G120.1+01.4

1 Summary

- Common Name: Tycho's
- Distance: 2.4 kpc (**Chevalier et al., 1980**)
- Center of X-ray emission (J2000): (00 25 19.9, 64 08 18.2)
- X-ray size: 8.7'x8.6'
- Description:

1.1 Summary of Chandra Observations

Sequence	Obs ID	Instrument	$Exposure_{uf}$ (ks)	$Exposure_{f}$ (ks)	Date Observed	Aimpoint (J2000) (α, δ)
500002	115	ACIS-235678	48.4	48.4	2000-09-20	(00 25 27.6, 64 09 14.7)

$Exposure_{uf} \rightarrow$ Exposure time of un-filtered event file
$Exposure_{f} \rightarrow$ Exposure time of filtered event file

- Images are incomplete (ACIS-S3 covers most of the remnant while some easten part is covered by ACIS-S2.)
- No background light-curve filtering.

1.2 Chandra Counts and Fluxes

Region	Energy Range (keV)	Signal (counts)	Rate (counts s^{-1})	F_x^{abs} (ergs cm^{-2} s^{-1})	F_x (ergs cm^{-2} s^{-1})	L_x (ergs s^{-1})
total?	0.3 - 10.0	4.691e+06	9.697e+01	5.12e-10	1.99e-09	1.37e+36
(115)	0.3 - 2.1	4.055e+06	8.382e+01	3.01e-10	1.76e-09	1.21e+36
	2.1 - 10.	6.425e+05	1.328e+01	2.12e-10	2.36e-10	1.62e+35

- N_H = 0.63 ($10^{22} cm^{-2}$)
- Assumed distance: 2.4 kpc (**Chevalier et al., 1980**)

- nH was derived by fitting the low energy spectum with one thermal plsama model.
- Flux value given above is NOT from whole SNR.

1.3 Nearby Sources

Obs ID	Position (J2000)	Size	Net Count	Count rate	Note
115					
	(00 24 29.9, 64 09 03.1)	$<$ 3.8"	48.4	1.00e-03	
	(00 24 37.1, 64 10 59.4)	$<$ 2.7"	70.6	1.46e-03	
	(00 24 40.7, 64 20 32.1)	$<$ 16.2"	414.0	8.56e-03	
	(00 24 51.4, 64 17 25.3)	$<$ 8.7"	71.2	1.47e-03	
	(00 24 52.5, 64 11 32.5)	$<$ 2.7"	14.7	3.04e-04	
	(00 25 02.5, 64 13 51.4)	$<$ 3.3"	33.4	6.90e-04	
	(00 25 58.0, 64 19 49.1)	$<$ 20.1"	39.0	8.06e-04	
	(00 26 21.5, 64 12 11.4)	$<$ 12.6"	130.0	2.69e-03	

```
(note) 1. This nearby source list is incomplete.
          All the above sources are originally from the "src2.fits" file
              which is distributed with standard chandra processing.
          Only sources with significant count rate and which are clear to
          visual inspection are included.
       2. The size given above is the size of the region used in detecting
          that source.
       3. For each source, background was subtracted from annular region
          around the source.
```

1.4 References

- Chevalier et al., 1980 ApJ, 235, 186 : Optical spectrum
- Reynoso et al., 1997 ApJ, 491, 816 : VLA

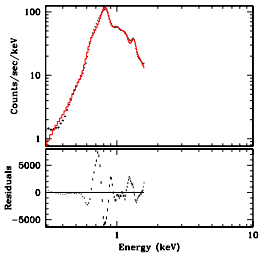
2 Fit Detail

- See spectrum page for used regions.

2.1 Total:

- soft energy region(0.3-1.6keV) was fitted with thermal plasma model
- Abundance of O, Ne, Mg, Fe were thawed and abundance of other O-like element were set to 0.

