G004.5+06.8

1 Summary

- Common Name: Kepler's SNR
- Distance: 5 kpc (**Reynoso and Goss, 1999**)
- Position of Central Source (J2000): (17 30 41.2, -21 29 32.2)
- X-ray size: 4.5'x3.7'
- Description:

1.1 Summary of Chandra Observations

Sequence	Obs ID	Instrument	$Exposure_{uf}$ (ks)	$Exposure_{f}$ (ks)	Date Observed	Aimpoint (J2000) (α, δ)
500003	116	ACIS-012367	48.8	35.3	2000-06-30	(17 30 41.0, -21 29 17.0)

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

- The whole remnant is covered by chip ACIS-S3(CCD_ID=7)

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	1.696e+06	4.799e+01	1.65e-10	6.85e-10	2.04e+36
(116)	0.3 - 2.1	1.613e+06	4.564e+01	1.27e-10	6.44e-10	1.92e+36
	2.1 - 10.	8.382e+04	2.371e+00	3.82e-11	4.13e-11	1.23e+35

- N_H = 0.52 ($10^{22} cm^{-2}$)
- Assumed distance: 5 kpc (**Reynoso and Goss, 1999**)
- nH was derived with two thermal plasma model

1.3 Nearby Sources

Obs ID	Position (J2000)	Size	Net Count	Count rate	Note
116					
	(17 29 52.7, -21 35 05.1)	< 23.1"	73.3	1.50e-03	
	(17 29 53.8, -21 35 33.4)	< 22.8"	28.7	5.88e-04	
	(17 29 55.1, -21 32 12.9)	< 18.5"	44.5	9.11e-04	
	(17 30 04.0, -21 35 53.2)	< 14.1"	23.9	4.89e-04	
	(17 30 09.3, -21 30 24.3)	< 7.3"	23.2	4.75e-04	
	(17 30 21.5, -21 37 30.6)	< 10.6"	42.2	8.64e-04	
	(17 30 22.0, -21 33 34.4)	< 5.0"	35.6	7.29e-04	
	(17 30 27.9, -21 31 42.5)	< 2.1"	358.0	7.33e-03	
	(17 30 34.3, -21 32 38.8)	< 2.3"	45.3	9.28e-04	
	(17 30 34.3, -21 37 24.9)	< 7.7"	247.0	5.06e-03	
	(17 30 34.9, -21 33 44.4)	< 2.4"	428.0	8.77e-03	
	(17 30 36.6, -21 33 31.9)	< 2.1"	76.5	1.57e-03	
	(17 30 37.0, -21 31 29.8)	< 1.1"	16.0	3.28e-04	
	(17 30 38.1, -21 24 02.9)	< 6.4"	170.0	3.48e-03	
	(17 30 39.2, -21 38 21.0)	< 8.4"	68.0	1.39e-03	
	(17 30 39.4, -21 32 36.5)	< 1.8"	63.5	1.30e-03	
	(17 30 40.8, -21 35 55.3)	< 5.0"	50.4	1.03e-03	
	(17 30 43.3, -21 32 19.7)	< 3.0"	26.1	5.35e-04	
	(17 30 51.2, -21 25 14.6)	< 6.4"	136.0	2.79e-03	
	(17 30 52.6, -21 38 16.4)	< 10.7"	125.0	2.56e-03	
	(17 30 59.8, -21 26 30.7)	< 6.3"	71.3	1.46e-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.
```

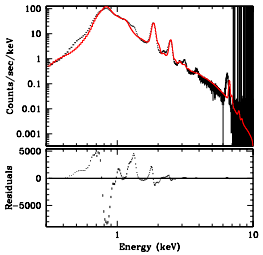
1.4 References

- Kinugasa and Tsunemi, 1999 PASJ, 51, 239 : ASCA
- Reynoso and Goss, 1999 AJ, 118, 926 : VLA at 1.4 GHz (23"x13") for HI studies

2 Fit Detail

- See spectrum page for used regions.

2.1 Total:



- Two thermal plasma model
- Abundance of O-like element set to 0 assuming Type Ia SN.
- Abundance of Si and S are thawed and linked between two component.
