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)
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Performed in collaboration with

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 model is by no means unique!

Deprojected values
R = 13.3" (0.12 pc)
\( \theta = 119.1^\circ \)
\( \psi = 298.4^\circ \)
\( \xi = 1.04" \) (0.01 pc)
\( \lambda = 4.5^\circ \)
Phase resolved spectroscopy of the pulsar at all phases
Variation of the powerlaw index
A challenge to the theorists
The $\gamma$-ray flare of April 2011
The rise in X-ray flux may slightly lead $\gamma$-ray flaring.

Acceleration typically reach X-ray energies first.

Synchrotron losses will probably cause the $\gamma$-ray flux to decline first.

The observed count rate is altered due to pileup.
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
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

2011 Flare

2005 Quiescence

Pulsar

Pulsar
The spectral energy distribution