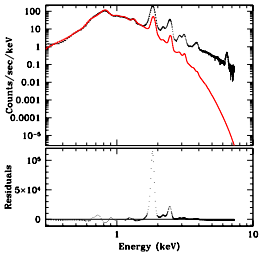
source=(xswabs * xsvapec)
reduced χ^2 = 115.712
nh = `0.6348 10^22/cm^2`



2.2 Total:

- Same as above, showing all the energy range

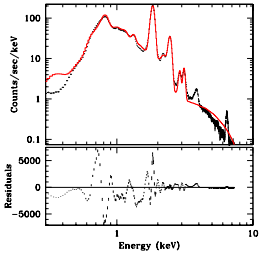
source=(xswabs * xsvapec)
reduced χ^2 = 2662.81
nh = `0.6348 10^22/cm^2`



2.3 Total:

- Addition to above model, several gaussian and a power model were added.

source=(xswabs * ((((((xsvapec + gauss1d) + gauss1d) + gauss1d) + gauss1d) + gauss1d) + powlaw1d))
reduced χ^2 = 98.8075
nh = `0.6348 10^22/cm^2`

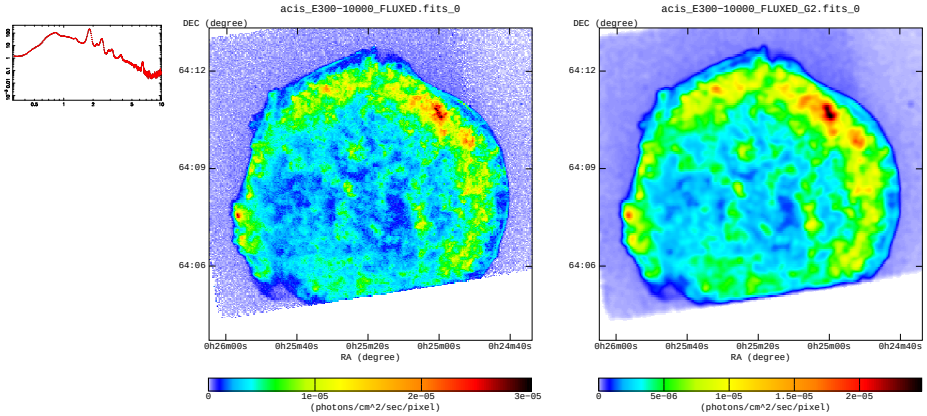


3 Chandra Images : Band Images

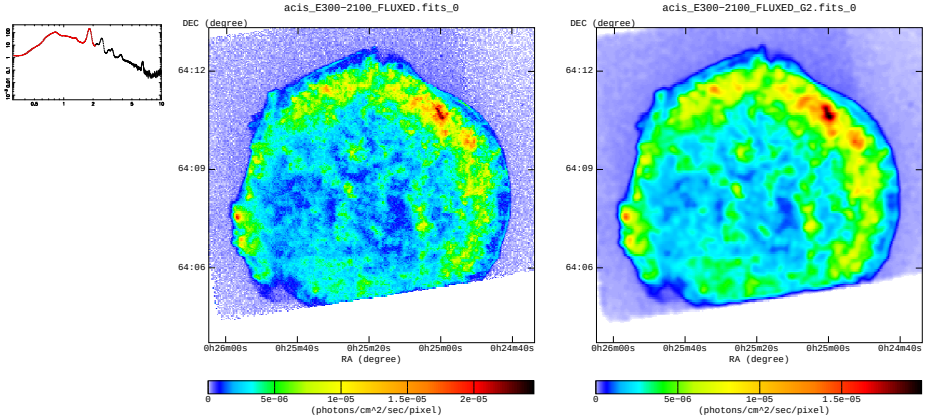
- Left : raw image, binned by 1x1 pixel
- Right : gaussian smoothed version of above (σ = 2 pixel)

