OBSERVATIONS OF THE CRAB NEBULA WITH THE CHANDRA X-RAY OBSERVATORY

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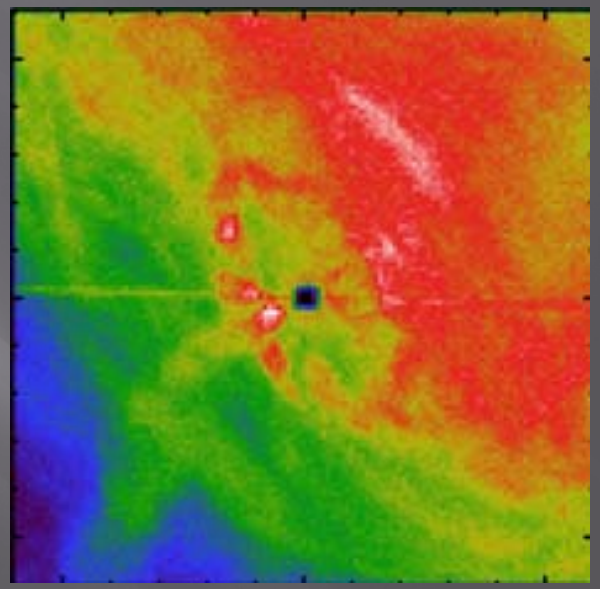

An INTEGRAL view of the high-energy sky (the first 10 years)

Paris, France October 15-19, 2012

Performed in collaboration with

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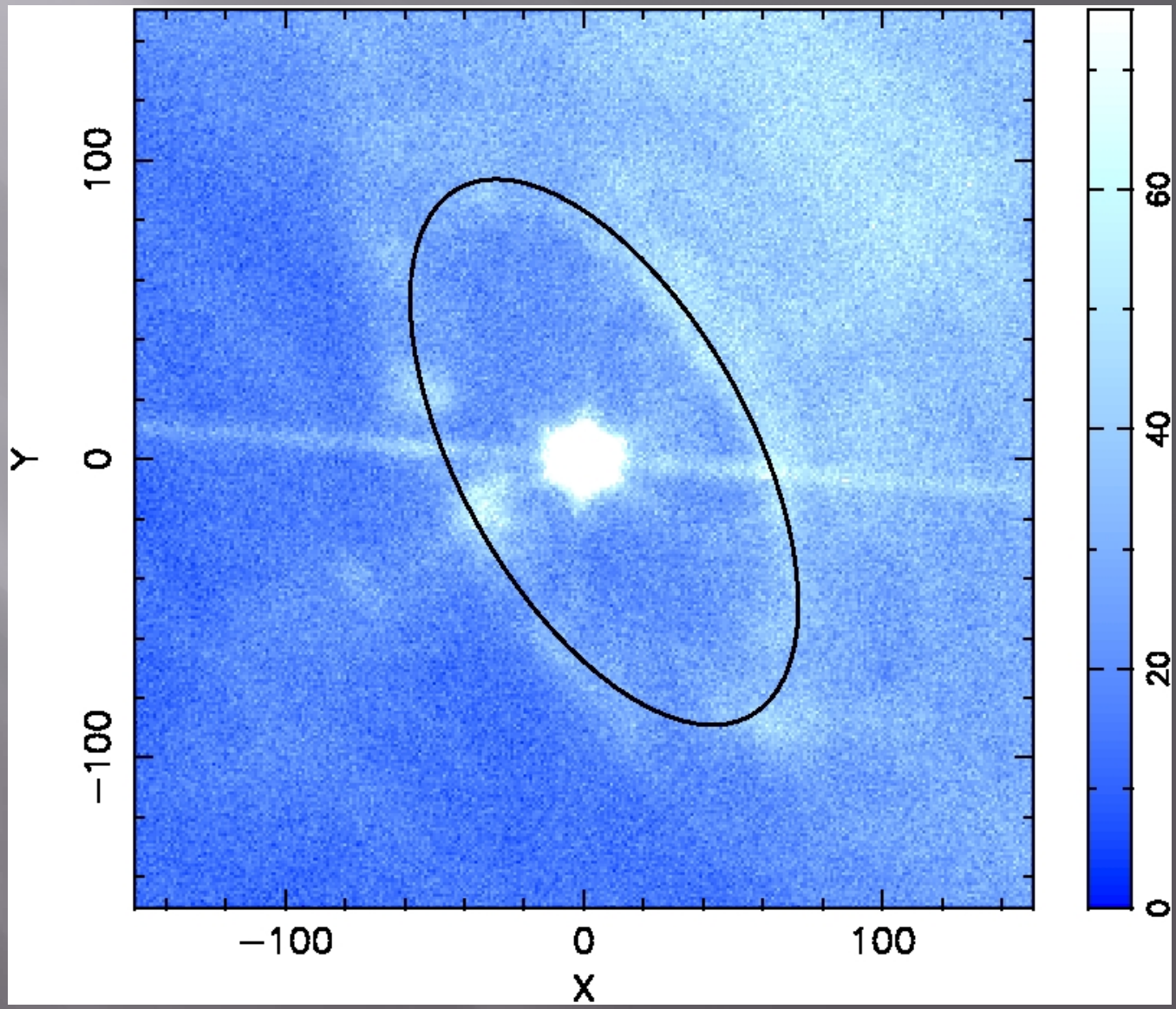
Topics