- **Kinugasa and Tsunemi(1999)** gives value between 0.51 and 0.63

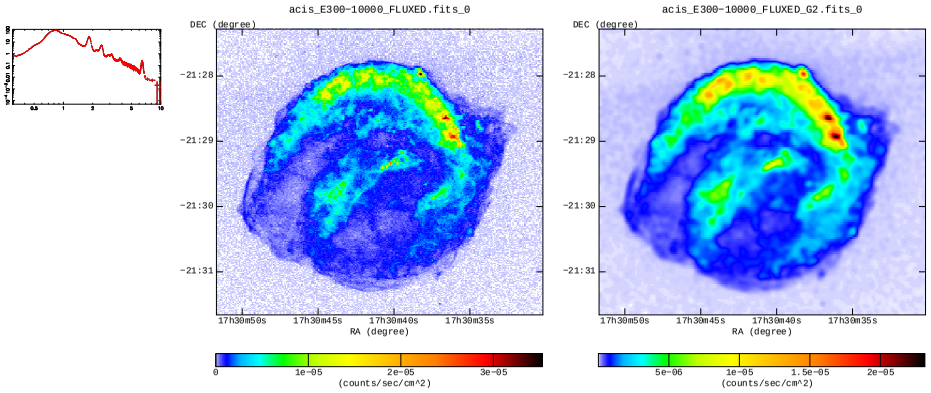
source=(xswabs * (xsvapec + xsvapec))
reduced χ^2 = 88.3319
nh = `0.5198 10^22/cm^2`

3 Chandra Images : Band Images

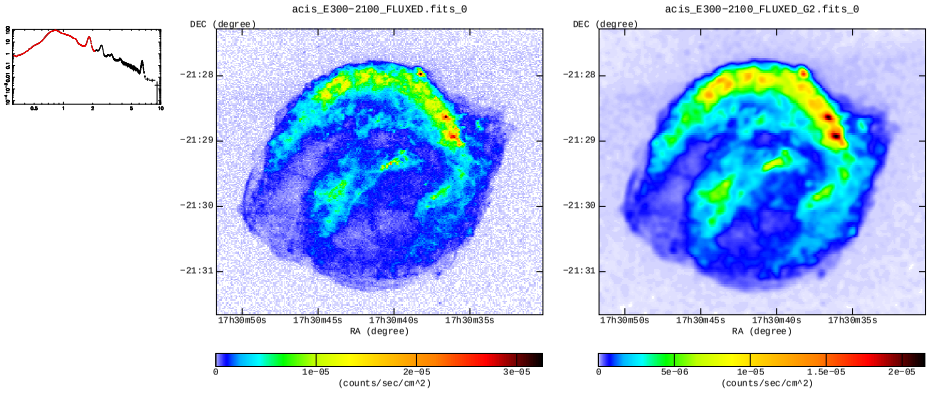
- Left : raw image, binned by 1x1 pixel
- Right : gaussian smoothed version of above (σ = 2 pixel)

3.1 Wide Band Images

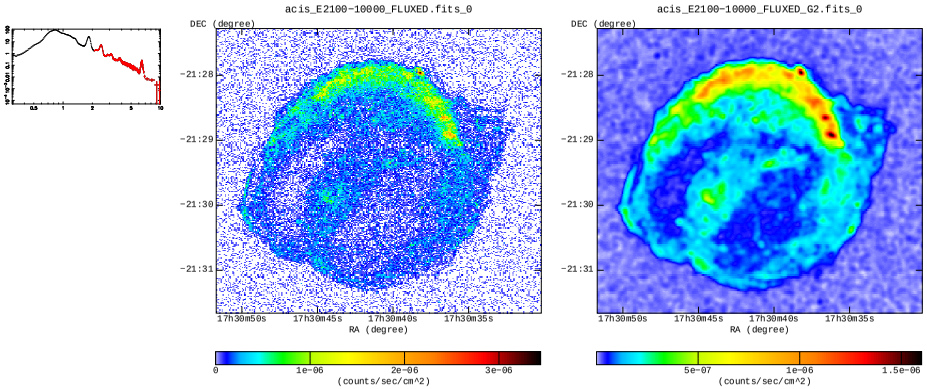