3.1 Wide Band Images

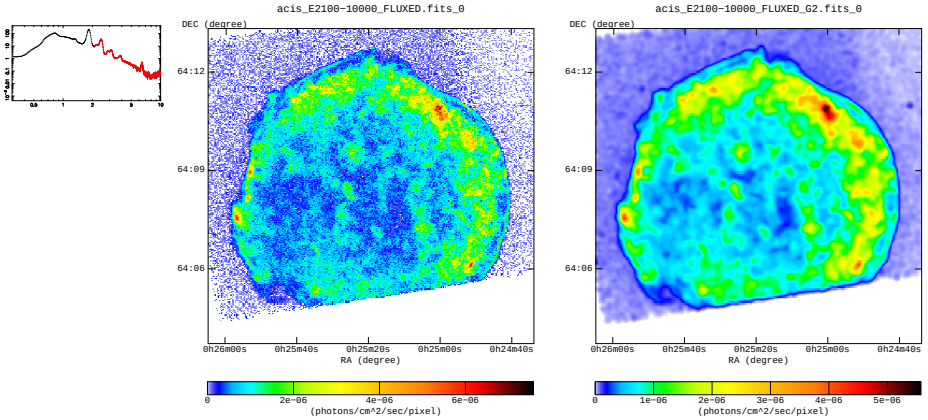
Total : 300-10000 eV



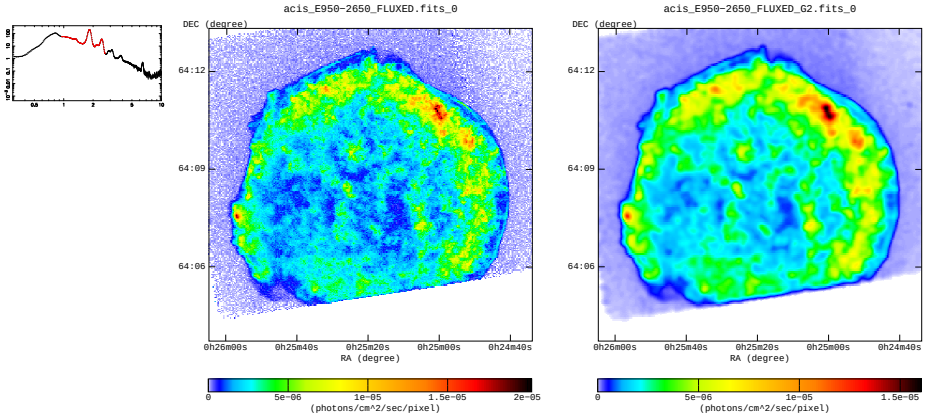
Soft Band : 300-2100 eV



Hard Band : 2100-10000 eV

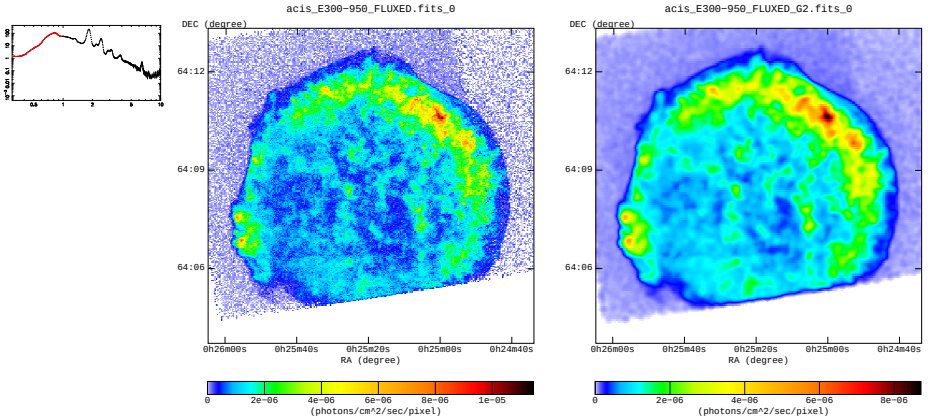


Green : 950-2650 eV

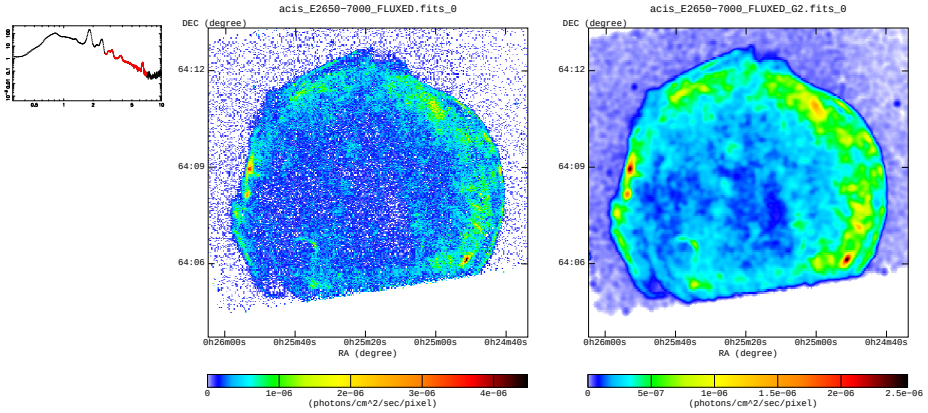


3.2 Band images used in true color image.

Red : 300-950 eV

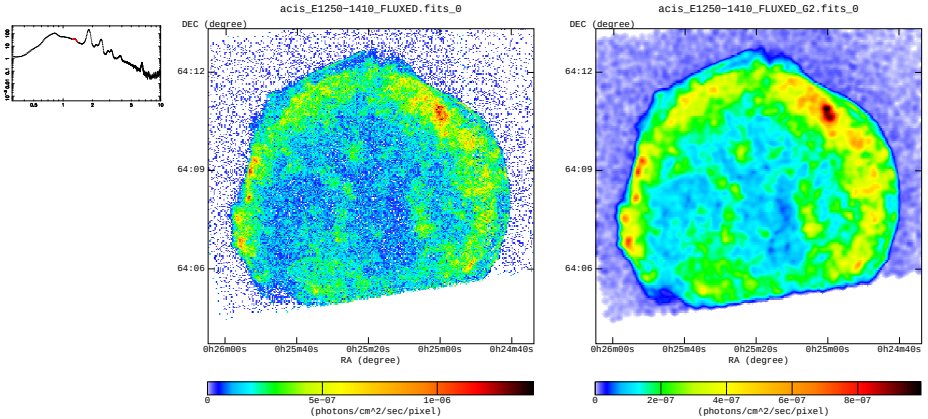


Blue : 2650-7000 eV