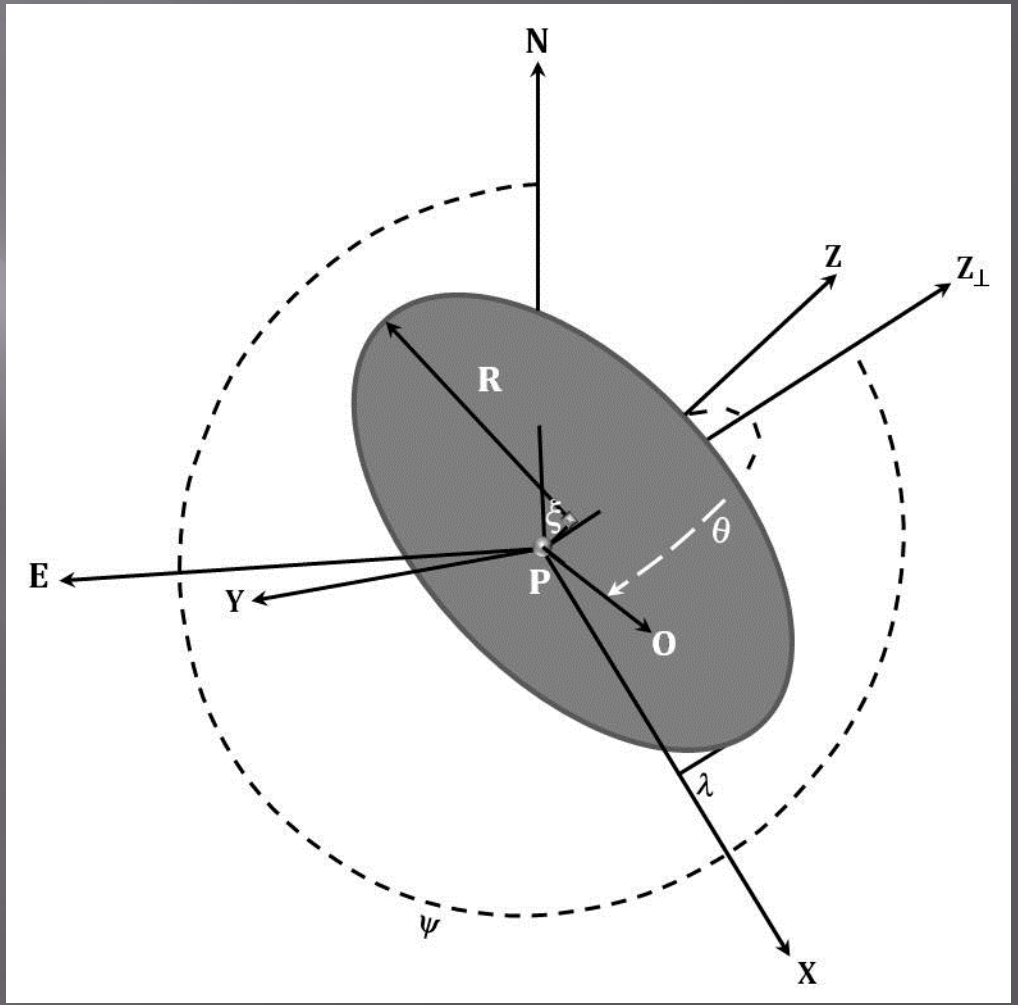
- The geometry of the system
  - The pulsar might not be where you thought it was
- Pulse phased spectroscopy
  - A challenge for the theorists
- Correlations with the gamma-ray flaring
  - Where is the beef?

The pulsar is not at the center of the "inner ring"