Total : 300-10000 eV



Soft Band : 300-2100 eV

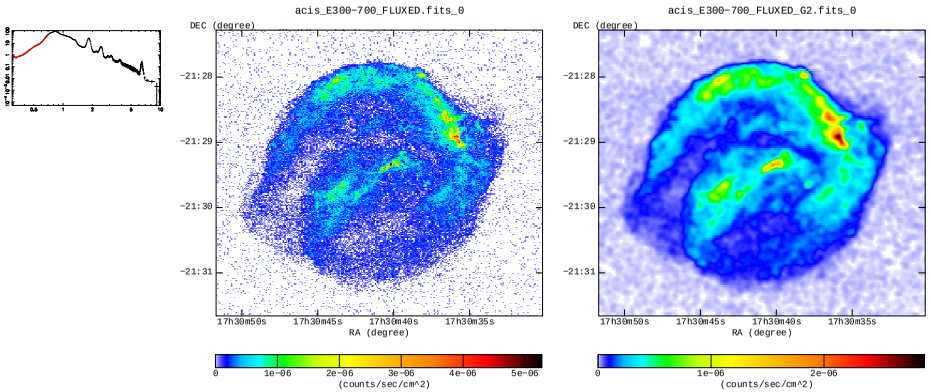


Hard Band : 2100-10000 eV

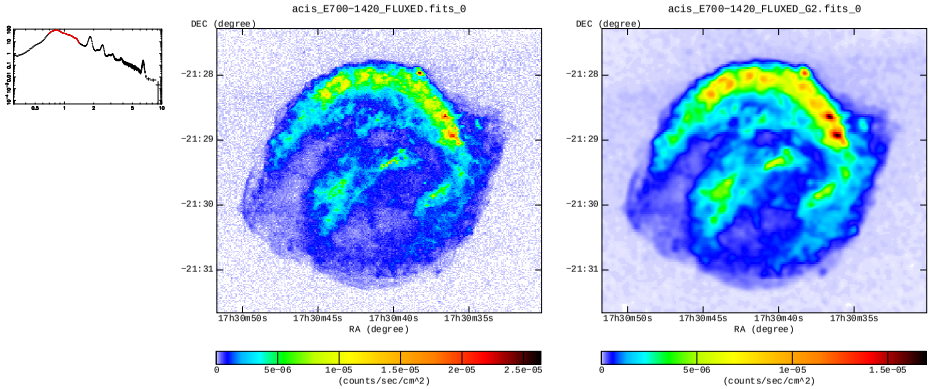


3.2 Band images used in true color image.

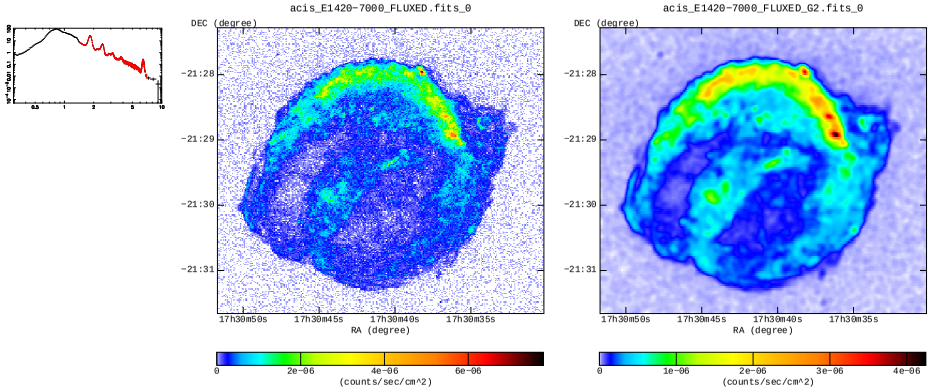
Red : 300-700 eV



Green : 700-1420 eV

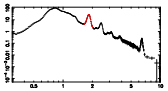


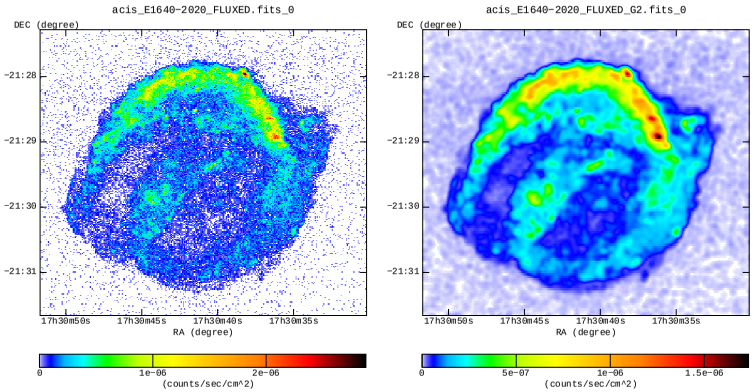
Blue : 1420-7000 eV