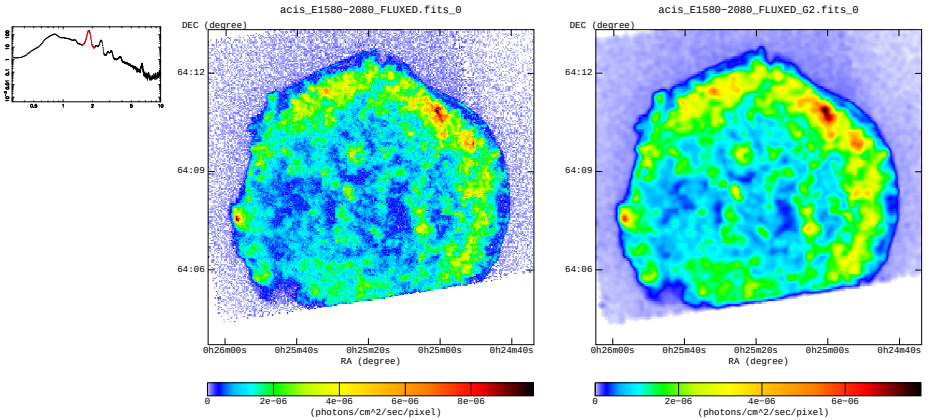


3.3 Misc.

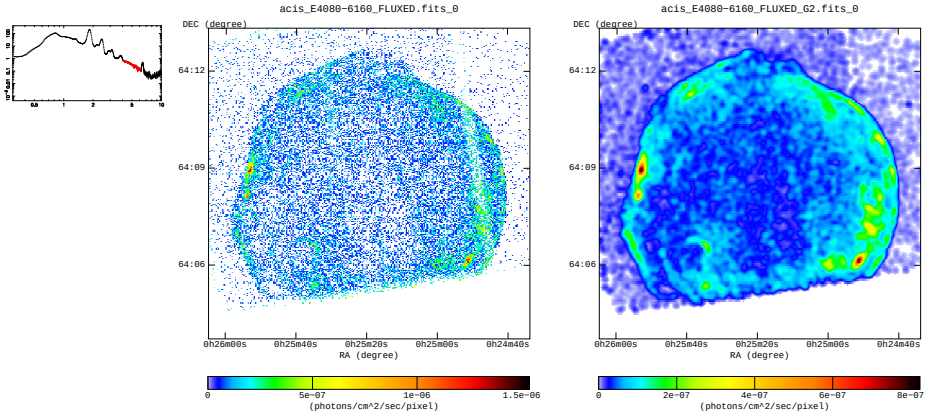
: 1250-1410 eV



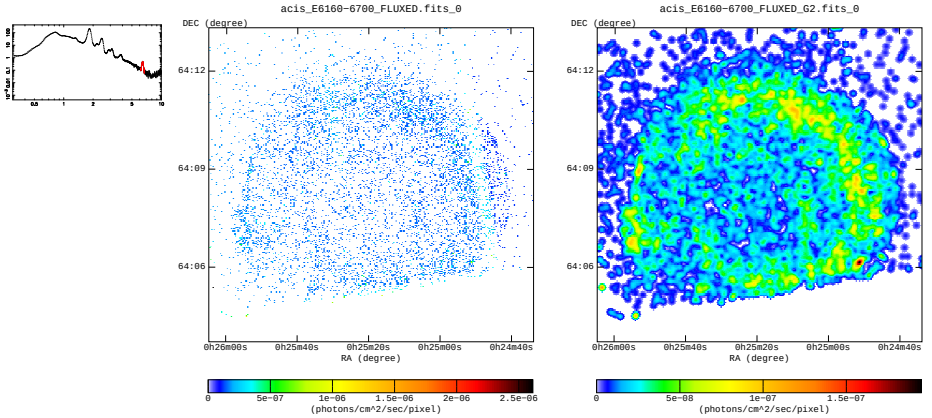
: 1580-2080 eV



: 4080-6160 eV



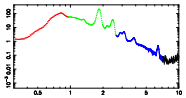
: 6160-6700 eV

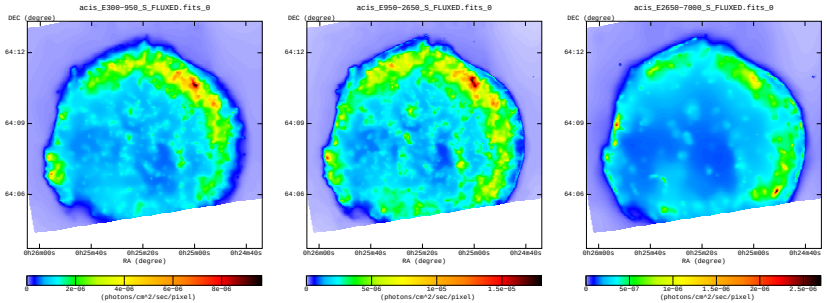


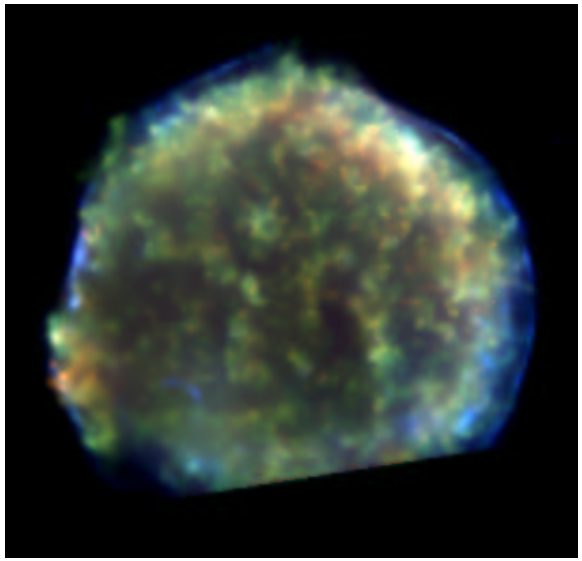
4 Chandra Images : True Color

- Individual images are adaptively smoothed.
