

The background of the slide features a photograph of the Chandra X-ray Observatory satellite in space. The satellite is covered in gold thermal insulation and has a large, circular, flat-panel X-ray telescope mirror assembly. It is positioned in the upper left quadrant of the frame. The background is a deep blue and purple space scene with numerous stars and a faint nebula. The title text is overlaid on the right side of the image.

*CHANDRA OBSERVATIONS  
OF NEUTRON STARS: AN  
OVERVIEW*

Martin C. Weisskopf

London --- April 2006

# The Observatory

Chandra Data Archive: Observation Search - Microsoft Internet Explorer

File Edit View Favorites Tools Help

Address http://cda.harvard.edu/chaser/mainEntry.do

## Chandra X-ray Center Observation Search

[New Search](#) [Retrieval List](#) [Help](#)

**Search**

Target Name   RA/Long/1  Dec/Lat/b  Radius  arcmin

Name Resolver  Coordinate System  Equinox

Observation ID  Sequence Number  Proposal Number

Proposal Title  PI Name  Observer Name

Start Date  Public Release Date  Exposure Time (ks)

Status  Science Category  Joint Observatories

Instrument  Grating  Type  Observing Cycle

ACIS-I  
ACIS-S  
HRC-I  
HRC-S

None  
LETG  
HETG

TOO  
CAL  
GO  
GTO

A00  
A01  
A02  
A03  
A04

Archived  
Observed  
Partially Observed  
Scheduled  
Unobserved

Solar System  
Stars and WD  
WD Binaries and CV  
BH and NS Binaries  
SN, SNR and Isolated NS

None  
HST  
NOAO  
RXTE  
Spitzer

Customize Output:

Sort Order   ascending  descending

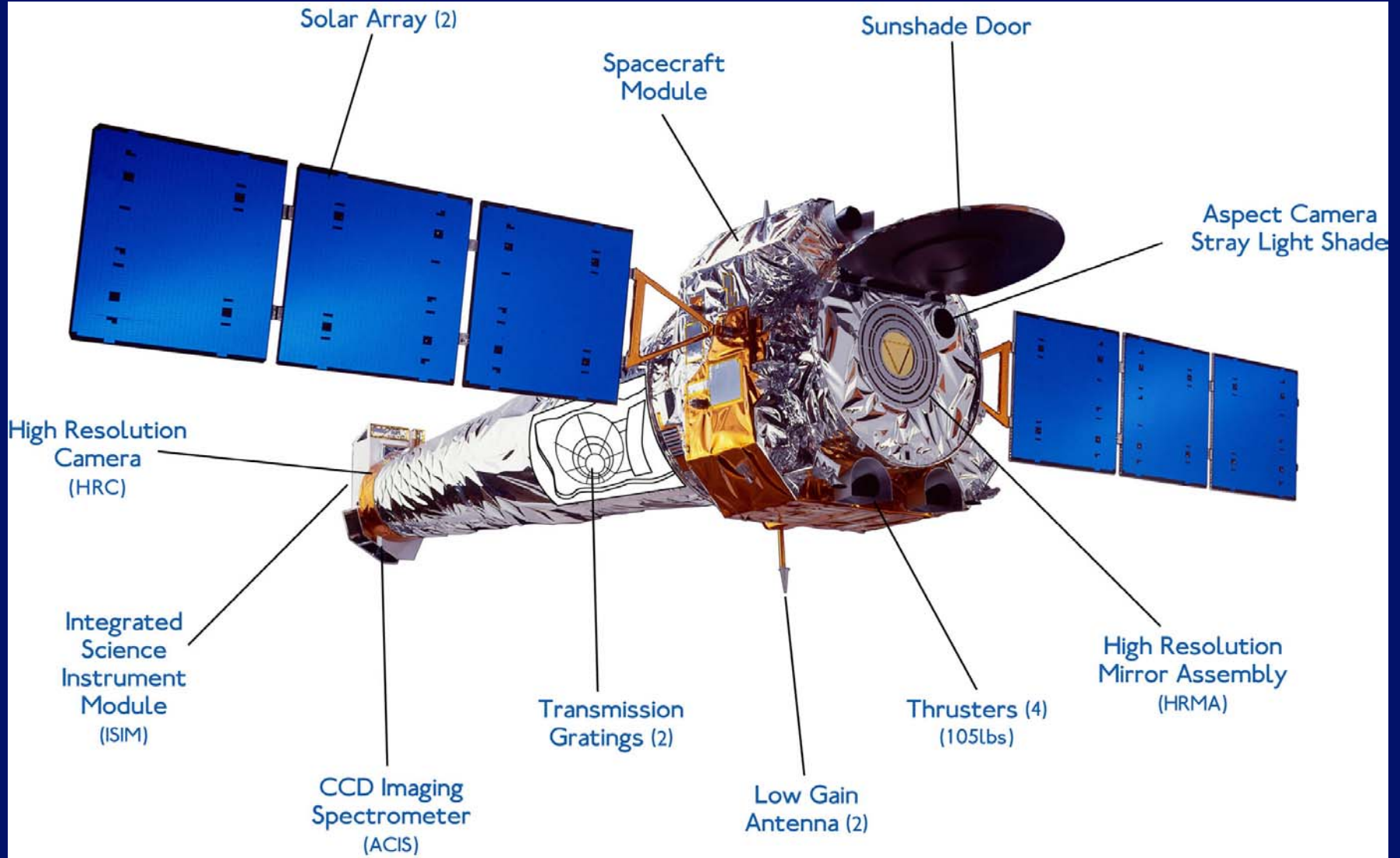
Display Format  Row Limit

Coordinate System  Equinox  Format

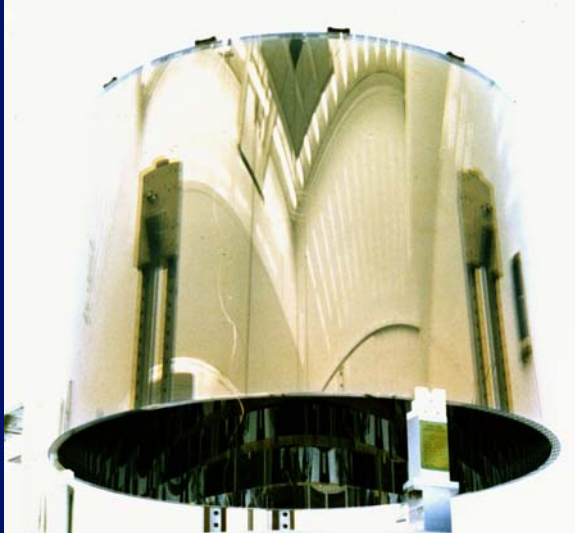
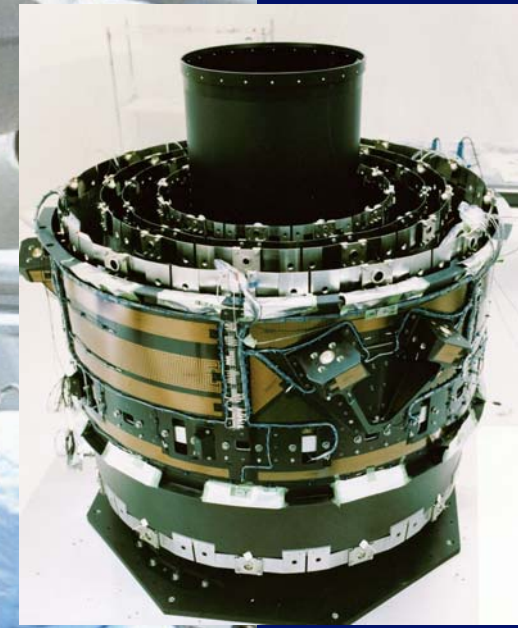
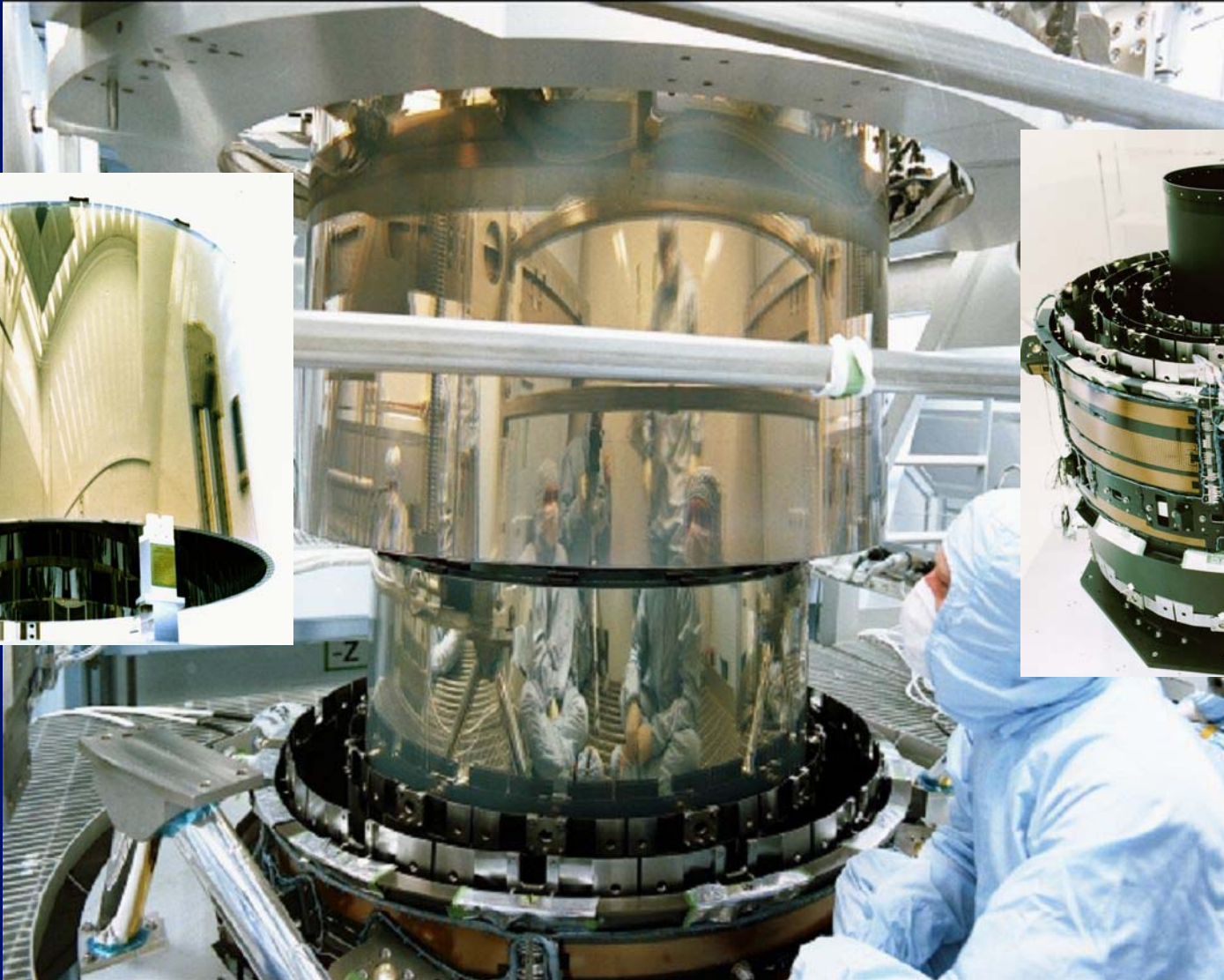
For online support please contact the [CXC Helpdesk](#).