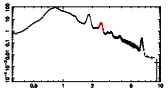
3.3 Misc.

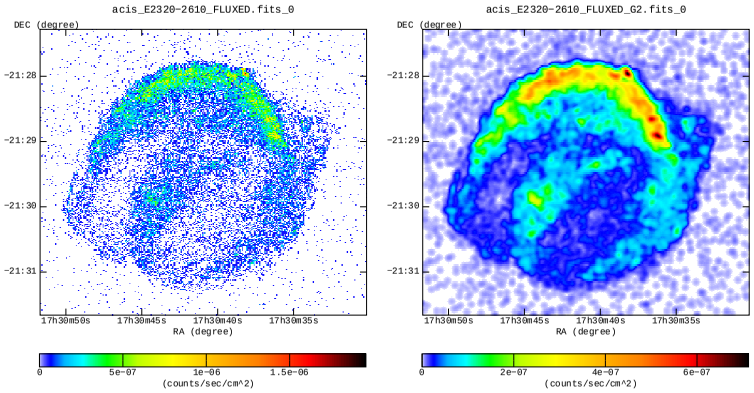
: 1640-2020 eV



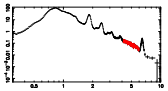


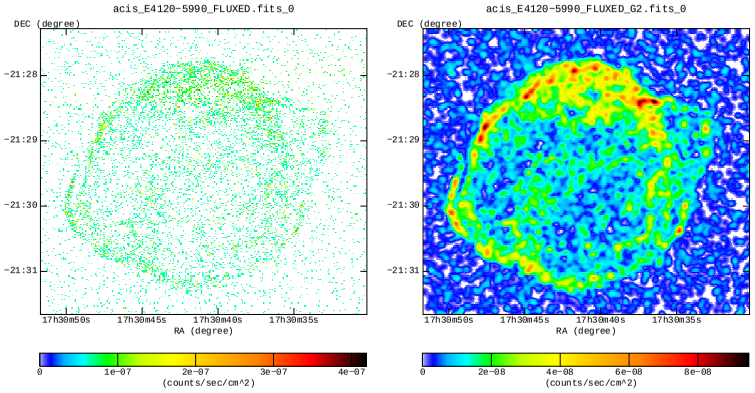
: 2320-2610 eV



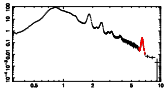


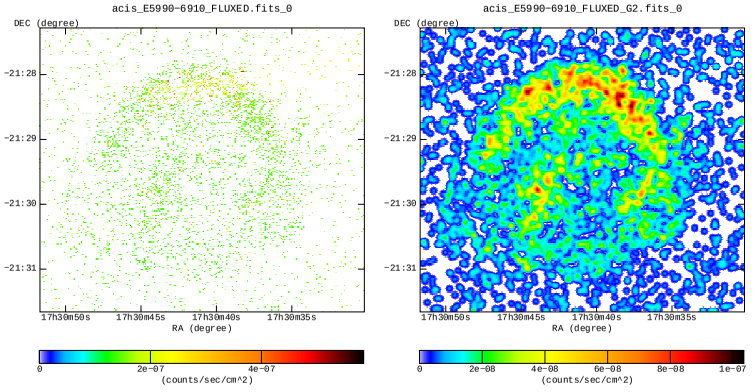
: 4120-5990 eV





: 5990-6910 eV

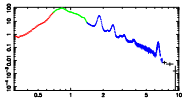


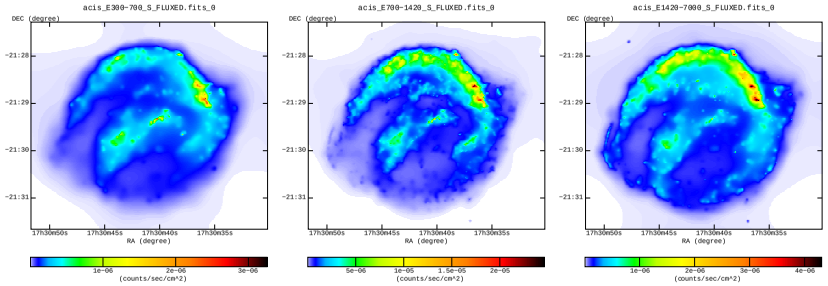


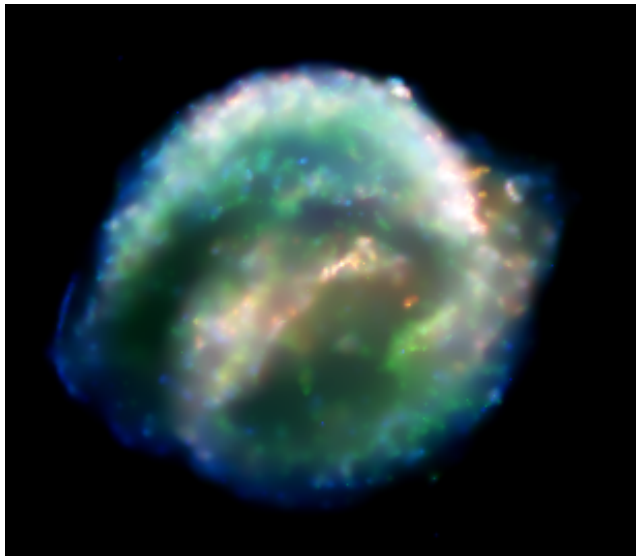
4 Chandra Images : True Color

- 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 : 300-700 eV
GREEN : 700-1420 eV
BLUE : 1420-7000 eV





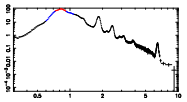


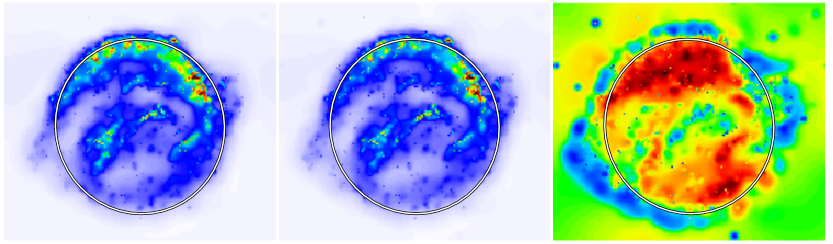
5 Chandra Images : Equivalent Width Map

5.1 Equivalent Width Images

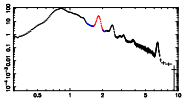