- Warning : the adaptive smoothing process sometimes produces artifacts.
- convolution method : fft
- kernel type : gauss
- significance (min , max) : (3 , 5)

RED : 300-950 eV
GREEN : 950-2650 eV
BLUE : 2650-7000 eV







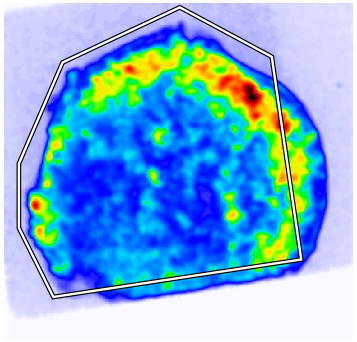
5 Chandra Spectrum

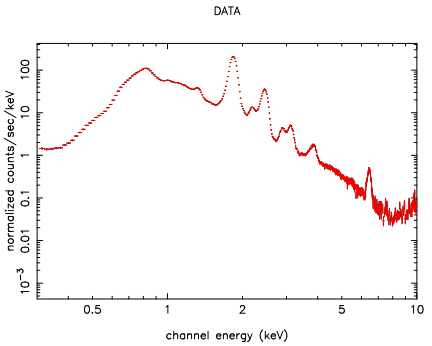
- Images show Regions used to extract spectra
- Regions with red strikes are excluded