Start | Inbox - Microsoft O... | Chandra Data Ar... | Internet

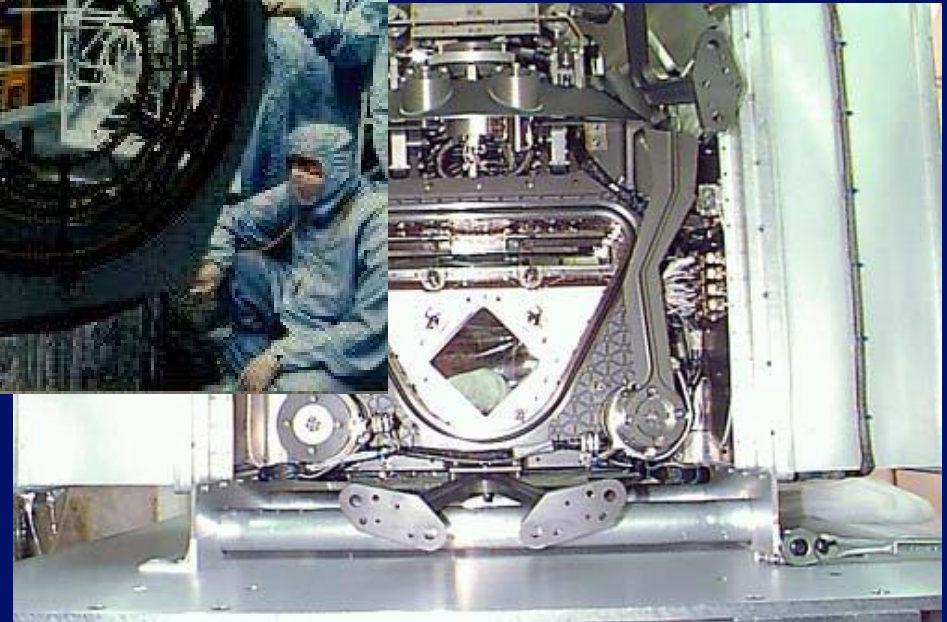
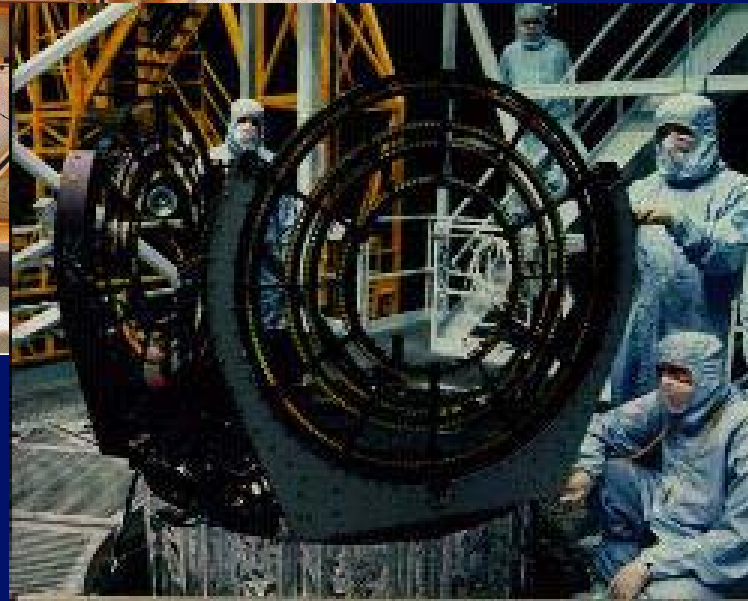
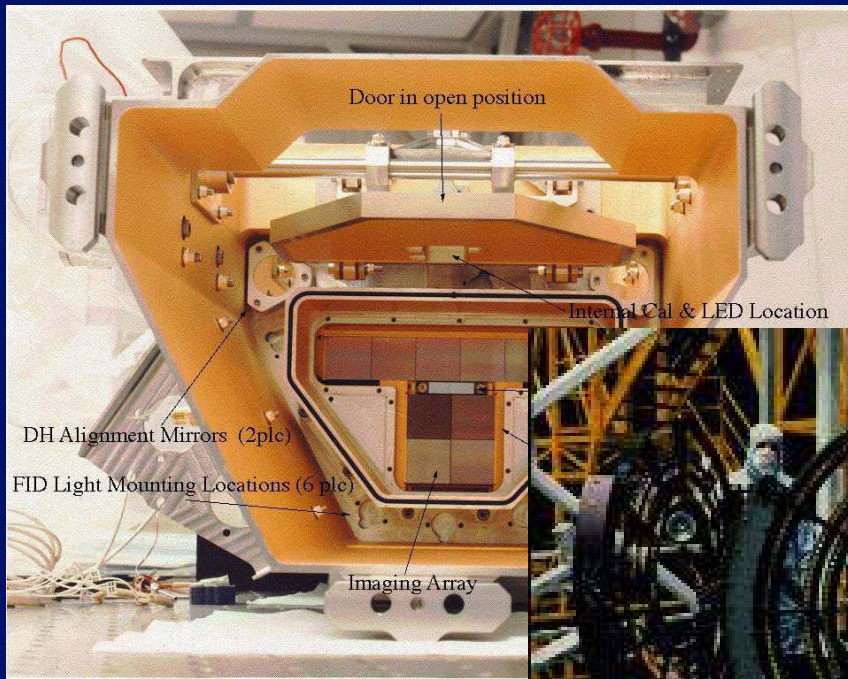
# The Observatory



# The Optics



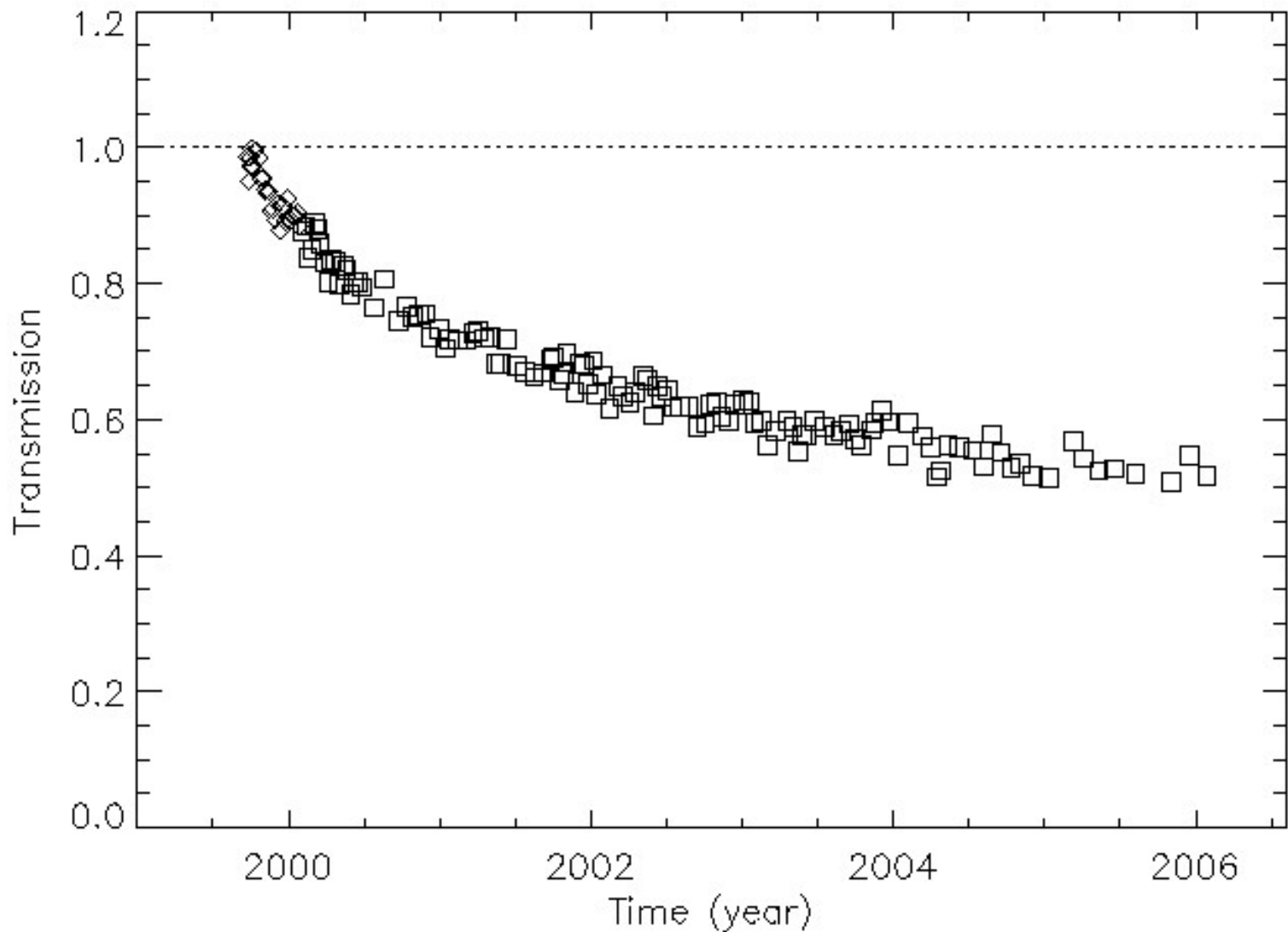
# The Instruments



## The Observatory – Status

- Launch July 23, 1999
- Designed for 3 years with a goal of 5
- Will soon (July) complete 7-th year!
- Operating successfully
  - Thermal degradation
  - ACIS filter contamination

# The Observatory – ACIS filter contamination

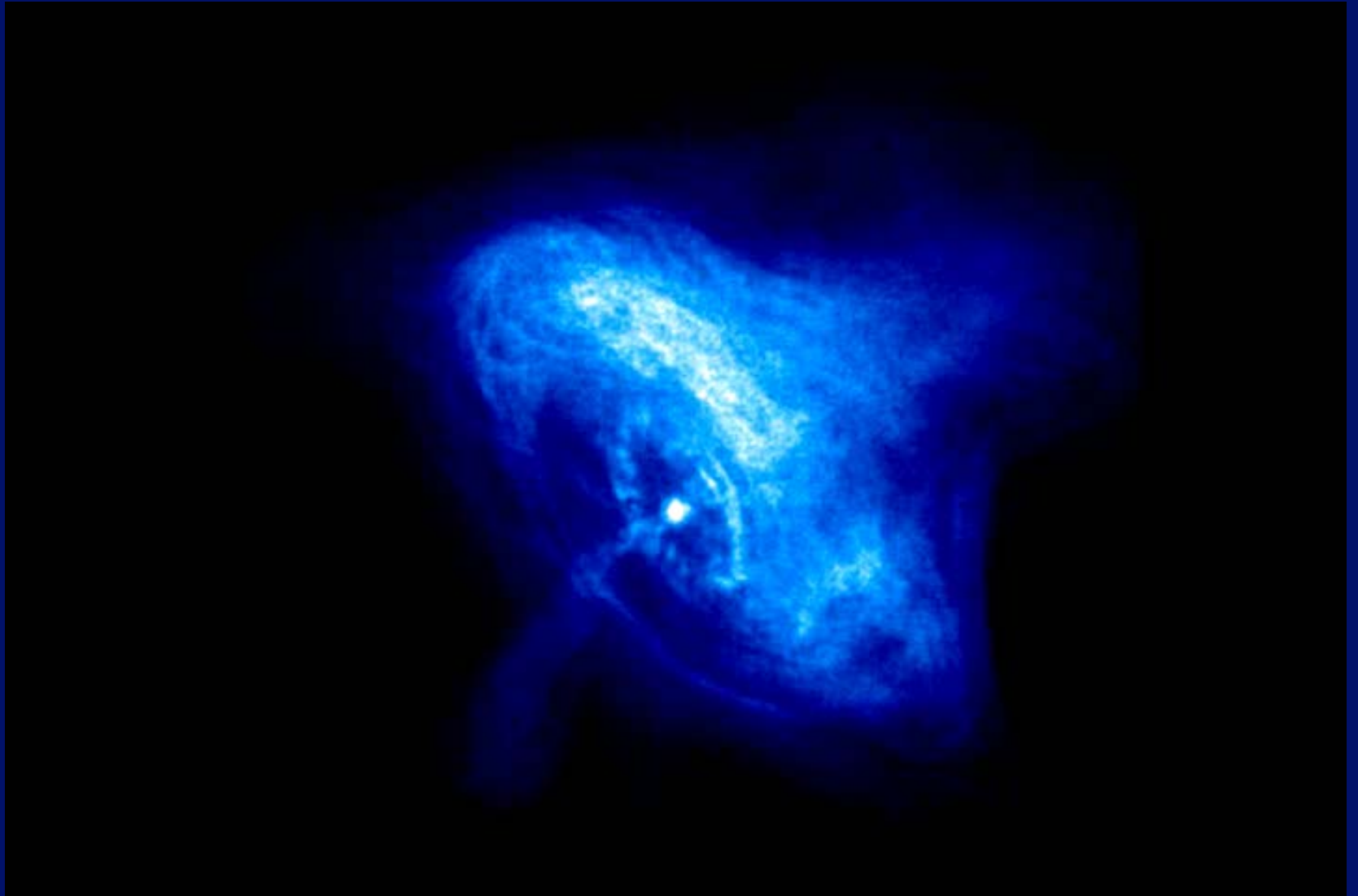


# The Observatory – Prospects

- Gas supply for pointing  $\gg$  15 years
- Stable Orbit  $\gg$  15 years
- Money  $\geq$  10 years ☺