- individual images(line and two continuum) are binned by given pixel size and then adaptively smoothed.
- same scale map (from the least count images) was used for all three images.
- continuum at given line position was estimated by linear interpolation of two continuum image in pixel-by-pixel base.

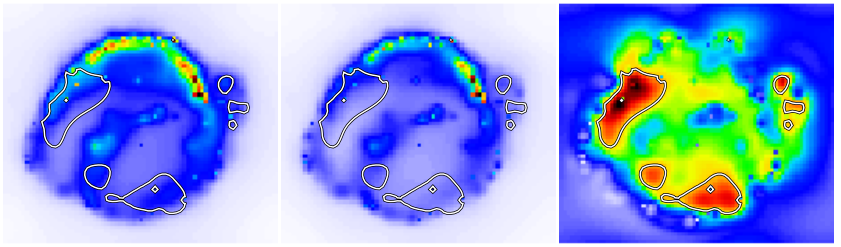
continuum : 600-720 eV
line : 720-930 eV
continuum : 930-1070 eV





continuum : 1420-1640 eV
line : 1640-2020 eV
continuum : 2020-2120 eV





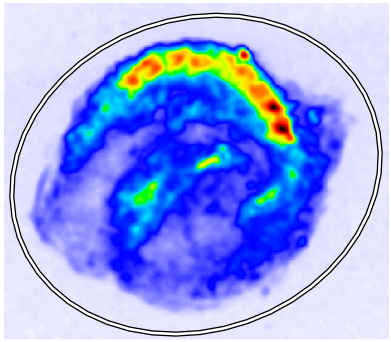
6 Chandra Spectrum

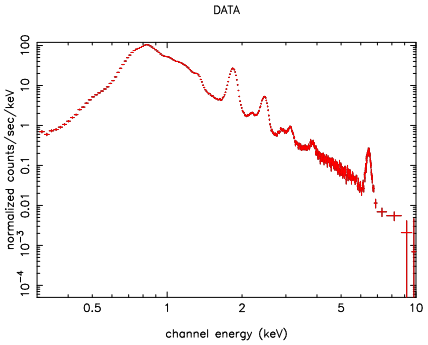
- Images show Regions used to extract spectra
- Regions with red strikes are excluded

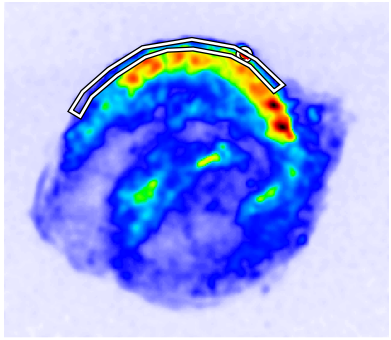
6.1 ObsID 116

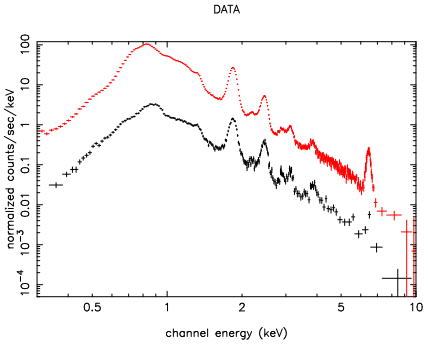
- Background was subtracted from the region around the SNR.