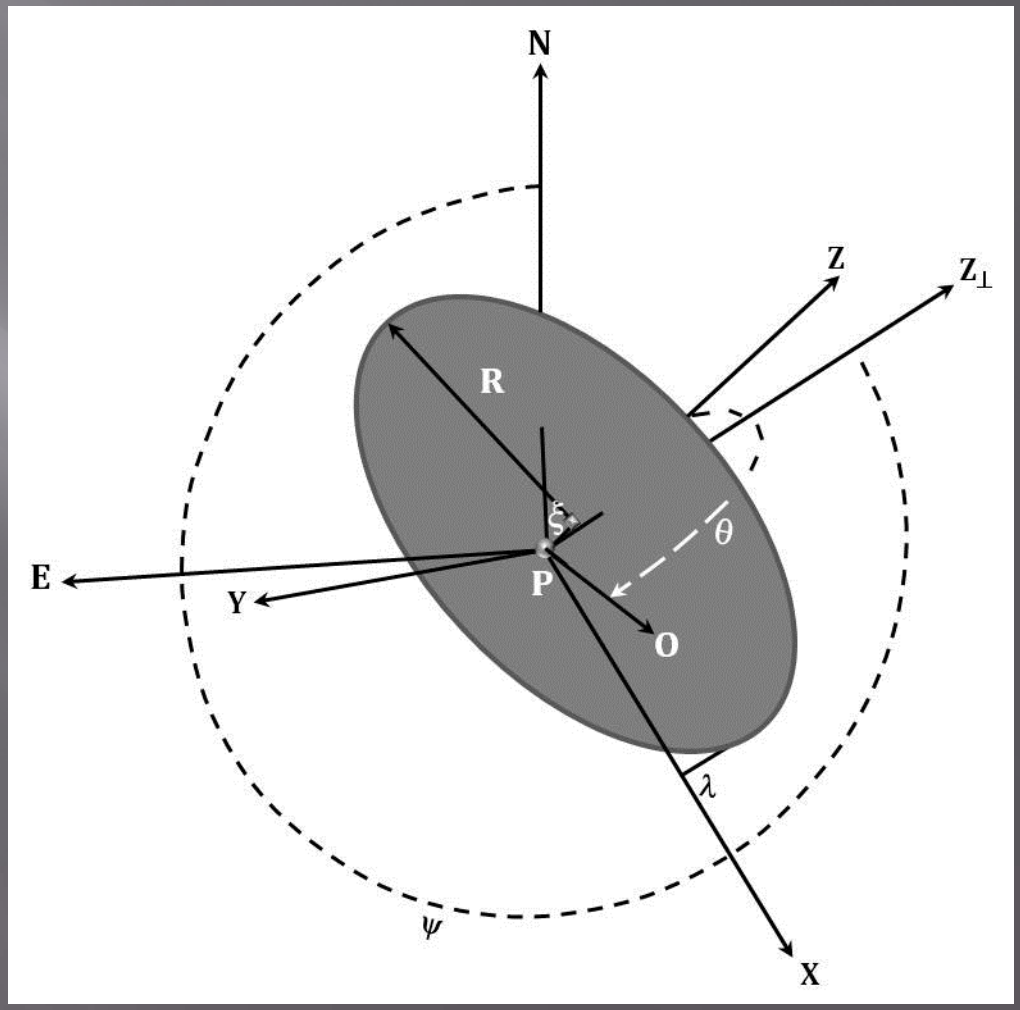
A simple geometrical model

Displace the pulsar along the spin axis away from the ring



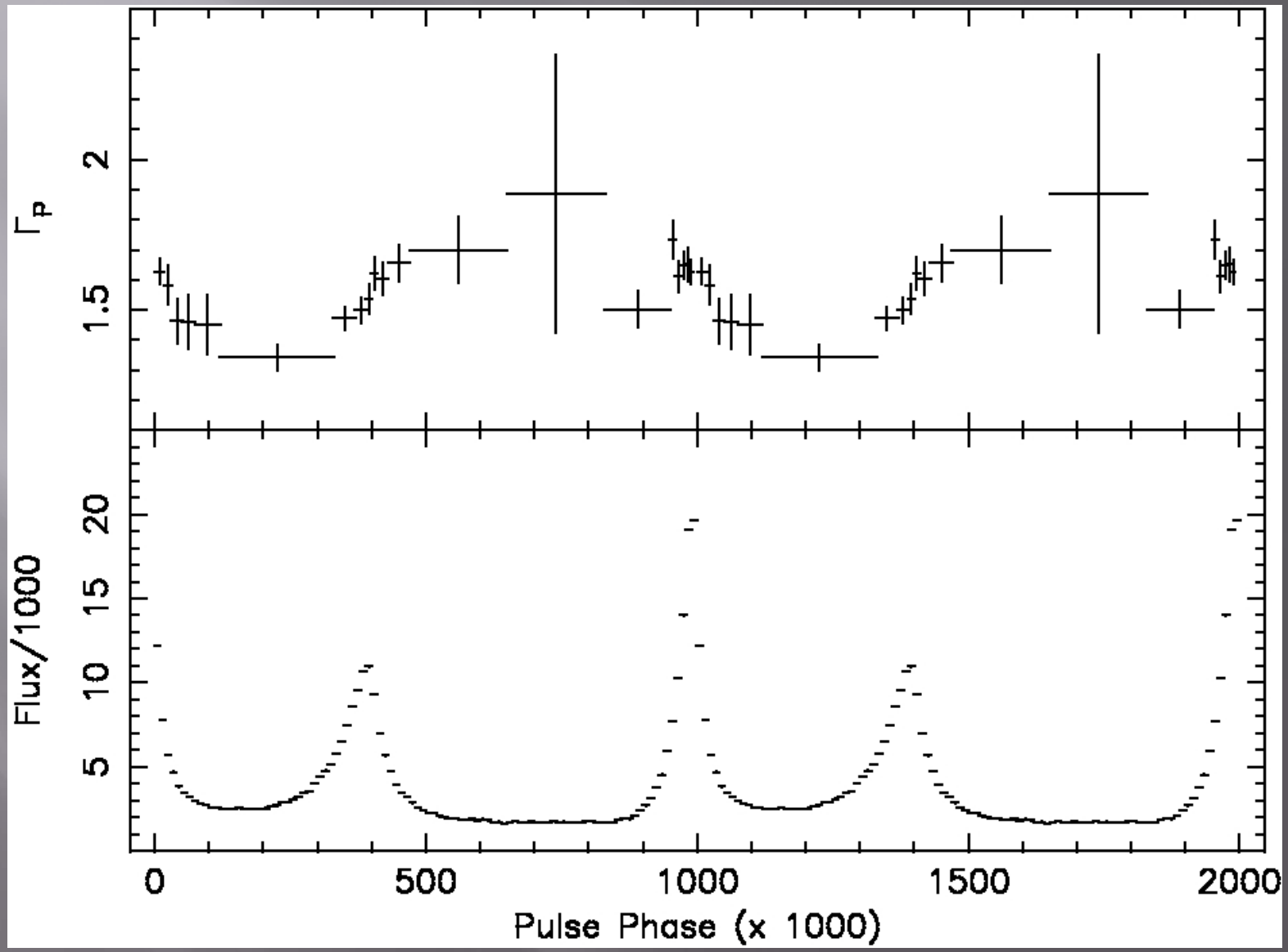
The parameters

Deprojected values
R=13.3″ (0.12 pc)