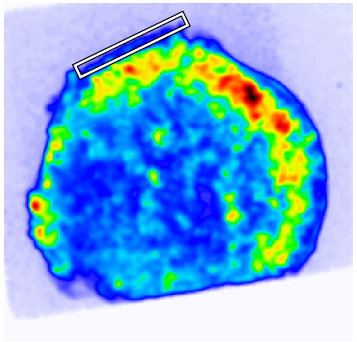
5.1 ObsID 115

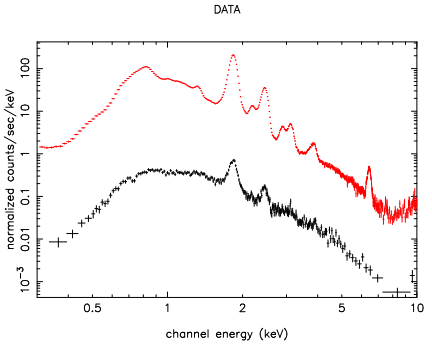
- Background was subtracted from the region around the SNR.

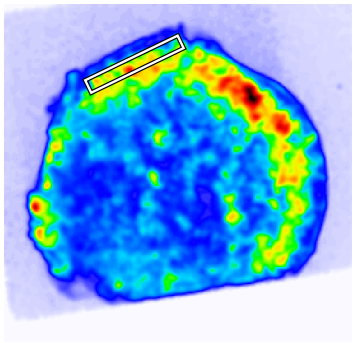
total?

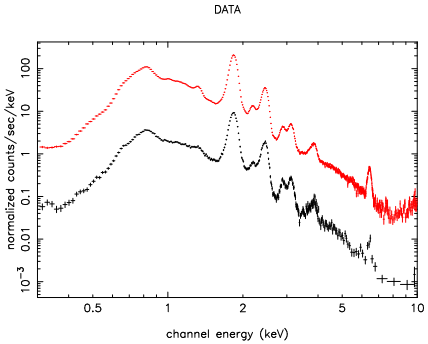


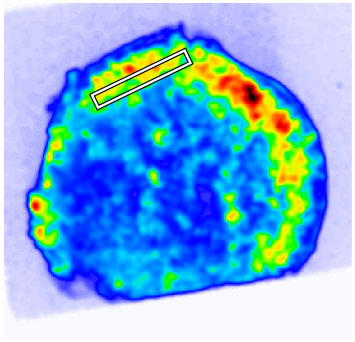


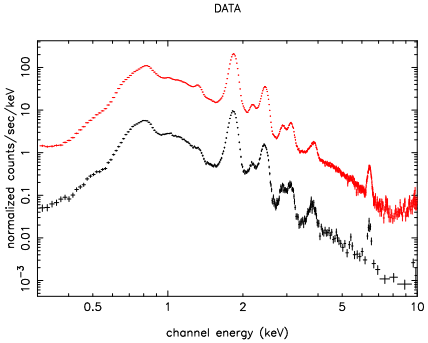


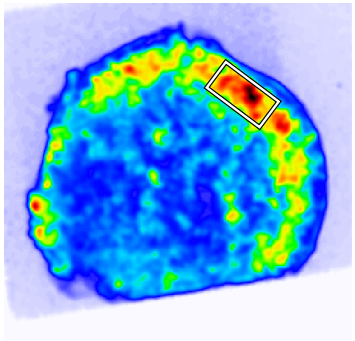


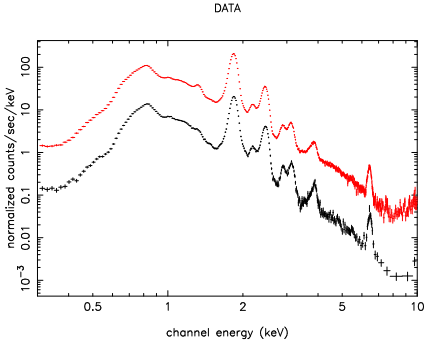


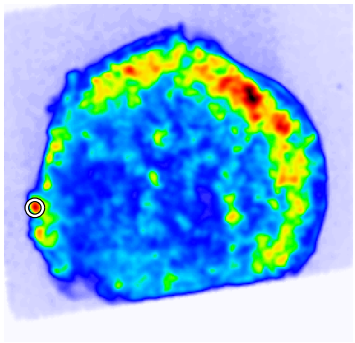

DATA
normalized counts/sec/keV
channel energy (keV)