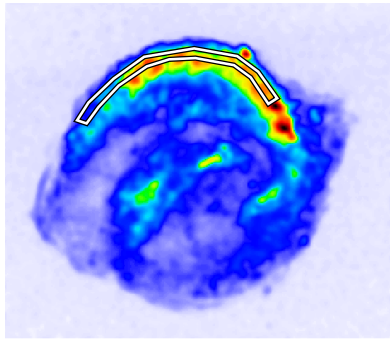
total

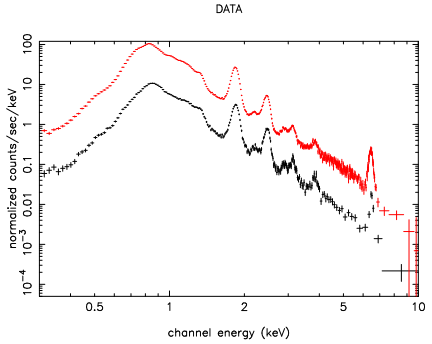


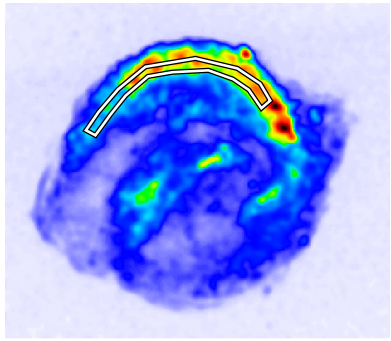


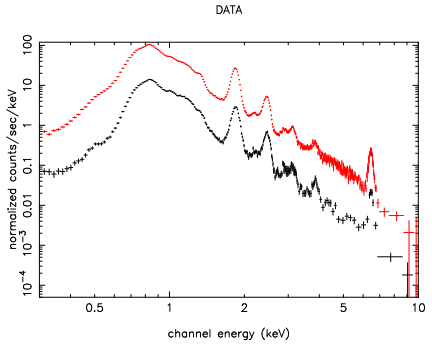


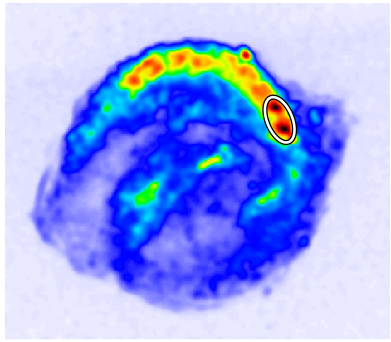


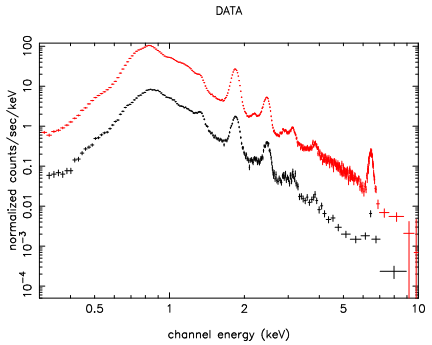




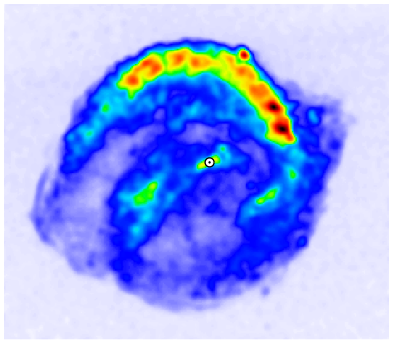


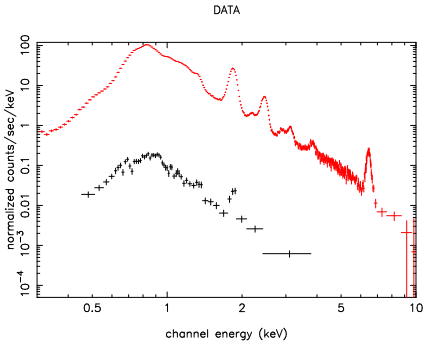




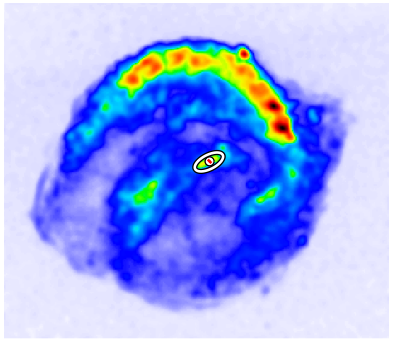


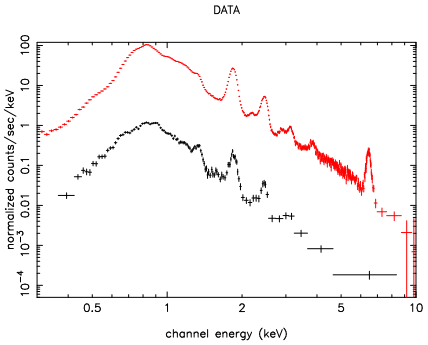
point-like source at the center



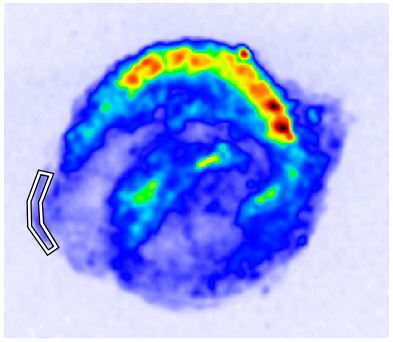