θ=119.1°
ψ=298.4°
ξ=1.04″ (0.01 pc)
λ=4.5°

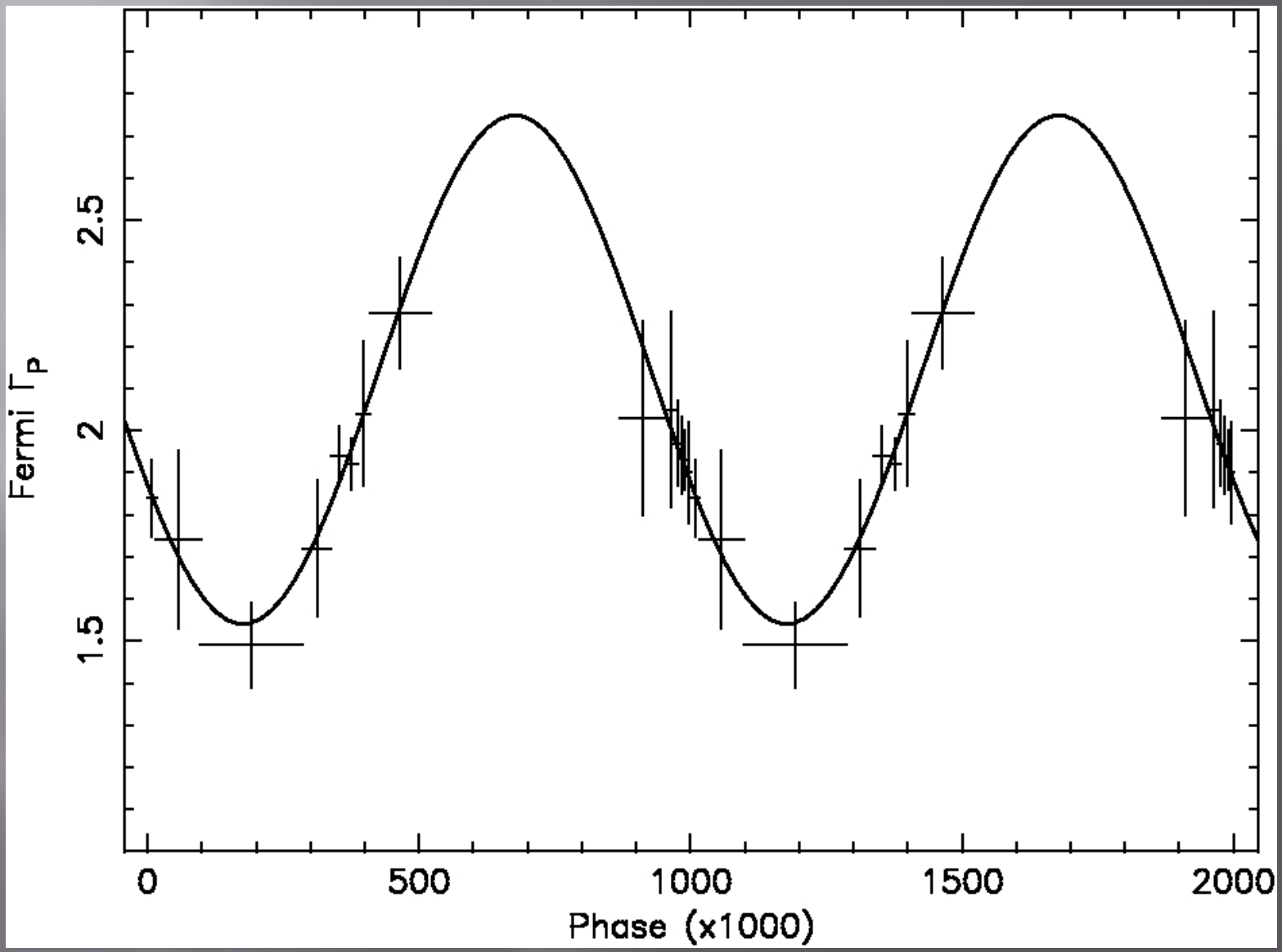


The model is by no means unique!

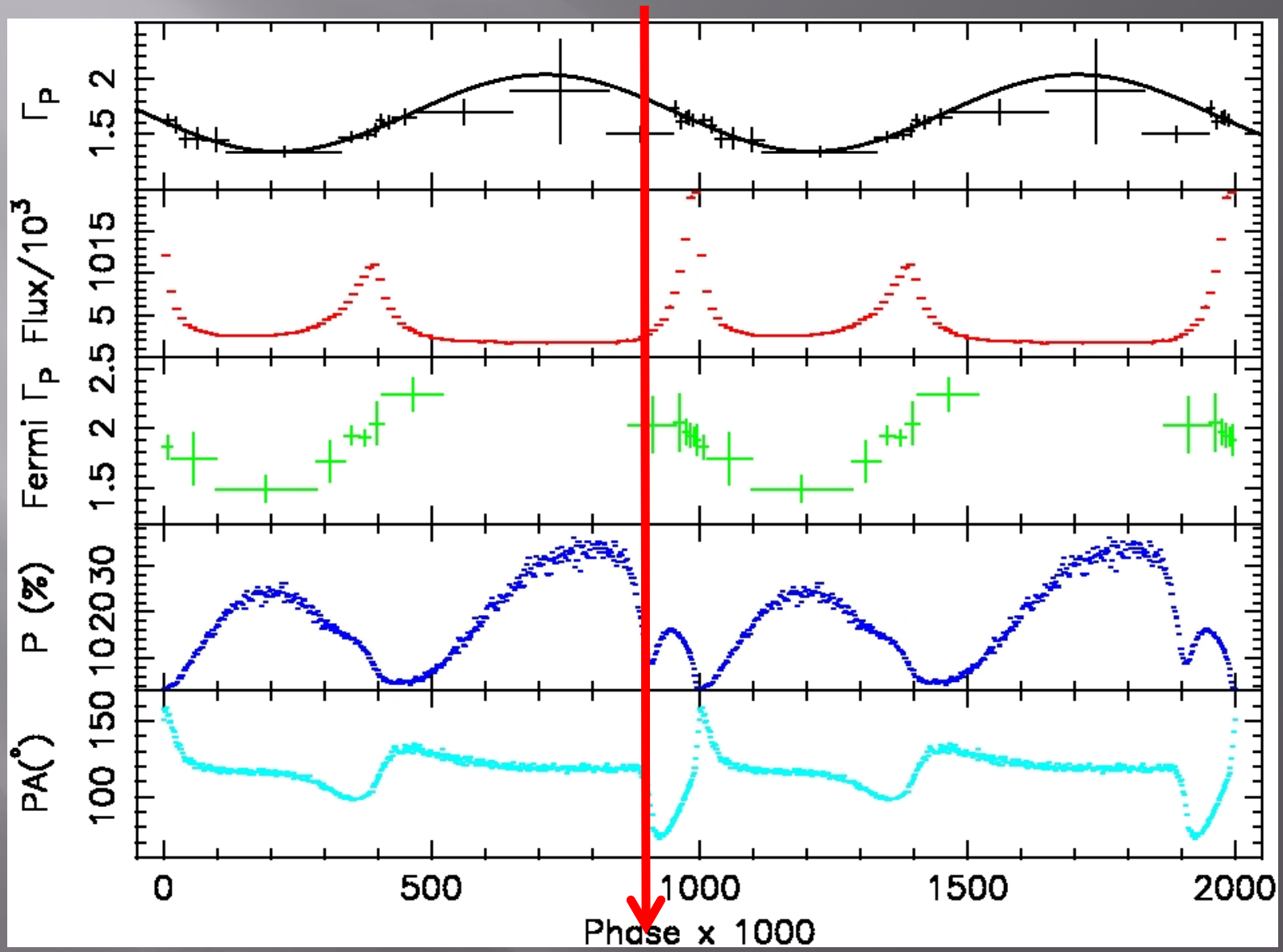
Phase resolved spectroscopy of the pulsar at *all* phases