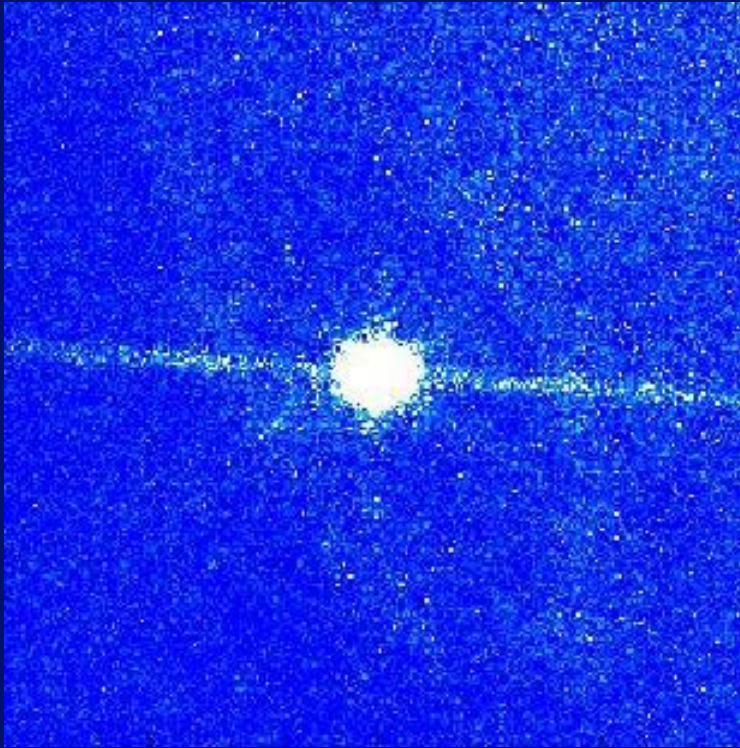


# The Crab Nebula and its Pulsar

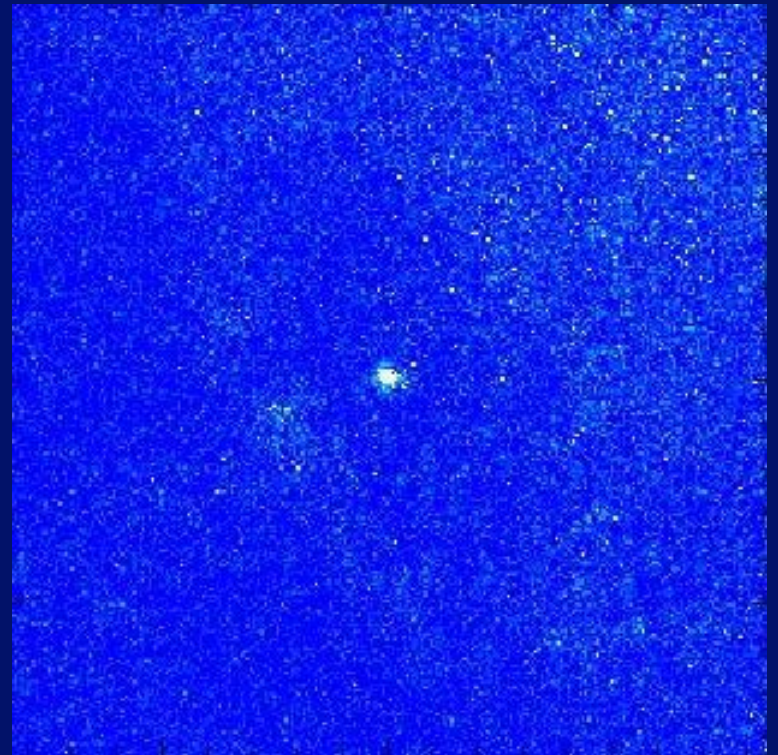


# The Crab Pulsar – Always on

Pulse maximum



Pulse minimum



# The Crab Pulsar – Yes - it is a power law!

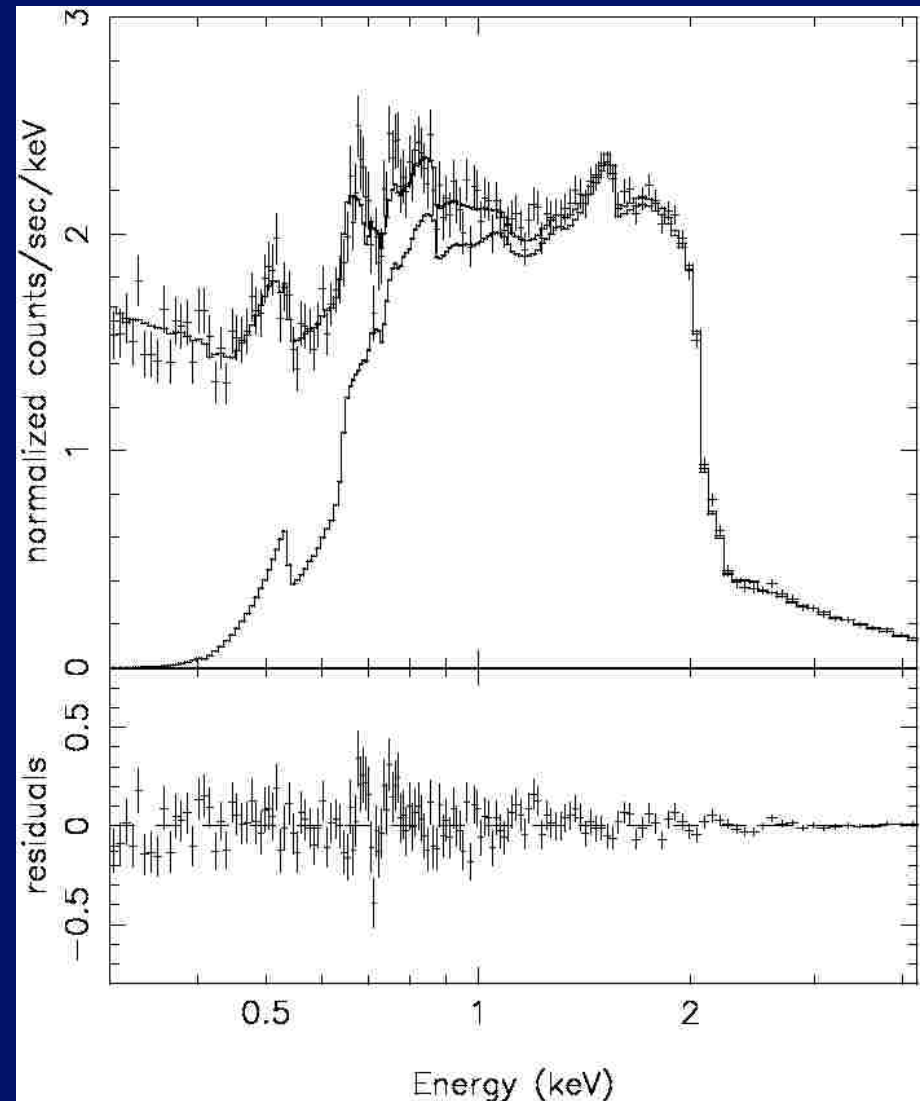
$$\Gamma = 1.59$$

$$N_{\text{H}} = 4.2 \times 10^{21} \text{ cm}^{-2}$$

$$[\text{O}/\text{H}] = 3.3 \times 10^{-4}$$

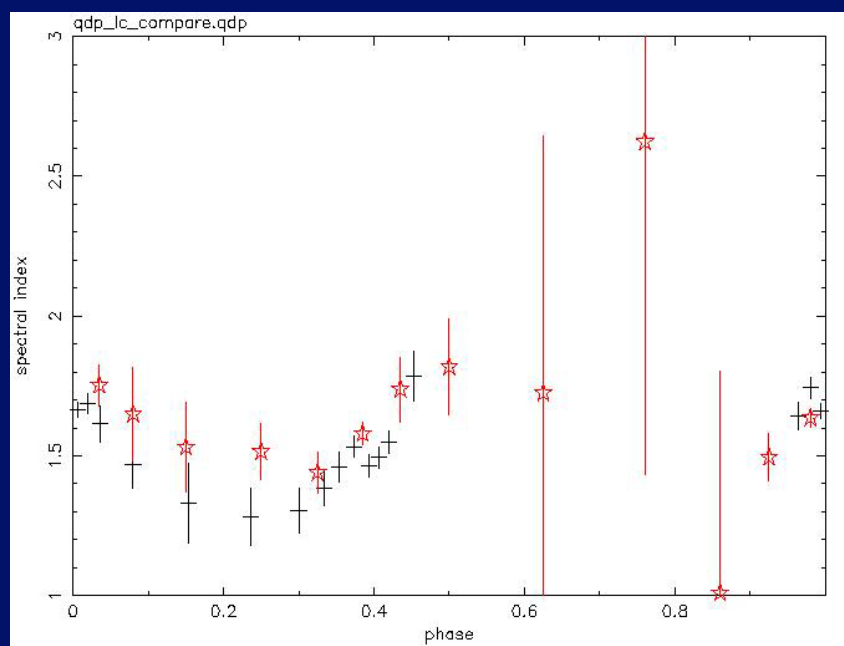
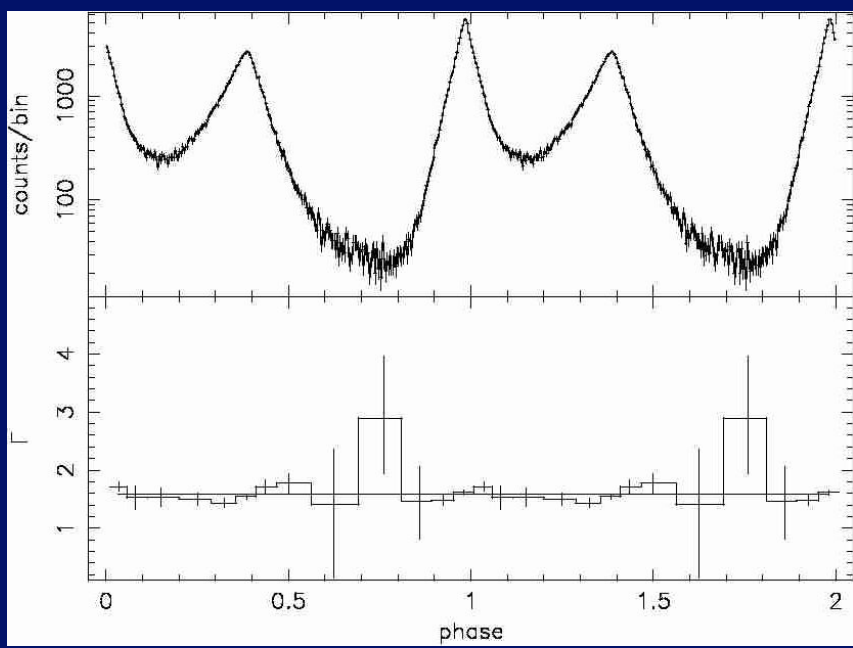
$$\chi^2:\nu = 1539:1552$$