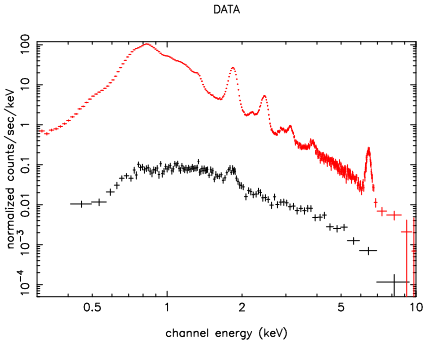
around the point-like source



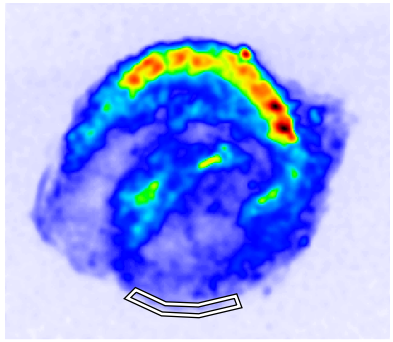


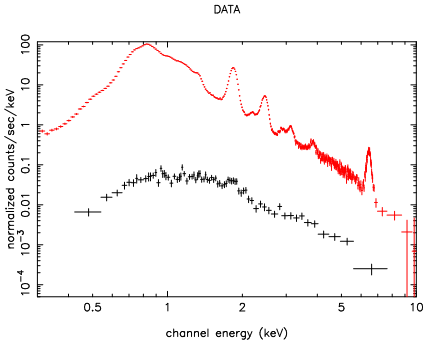
outer shell at east

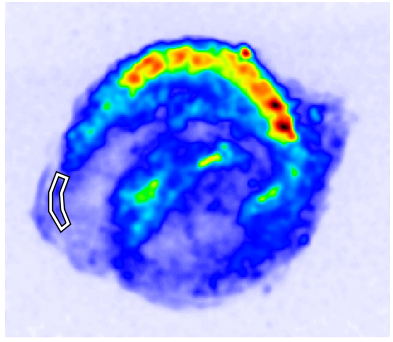


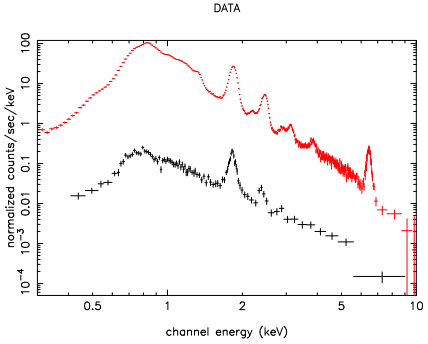


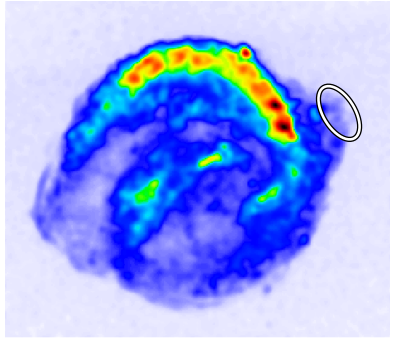
outer shell at south

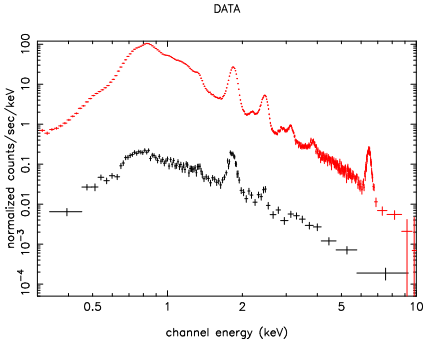








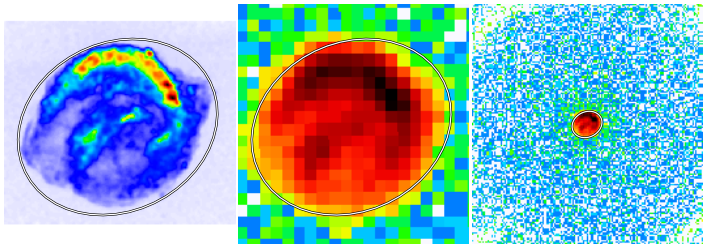




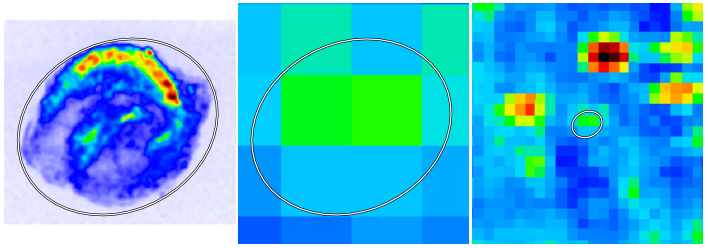
7 Images from Survey Missions