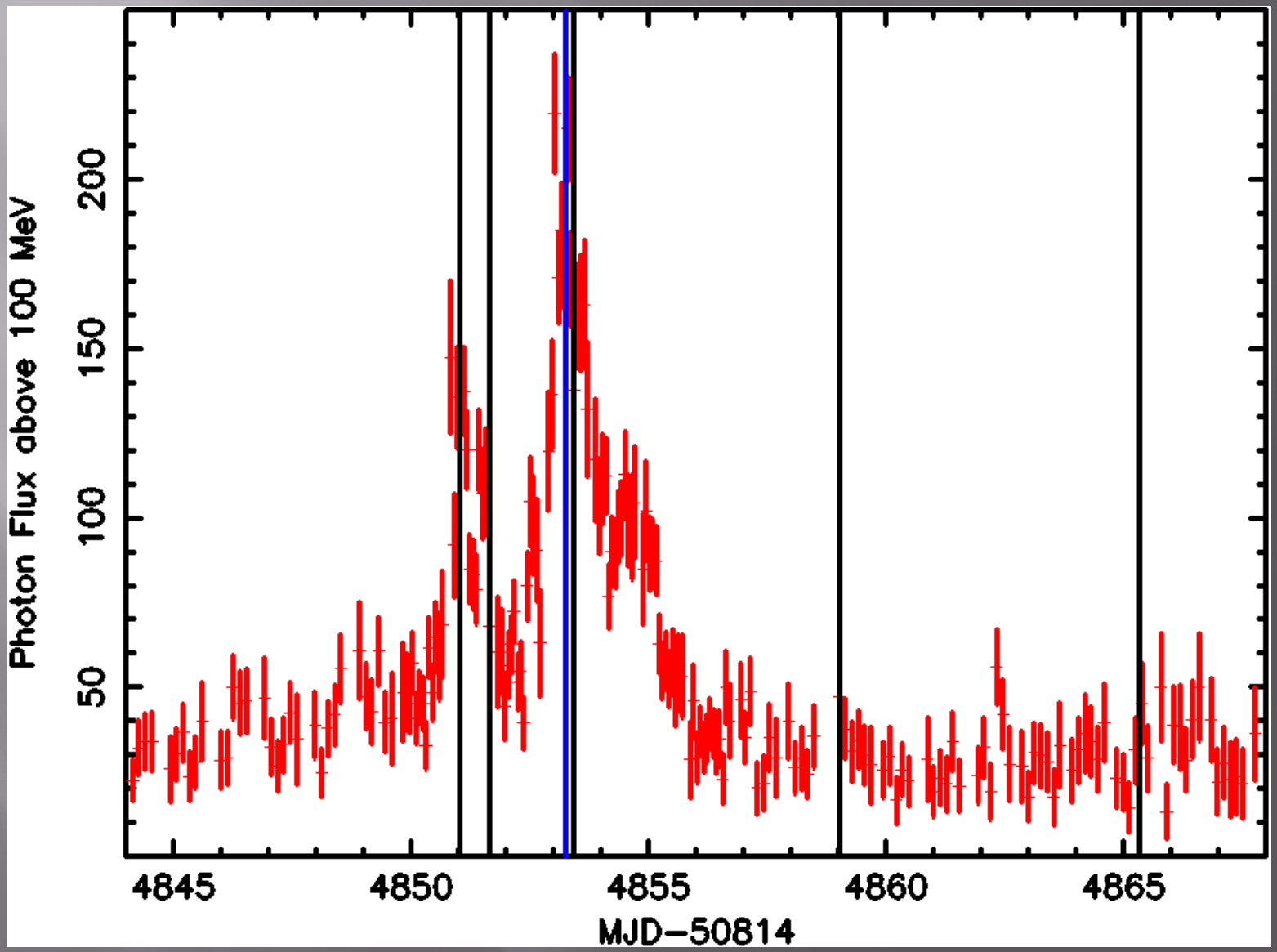
Variation of the powerlaw index



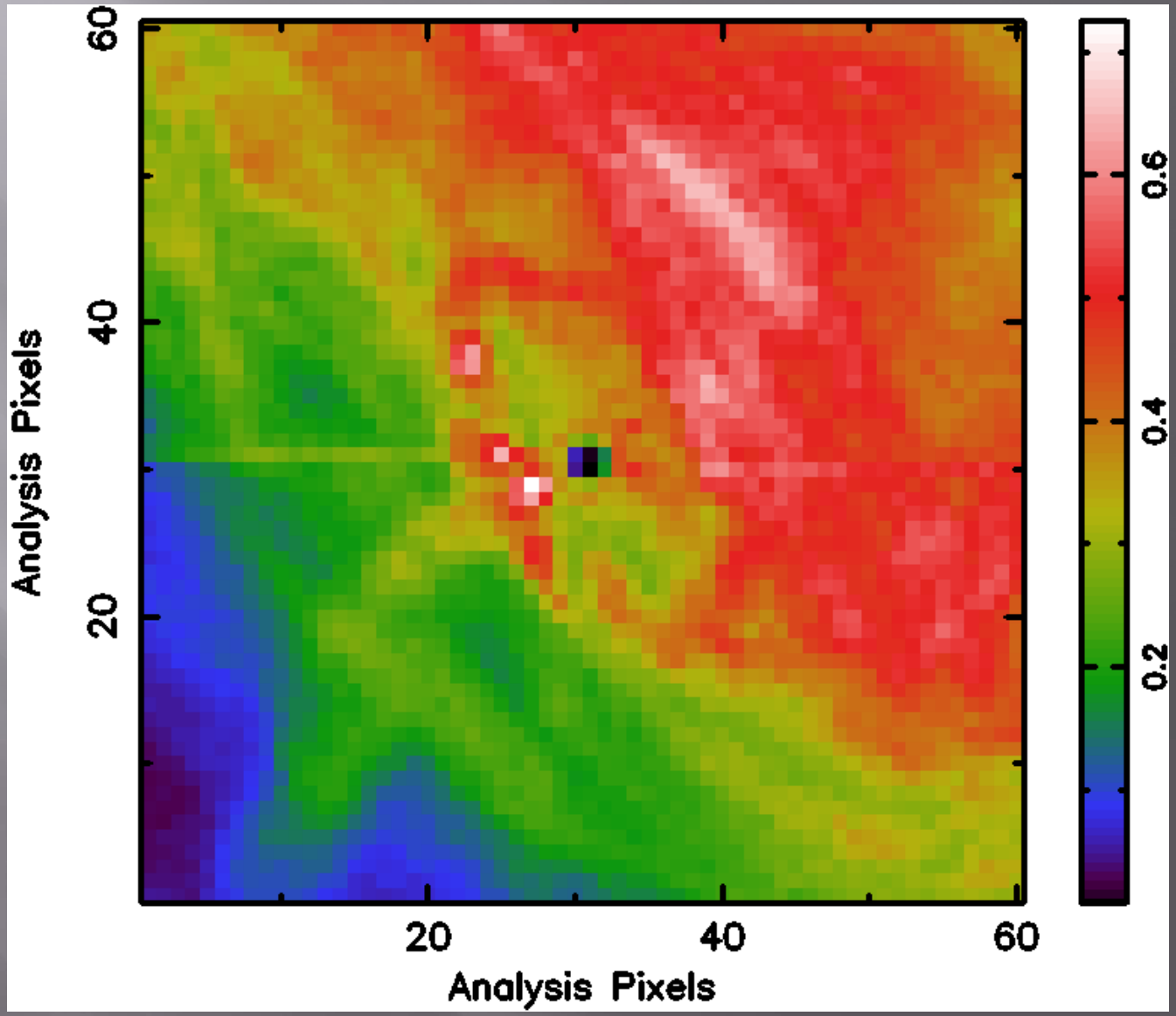
A challenge to the theorists



The γ-ray flare of April 2011



Average Chandra image 2011 April



Search for the origin of the γ-ray flares is tricky I

