SNR 0540-69.3

1 Summary

- Common Name: 0540-69.3
- Distance: 50 kpc (distance to LMC, **Westerlund(1990)**)
- Position of Central Source (J2000): (05 19 34.9, -69 02 07.3)
- X-ray size: 72”x65”
- Description: Irregular shell with central pulsar and nebula

1.1 Summary of Chandra Observations

Sequence	Obs ID	Instrument	$Exposure_{uf}$ (ks)	$Exposure_{f}$ (ks)	Date Observed	Aimpoint (J2000) (α, δ)
500006	119	ACIS-56789	30.5	27.6	1999-11-22	(05 40 11.0, -69 20 00.0)

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

- The whole remnant is covered by chip ACIS-S3(CCD_ID=7)
- central source shows **Pile Up**.
- **Trailed Image** of the central source is significant.

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	4.089e+04	1.479e+00	1.24e-11	2.55e-11	7.58e+36
(119)	0.3 - 2.1	3.043e+04	1.101e+00	3.31e-12	1.61e-11	4.79e+36
	2.1 - 10.	1.054e+04	3.813e-01	9.06e-12	9.39e-12	2.80e+36
central source	0.3 - 10.0	2.492e+04	9.016e-01	1.00e-11	1.42e-11	4.24e+36
(119)	0.3 - 2.1	1.592e+04	5.759e-01	2.02e-12	5.95e-12	1.77e+36
	2.1 - 10.	9.070e+03	3.281e-01	8.02e-12	8.30e-12	2.47e+36
shell	0.3 - 10.0	1.434e+04	5.188e-01	2.34e-12	1.12e-11	3.35e+36
(119)	0.3 - 2.1	1.316e+04	4.762e-01	1.29e-12	1.01e-11	3.02e+36
	2.1 - 10.	1.204e+03	4.357e-02	1.05e-12	1.09e-12	3.24e+35

- N_H = 0.46 ($10^{22} cm^{-2}$)
- Assumed distance: 50 kpc (distance to LMC, **Westerlund(1990)**)
- nH was derived by fitting the trail of central source which is believed not to be piled-up.

1.3 Nearby Sources

Obs ID	Position (J2000)	Size	Net Count	Count rate	Note
119					
	(05 39 13.6, -69 22 11.4)	< 7.9”	177.0	5.80e-03	
	(05 39 33.2, -69 19 41.8)	< 3.8”	76.0	2.49e-03	
	(05 39 42.8, -69 19 43.3)	< 3.1”	55.0	1.80e-03	
	(05 39 53.2, -69 19 14.7)	< 2.4”	31.0	1.02e-03	
	(05 40 00.6, -69 19 19.0)	< 3.9”	39.0	1.28e-03	
	(05 40 08.2, -69 17 12.6)	< 4.3”	263.0	8.62e-03	
	(05 40 13.2, -69 22 46.9)	< 2.2”	85.0	2.79e-03	
	(05 40 13.6, -69 22 57.5)	< 2.0”	18.0	5.90e-04	
	(05 40 45.3, -69 14 51.5)	< 4.6”	39.0	1.28e-03	
	(05 41 21.0, -69 18 50.5)	< 4.5”	31.0	1.02e-03	
	(05 41 34.7, -69 19 36.9)	< 5.8”	92.0	3.02e-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

- Gotthelf and Wang, 2000 ApJ, 532L, 117 : Chandra HRC
- Hwang et al., 2001 ApJ, 560, 742 : Chandra ACIS imaging and spectroscopy
- Manchester et al., 1993 ApJ, 411, 756 : ATCA 5 GHz and 1.5 Ghz radio observation
- Westerlund, 1990 A&ARv, 2, 29 : Distance to LMC

2 Fit Detail

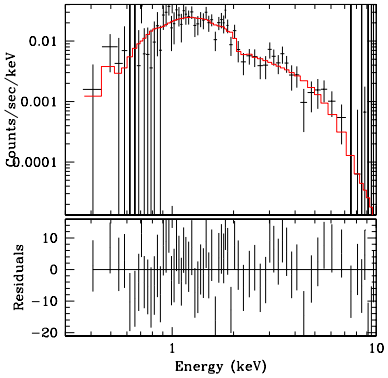
- See spectrum page for used regions.

nH was derived by fitting the trail of central source which is believed not to be piled-up.

2.1 trail:

- nH was derived from the **trail of the central source**.