Abundances: Wilms  
Cross-sections: Verner &  
TBvarabs

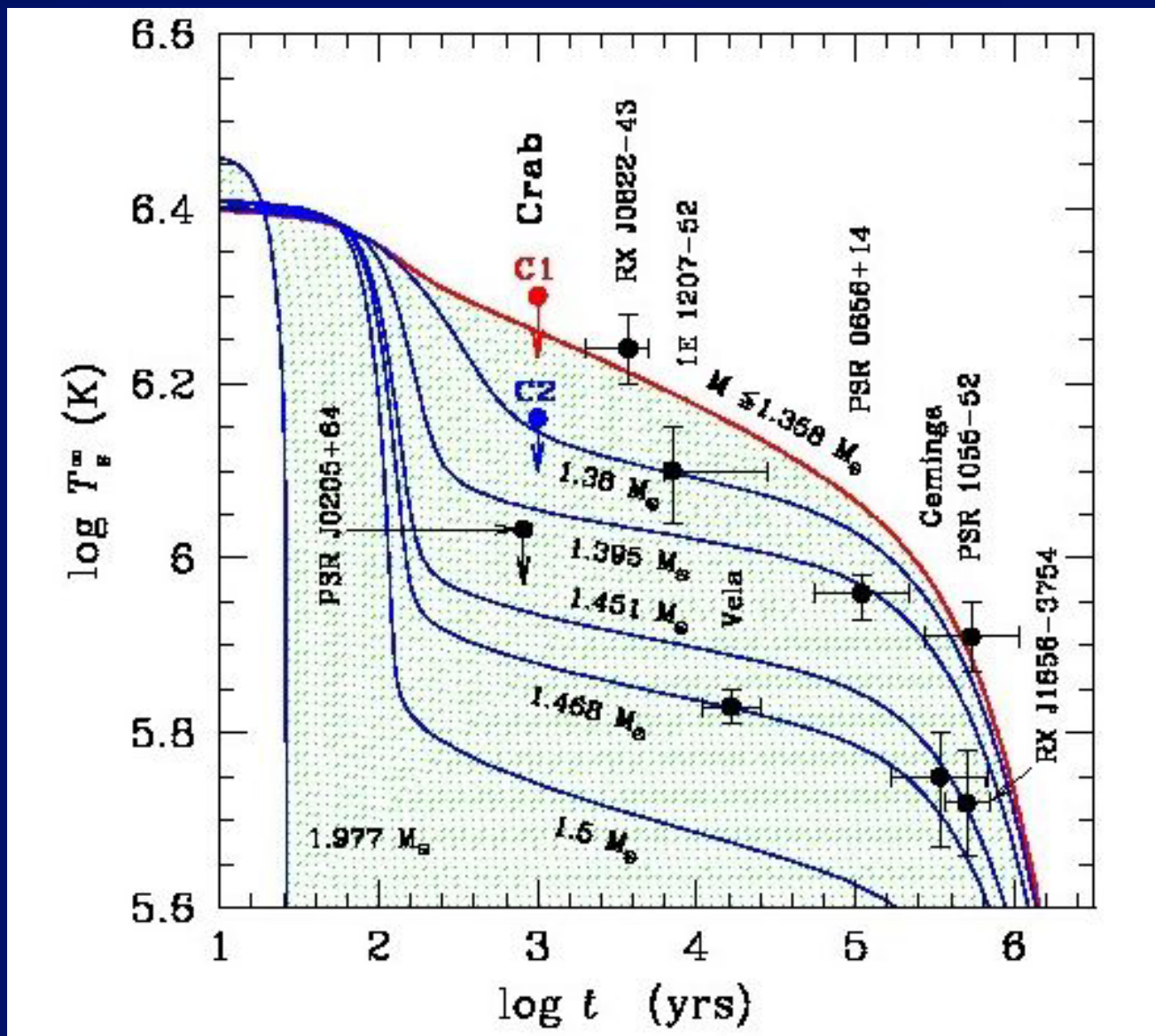




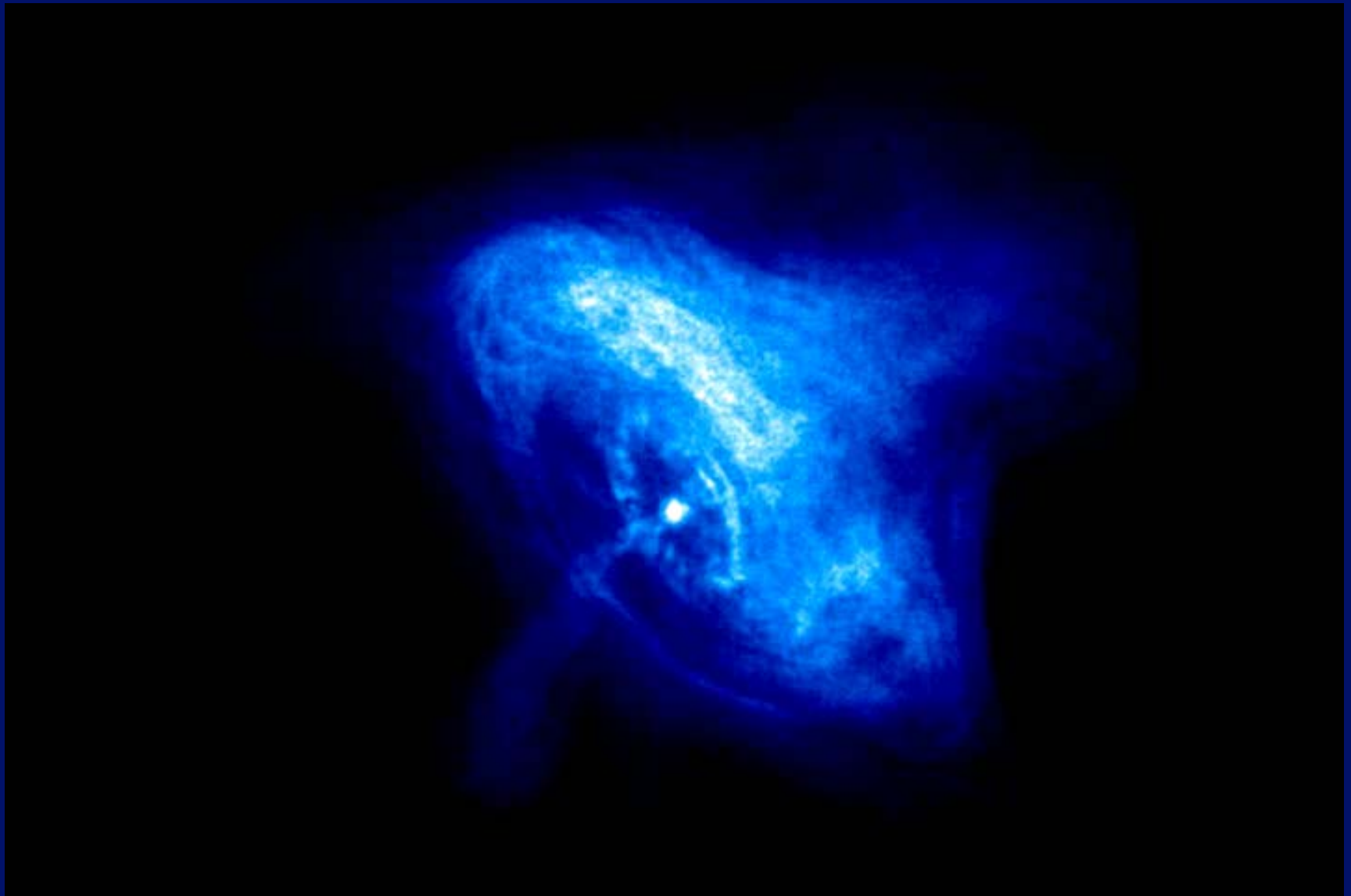
# The Crab Pulsar – Spectral Variation with Pulse Phase



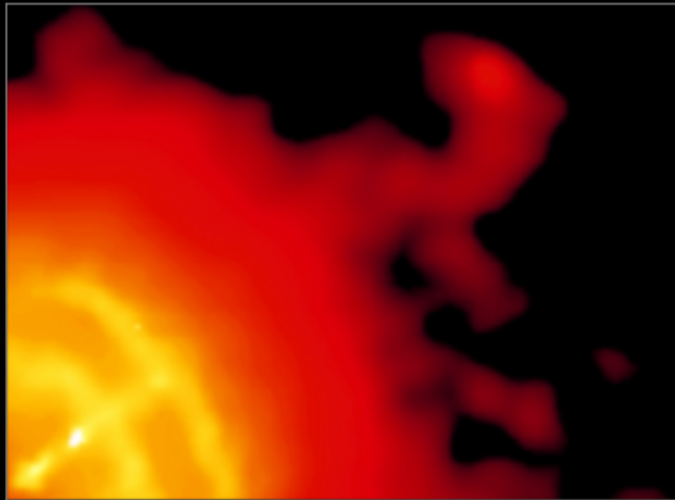
# The Crab Pulsar – Thermal Component?