The rise in X-ray flux may slightly lead γ-ray flaring

Acceleration typically reach X-ray energies first

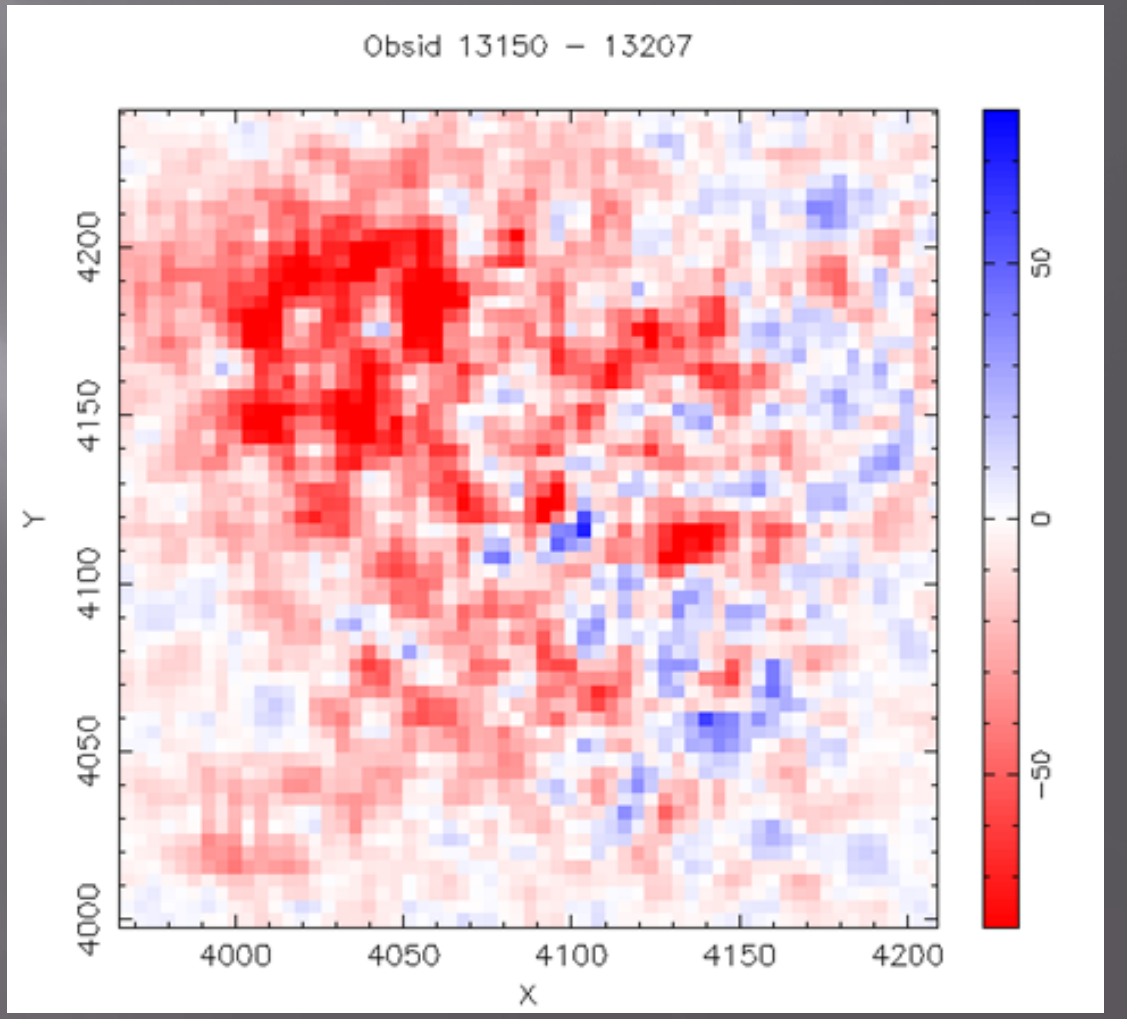
Synchrotron losses will probably cause the γ-ray flux to decline first

