky