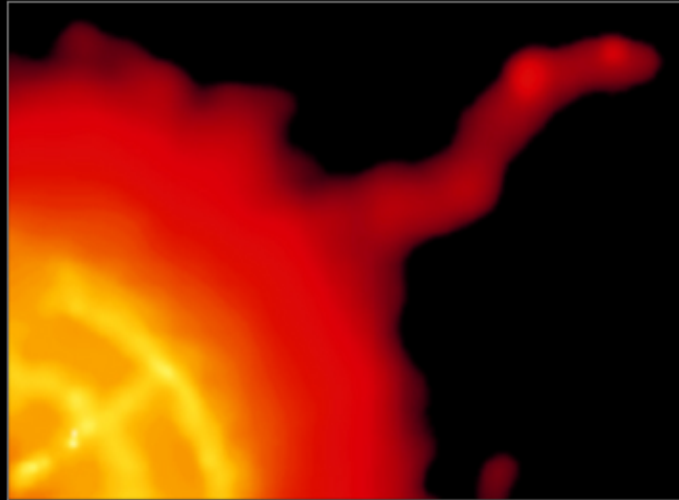
# The Crab Pulsar – Dynamical Effects



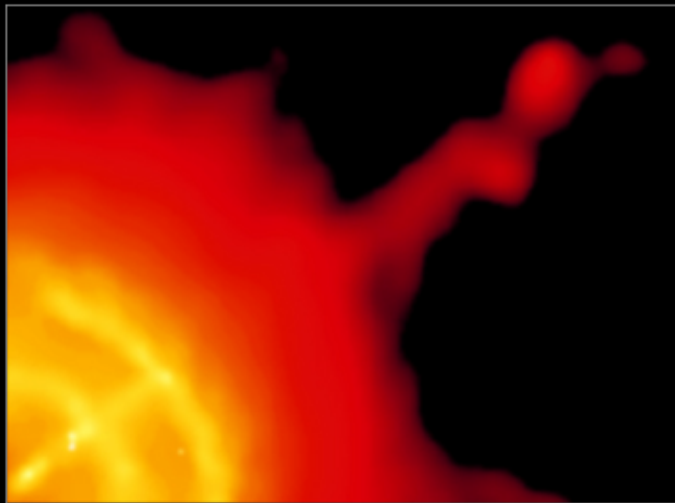
# The Vela Pulsar and its Jet



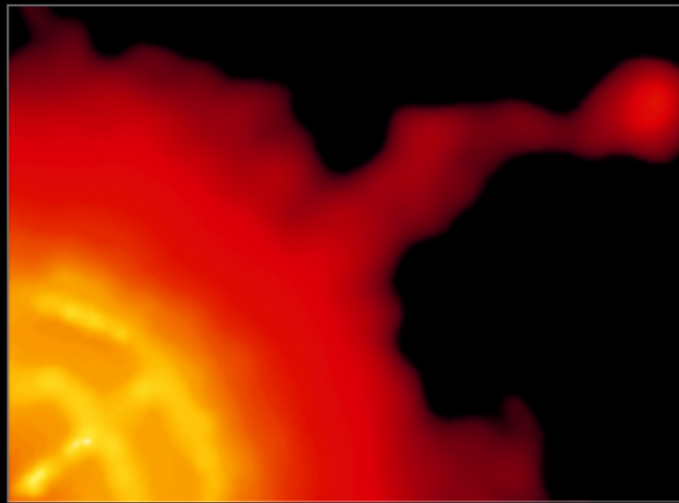
2000 Nov 30



2001 Dec 11

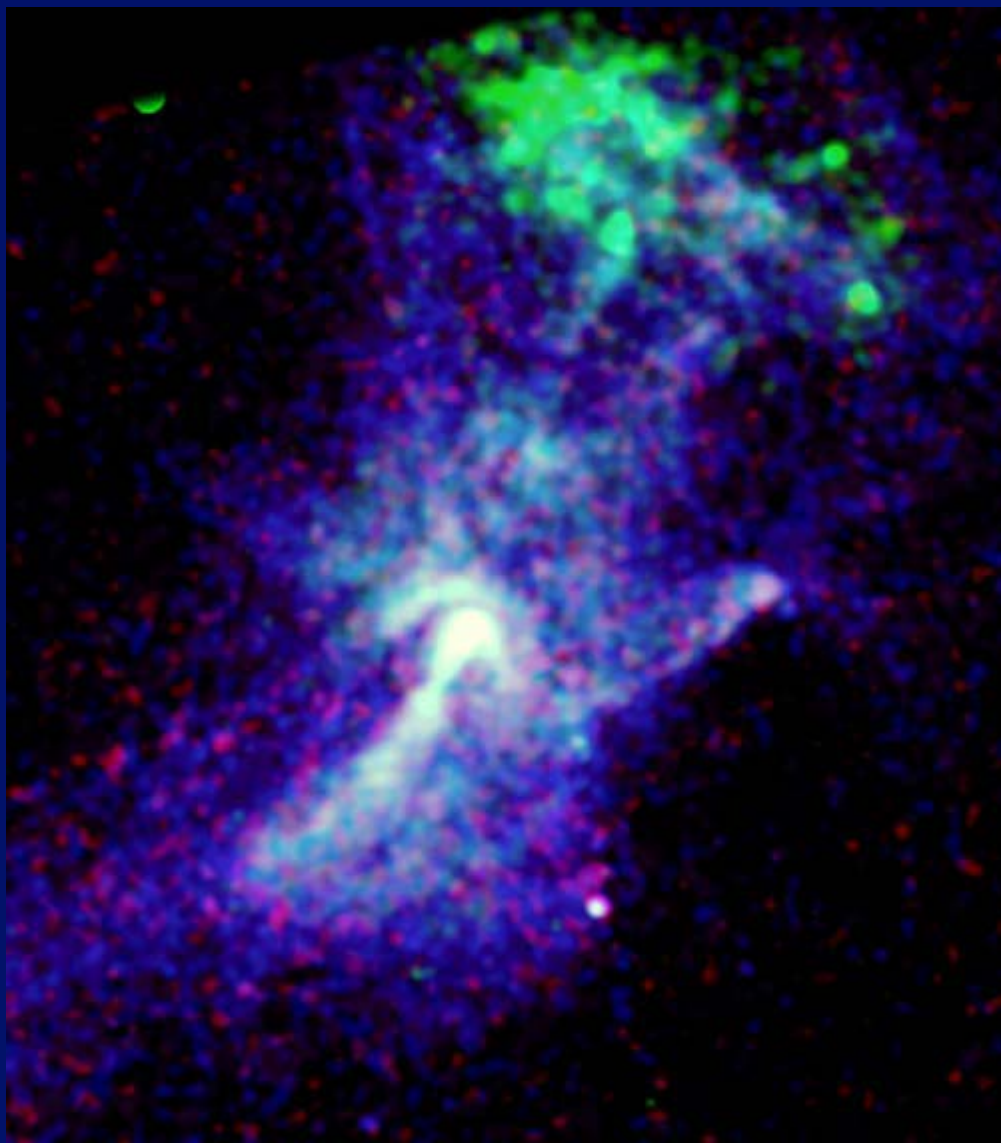


2001 Dec 29



2002 Apr 03

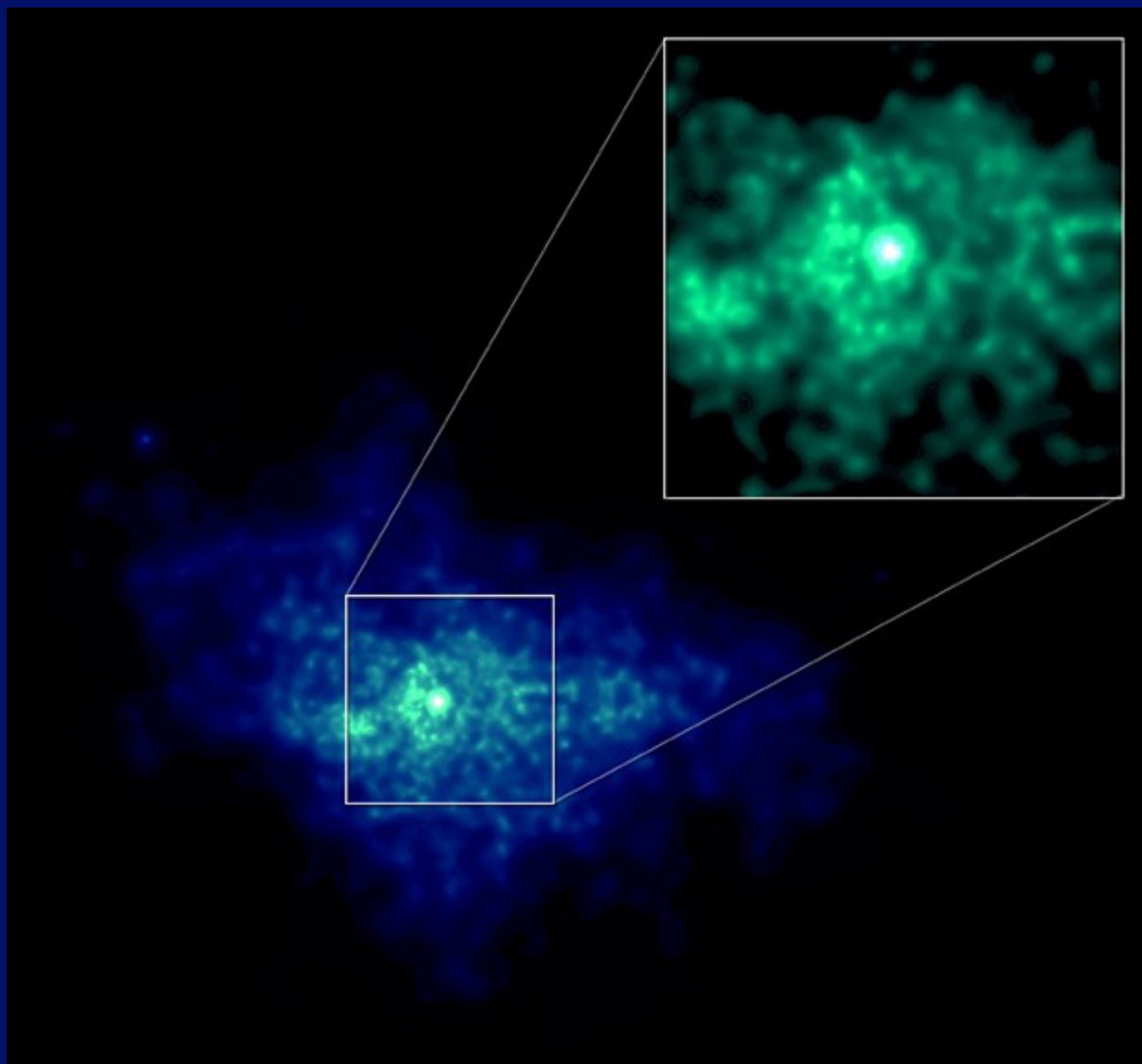
B1509-58 in SNR 230.4-1.2



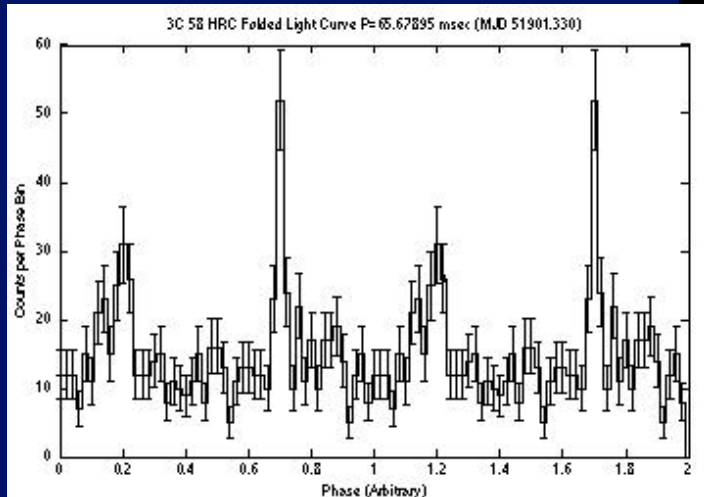
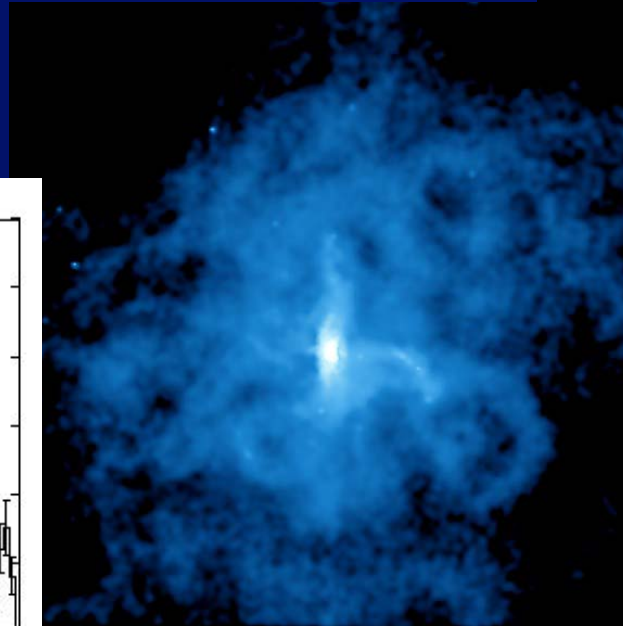
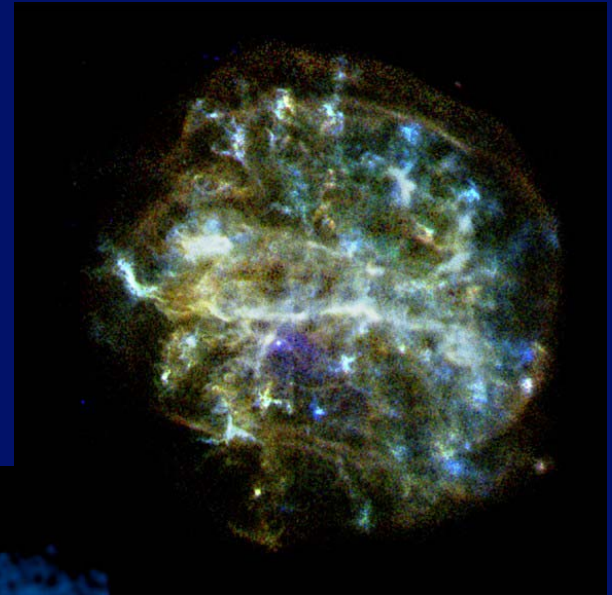
Gaensler et al. 2002



SNR  $54.1 \pm 0.3$

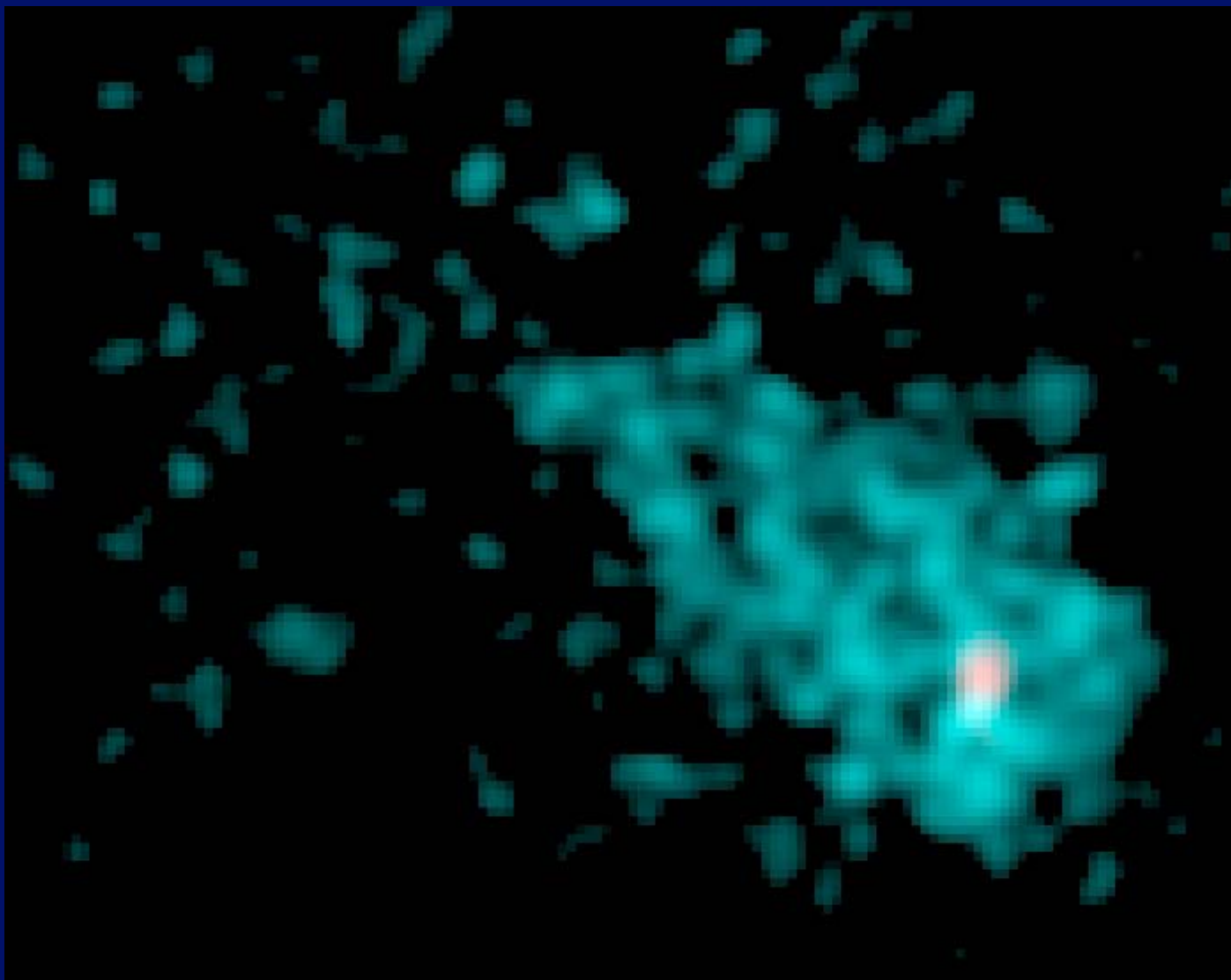


# SNR 292.0-1.8 & 3C58



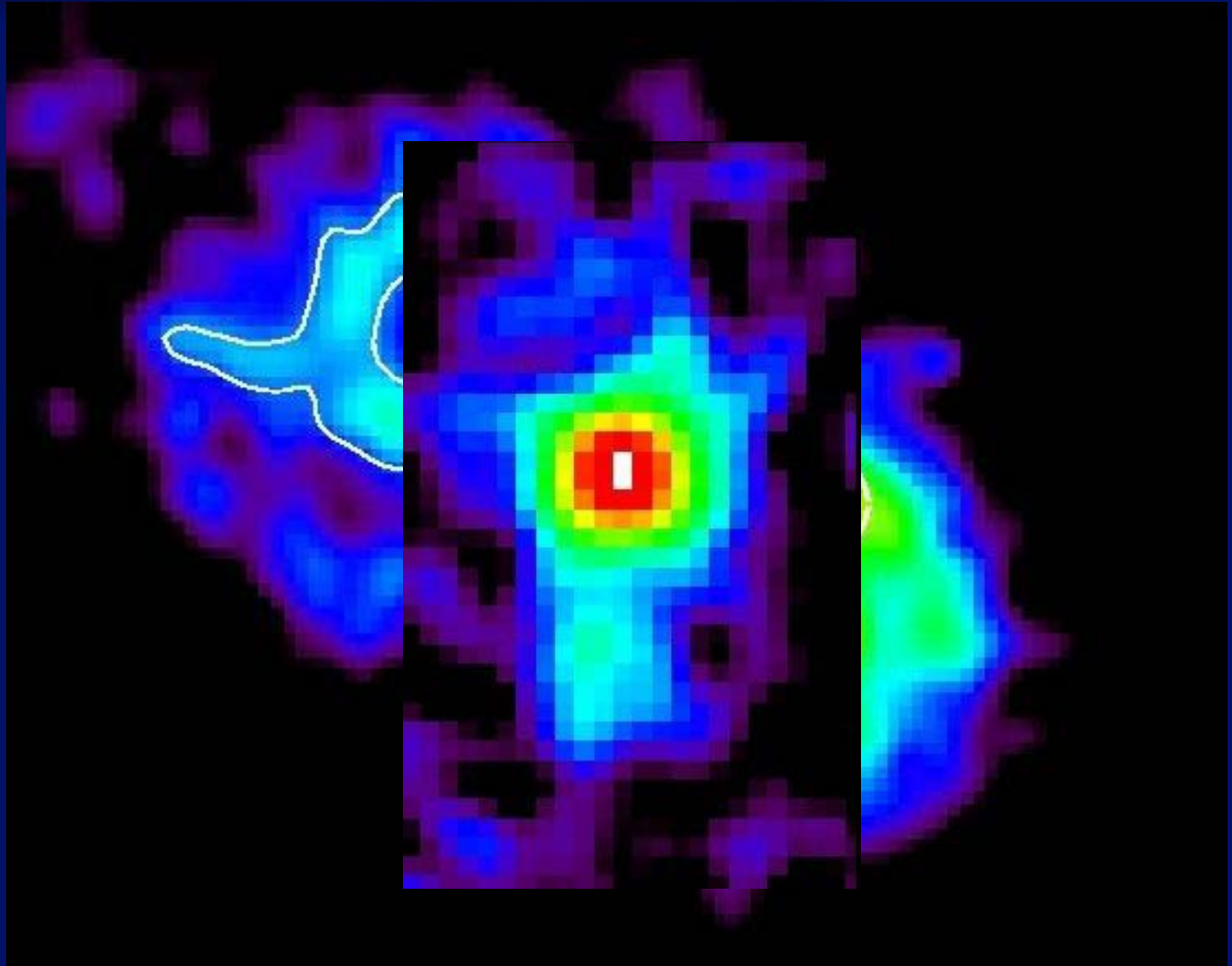
(3C58) Murrey et al. 2002; (292.0+0.8) Hughes et al. 2001