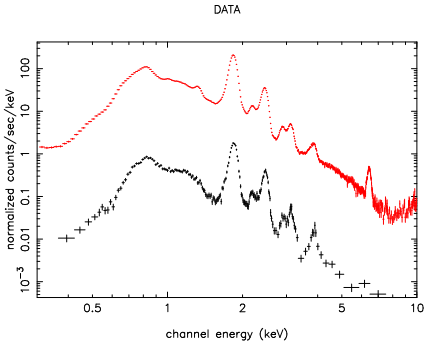



DATA
normalized counts/sec/keV
channel energy (keV)




DATA
normalized counts/sec/keV
channel energy (keV)



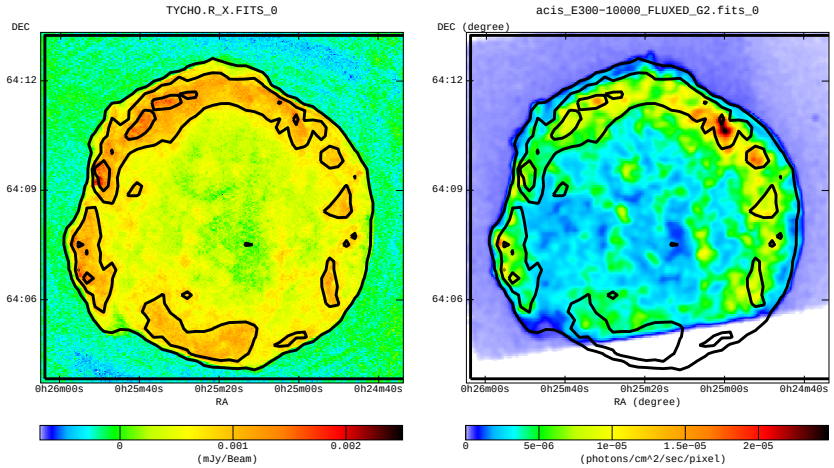

DATA
normalized counts/sec/keV
channel energy (keV)

6 Radio Image

- left : radio image
- right : chandra x-ray image with radio contour lines

1.375 GHz

-. Image from **Reynoso et al.(1997)**
-. 1 GHz flux density: 56 Jy (citepGREEN2001)

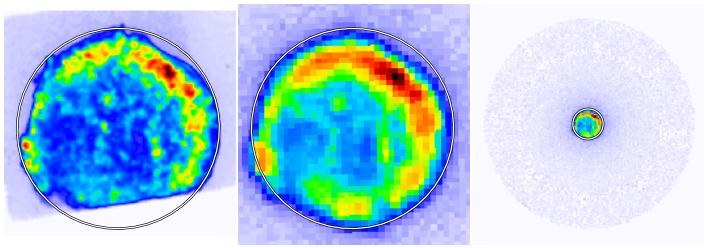


Summary of Observation	
Telescope	VLA
Date	1994 Mar, Aug, Dec, 95 May
Frequency	1.375 GHz
Beam size	1.45x1.38”
1 sigma noise ..	0.14 mJy / beam

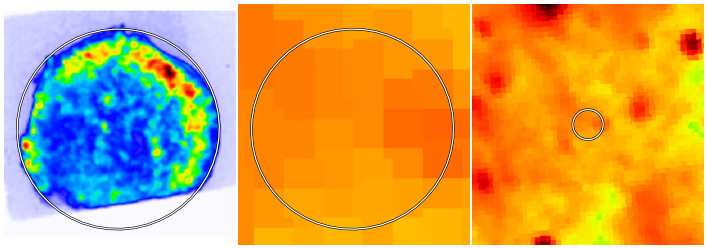
7 Images from Survey Missions

- Left : Chandra Image (0.3-10. keV)
- Center : Images from *SkyView* with the **same** scale
- right : Images from *SkyView* with a **reduced** scale