The observed count rate is altered due to pileup

Searching for variations is tricky II

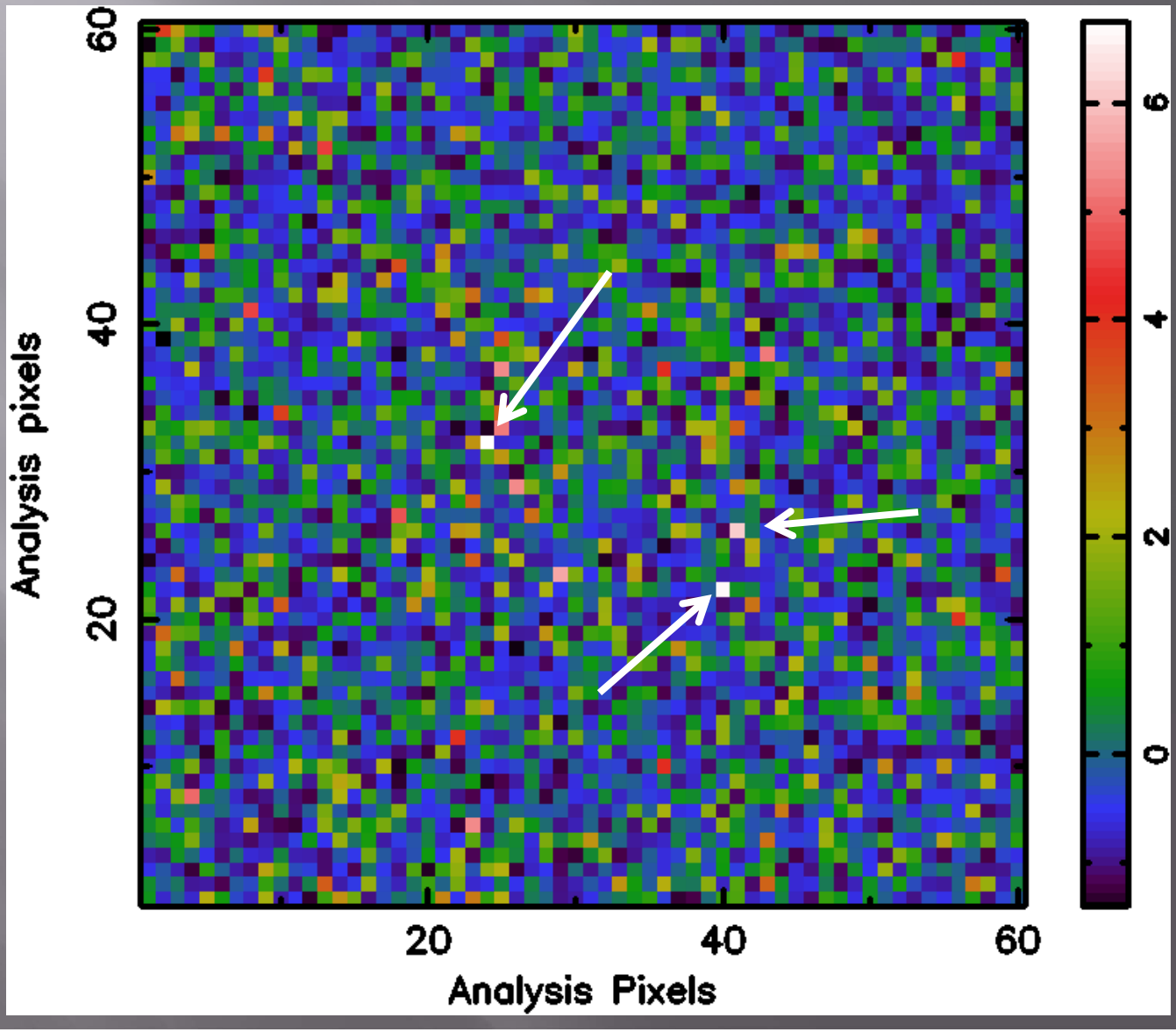
Huge swath of nebular faded in 33 hours?

No!