IC443



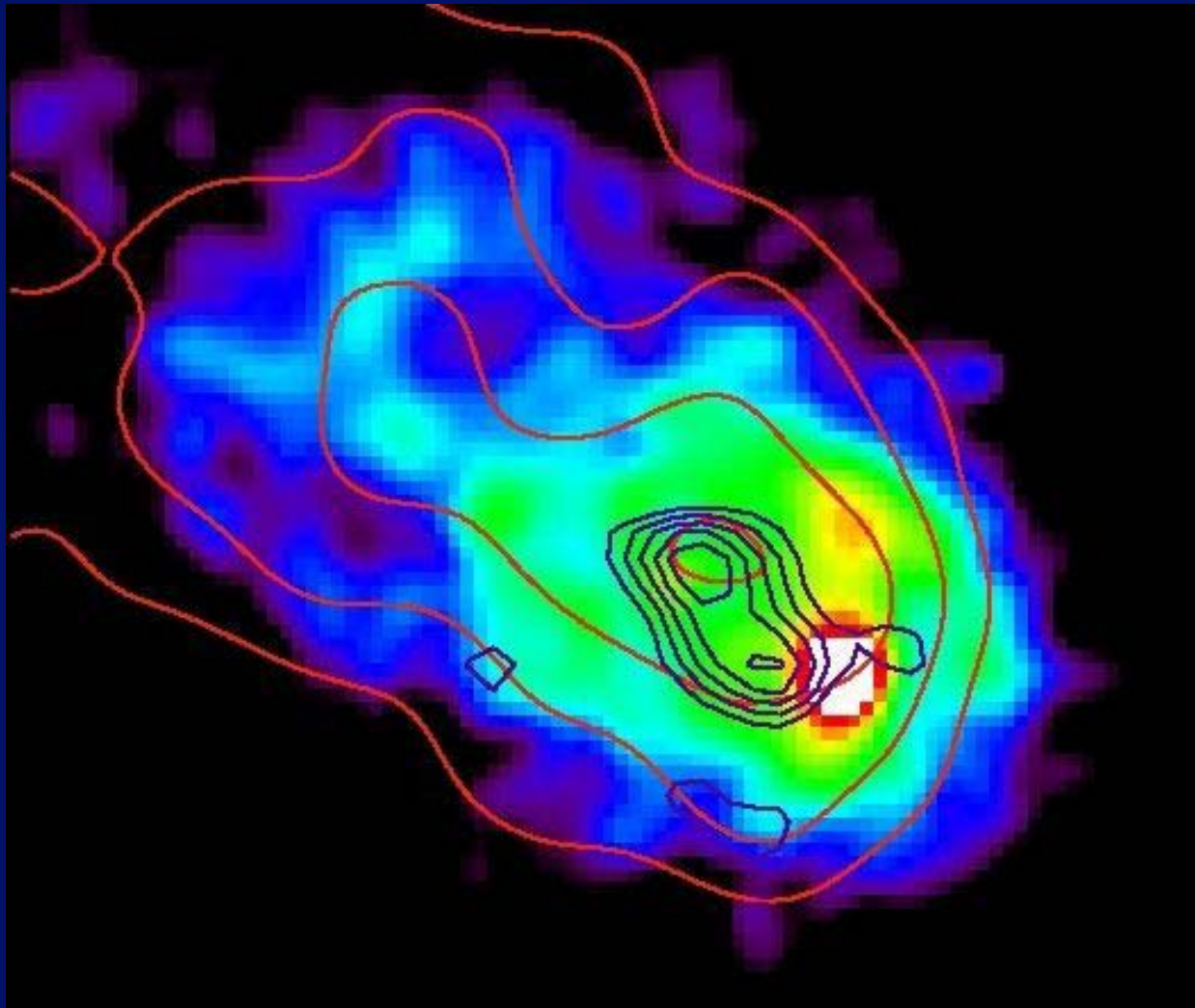
Olbert et al. 2001

# Gallery of PWNe – IC443

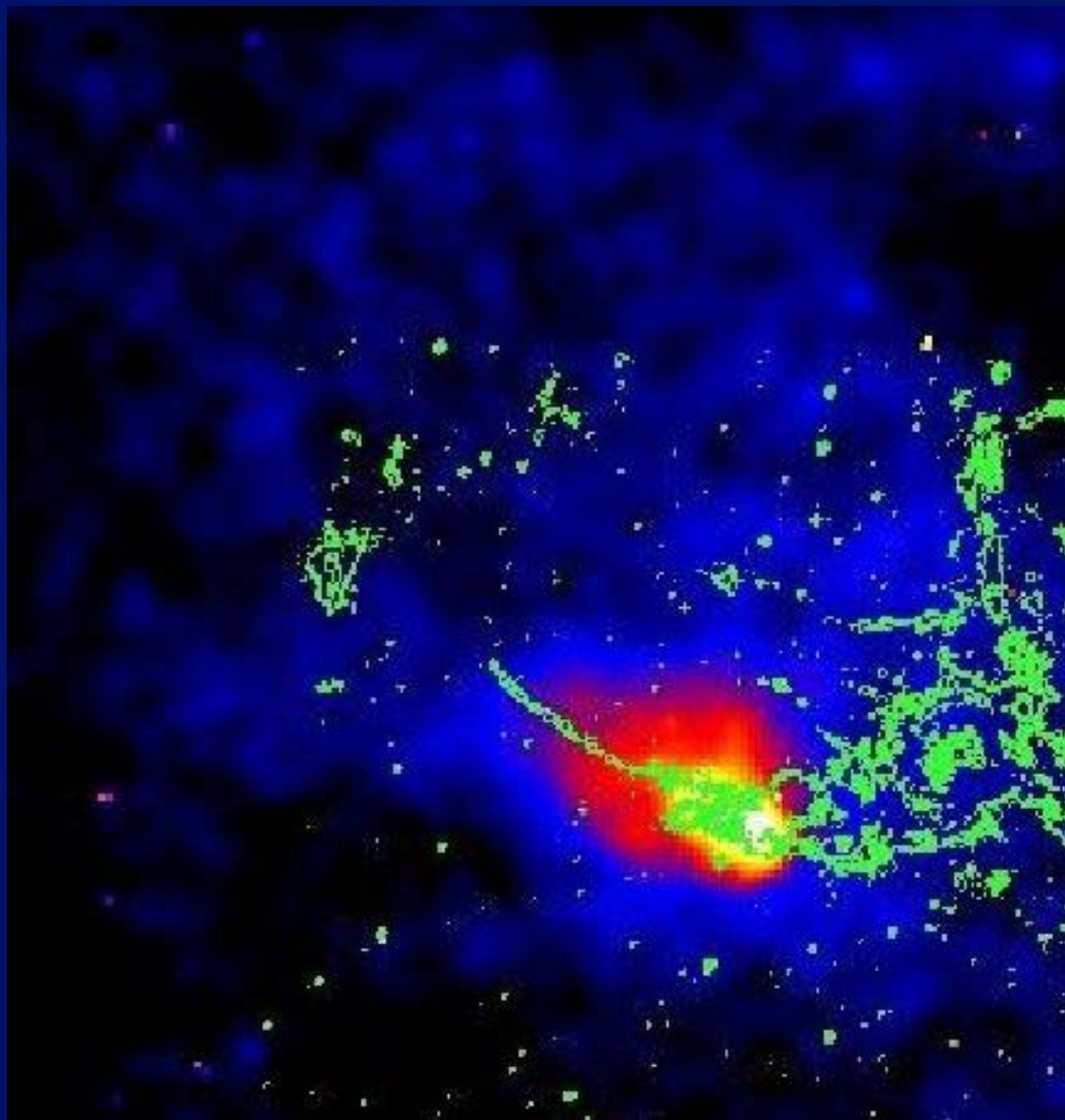


Gaensler et al. 2006

IC443



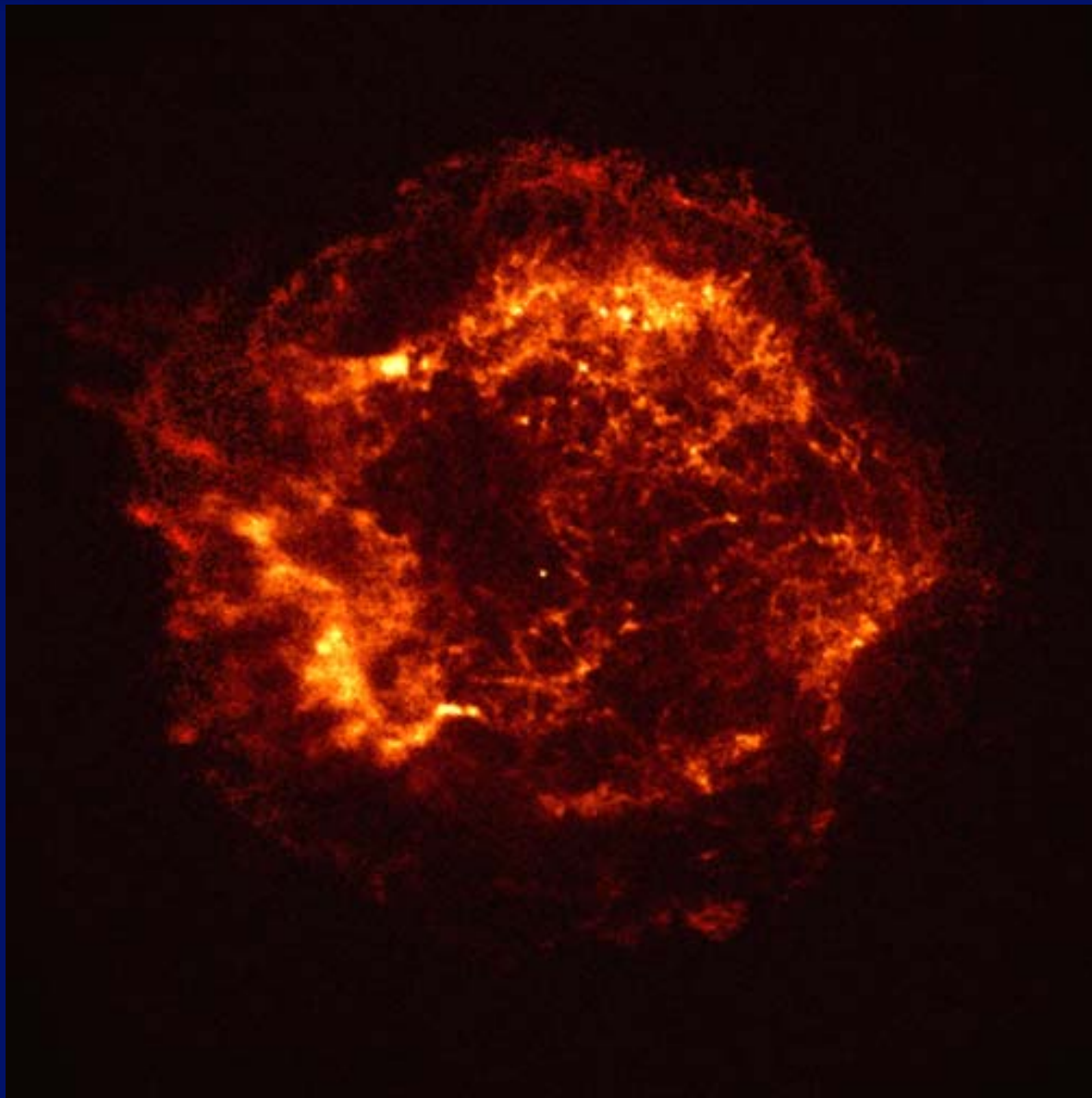
# Gallery of PWNe – IC443



Karovska, Clarke, Pavlov, Weisskopf & Zavlin

# CCOs

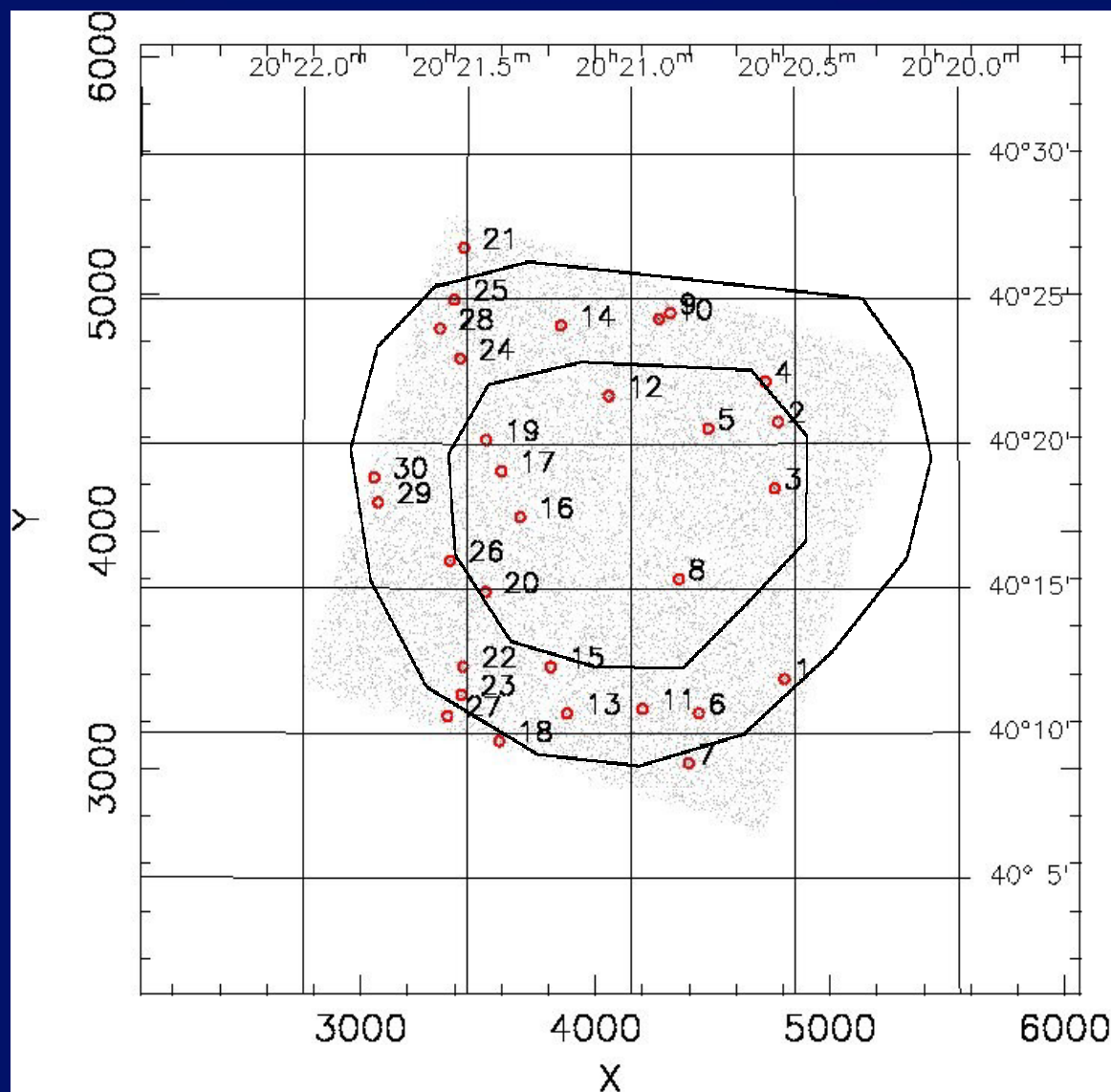
- Associated with SNR
- Radio Quiet
- BB X-ray spectra with  $kT$  about 0.4 keV
- BB radii typically smaller than canonical NS
- Don't pulse?