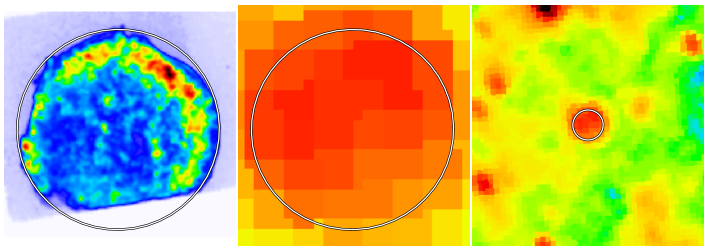
ROSAT PSPC (1.0 deg): X-ray (0.1-2.4 keV)



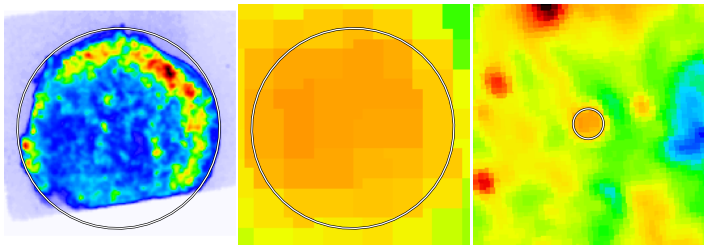
IRAS 12 micron: Infrared (12 micron)



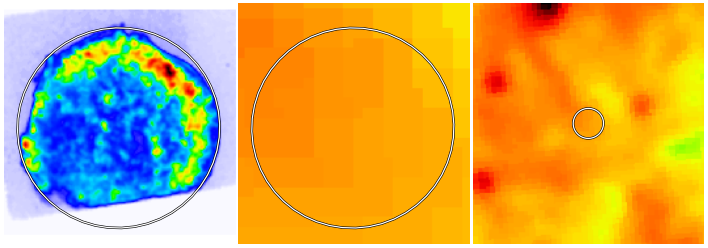
IRAS 25 micron: Infrared (25 micron)



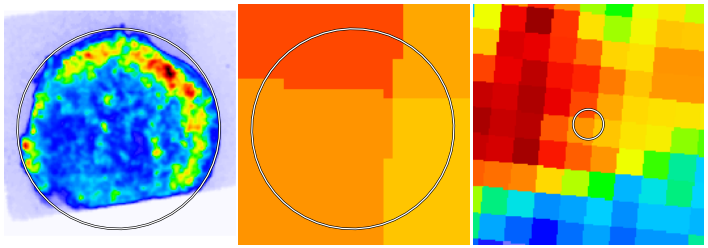
IRAS 60 micron: **Infrared (60 micron)**



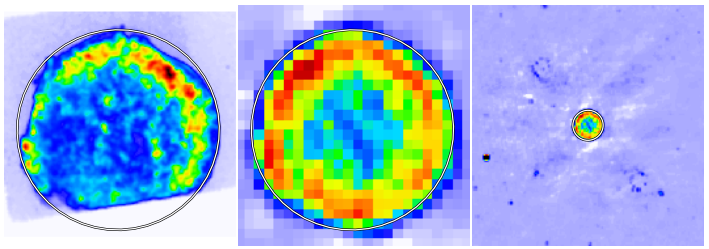
IRAS 100 micron: **Infrared (100 micron)**



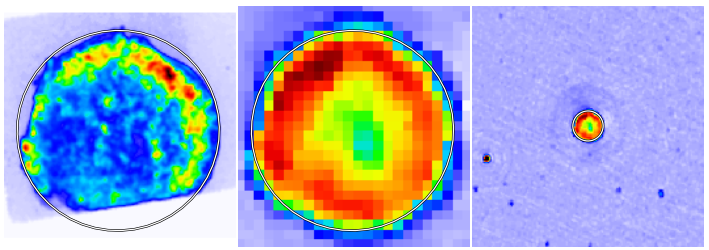
CO survey: **Radio (115 GHz)**



NRAO VLA Sky Survey (NVSS): **Radio (1.4 GHz Continuum)**



Westerbork Northern Sky Survey (WENSS): **Radio (325 MHz Continuum)**



Digitized Sky Survey: **Optical (J or E band images with a few exceptions)**