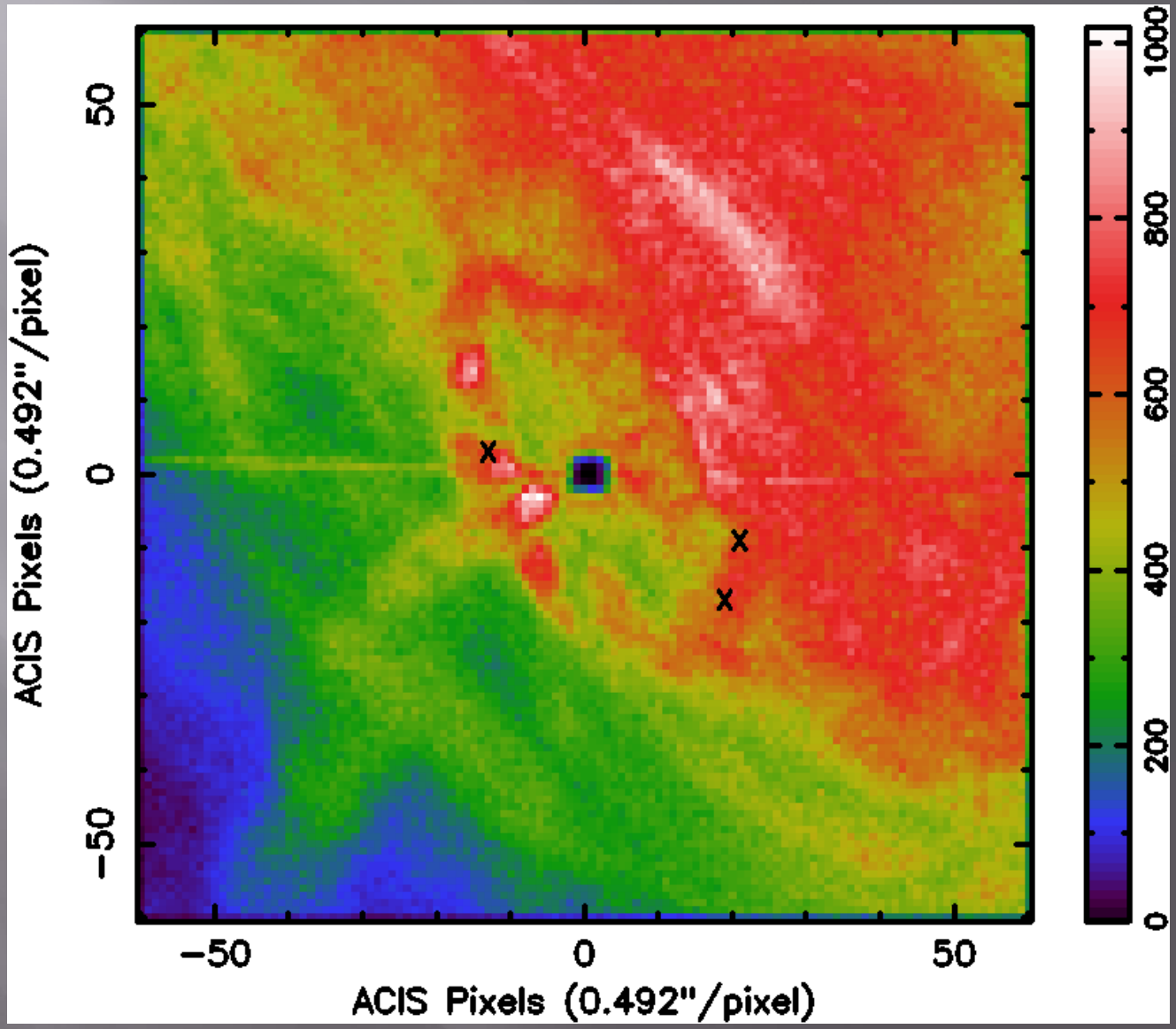


One image is closer to the edge of the detector where the contamination layer is thicker

Is there variability amongst the 5 Chandra images?



The "most significant" variations



The significance image

Are these detections?

We have 3 events with $s \geq 6$

We have 3600 chances to find something

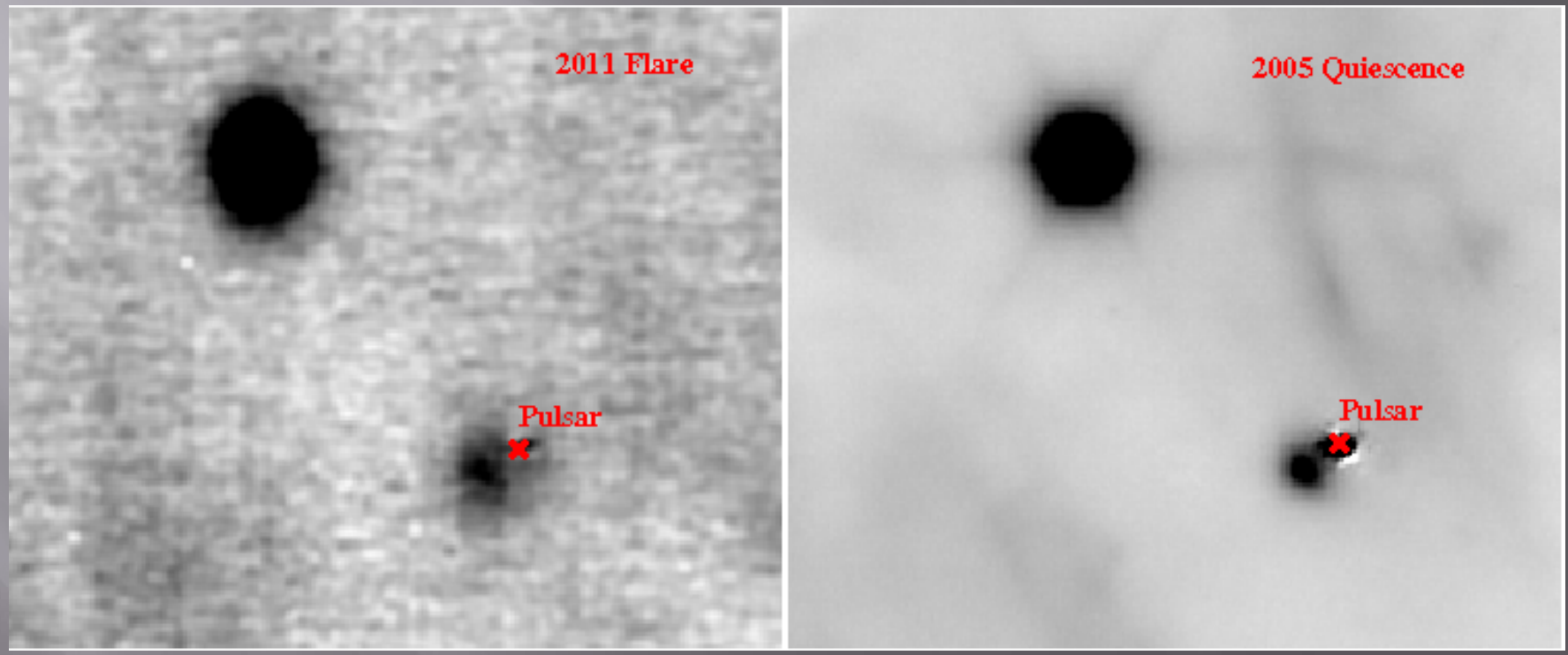
11% probability that there are three or more events with $s > 6$

Short term x-ray variations

We also looked for time variability within each observation, hence time scales < 10,000 seconds

Once again we found no solid evidence for variability

The Keck infrared observation



The spectral energy distribution