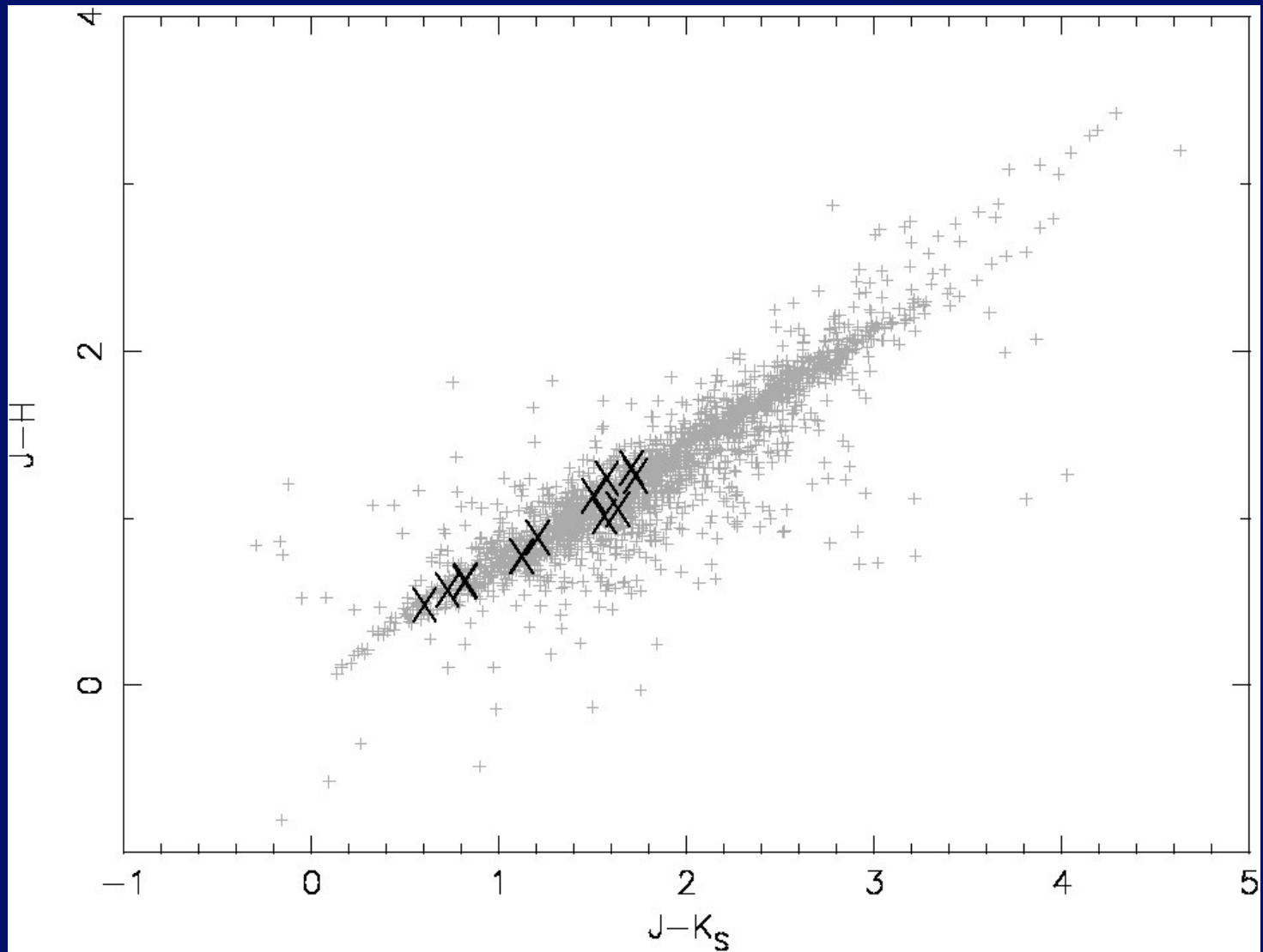
# Not Identifying the Compact Objects in SNR

$\gamma$ -Cygni

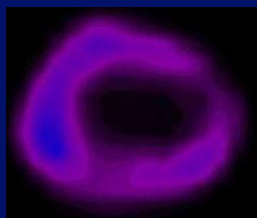


# Not Identifying the Compact Objects in SNR

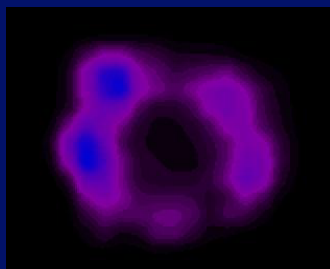
$\gamma$ -Cygni



# SNR1987A



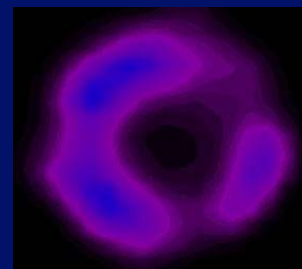
1999-10-06



2000-01-17



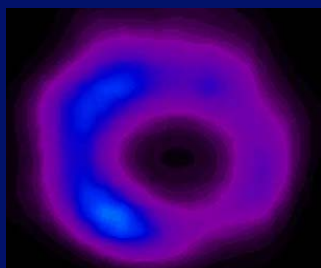
2000-12-07



2001-04-25



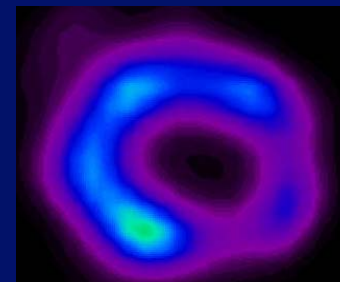
2001-12-12



2002-05-15



2002-12-31



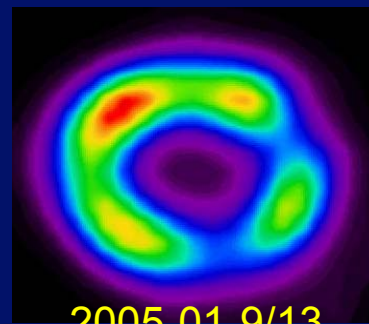
2003-07-08



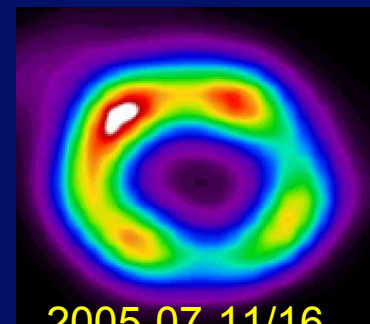
2004-01-02



2004-07-22



2005-01-9/13

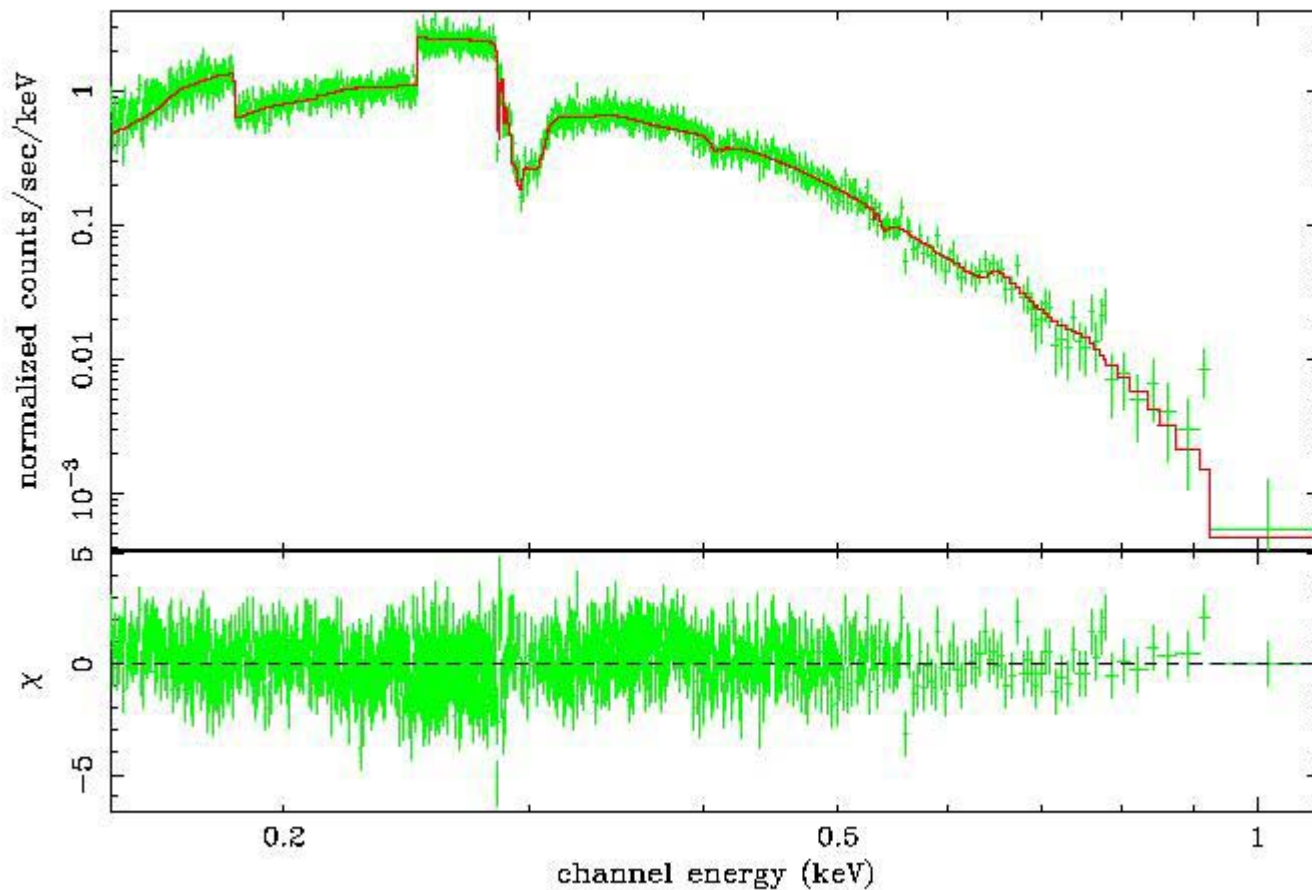


2005-07-11/16

*1 arcsec*

# THE PUZZLING CASE OF RX J1856.5-3754

RXJ1856: all the LETG data (502 ks): BB fit



zavlin 12-Nov-2001 18:38

# THE PUZZLING CASE OF RX J1856.5-3754

- Quark Star?
- High Field Strength ( $10^{13}$  Gauss) NS
  - Trümper et al. (2003)
  - Turolla, Zane & Drake (2004)
- Slowly spinning Magnetar
  - Mori & Ruderman (2003)

# Future prospects