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

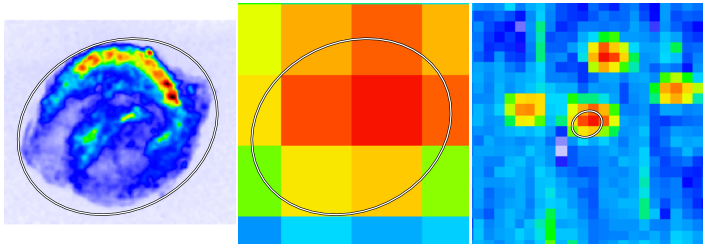
ROSAT PSPC (1.0 deg): X-ray (0.1-2.4 keV)



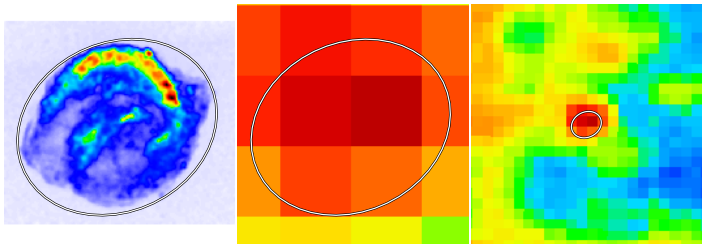
IRAS 12 micron: Infrared (12 micron)



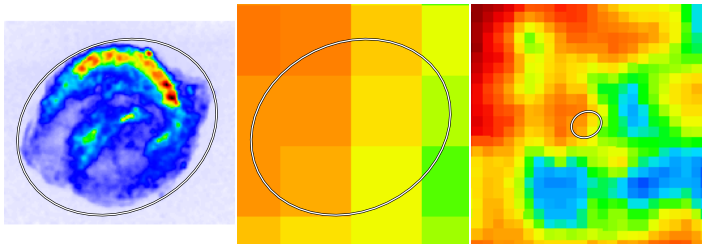
IRAS 25 micron: Infrared (25 micron)



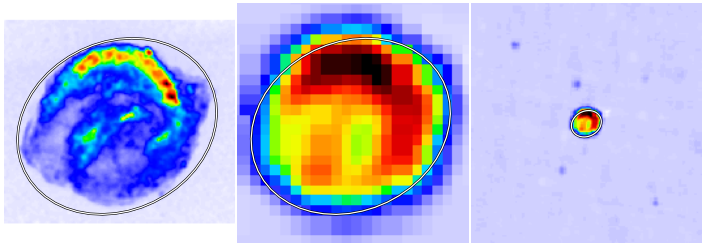
IRAS 60 micron: Infrared (60 micron)



IRAS 100 micron: Infrared (100 micron)



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



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