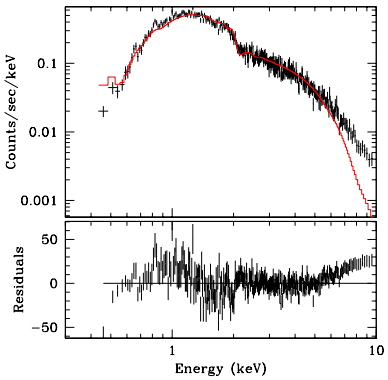
  source=(xswabs * powlaw1d)
  reduced χ^2 = 0.837752
  nh = `0.4591 10^22/cm^2`



2.2 central source:

- while spectrum from the **central source** is stronly affected by pile-up, derived nH is similar.

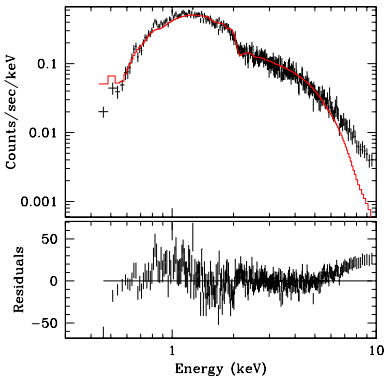
  source=(xswabs * powlaw1d)
  reduced χ^2 = 1.99201
  nh = `0.4737 10^22/cm^2`



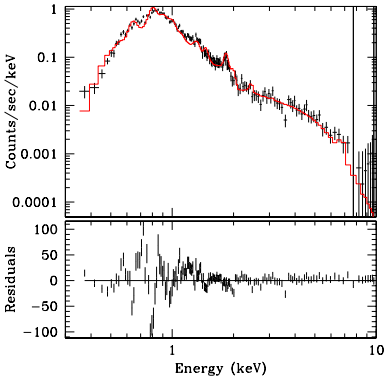
2.3 central source(2):

- spectrum was refitted with nH fixed at the value derived from the trail of central source.

  source=(xswabs * powlaw1d)
  reduced χ^2 = 1.99539
  nh = `0.4591 10^22/cm^2`



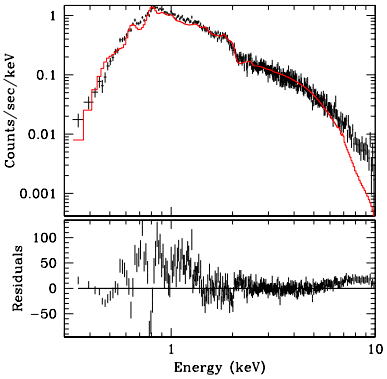
2.4 shell:



- **shell** was fitted by 3 thermal plasma model with nH fixed.

  source=(xswabs * ((xsraymond + xsraymond) + xsraymond))
  reduced χ^2 = 2.6843
  nh = `0.4591 10^22/cm^2`

2.5 total:



- sum of the spectral models from central source and shell.
- no futher fitting was done.
- **Hwang et al.(2001)** derived nH=0.2 0.5 for various part of the shell(dimension of the nH in their table seems to be a typo(10^22 instead of 10^21)).

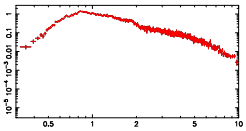
  source=(xswabs * (((powlaw1d + xsraymond) + xsraymond) + xsraymond))
  reduced χ^2 = 2.54079
  nh = `0.4591 10^22/cm^2`

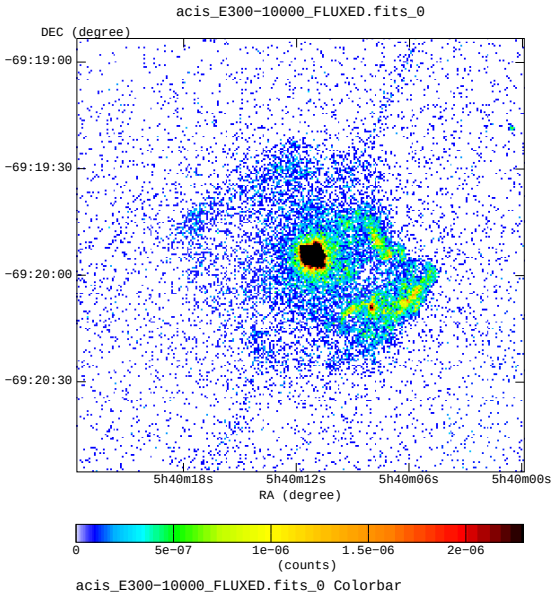
3 Chandra Images : Band Images

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

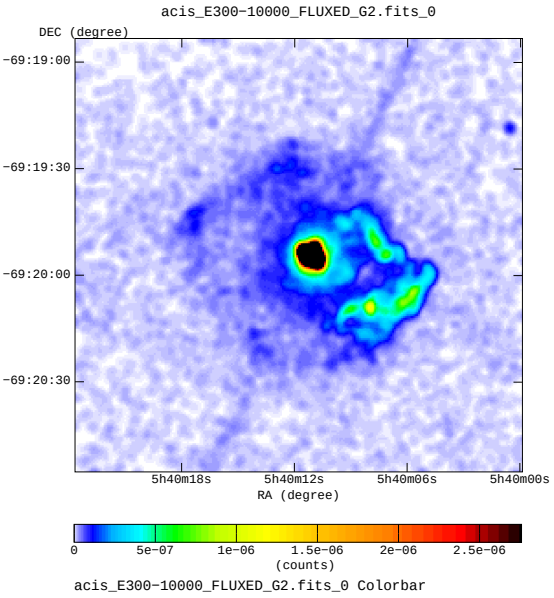
3.1 Wide Band Images

Total : 300-10000 eV



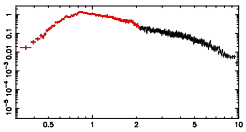


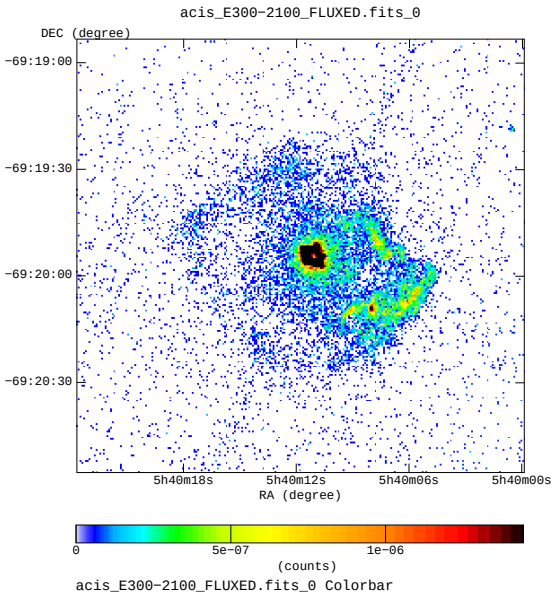
acis_E300-10000_FLUXED.fits_0 Colorbar



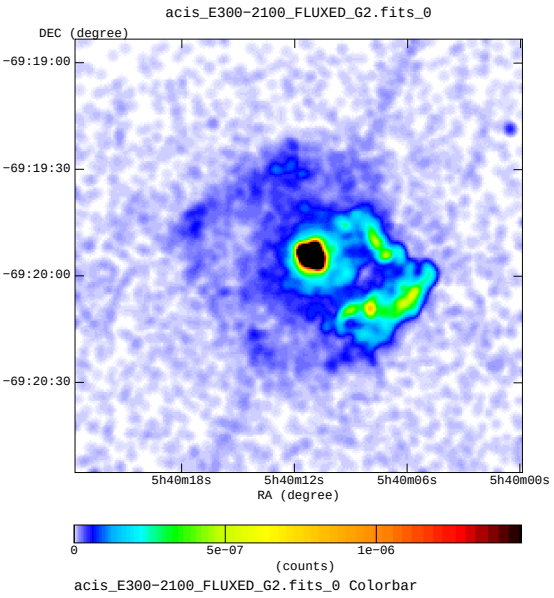
acis_E300-10000_FLUXED_G2.fits_0 Colorbar

Soft Band : 300-2100 eV



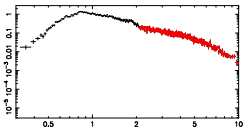


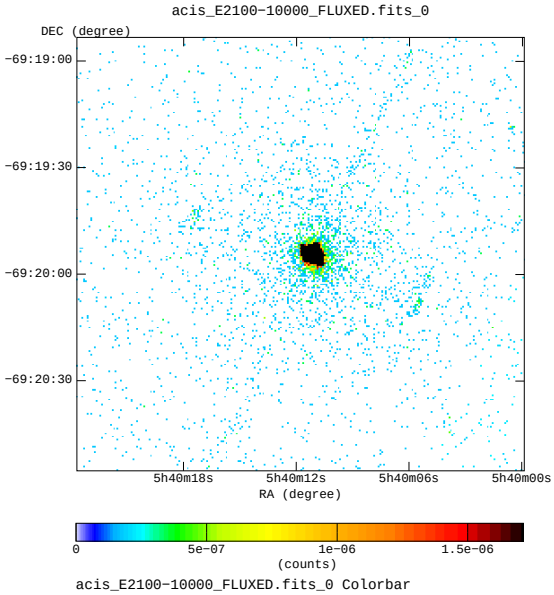
acis_E300-2100_FLUXED.fits_0 Colorbar

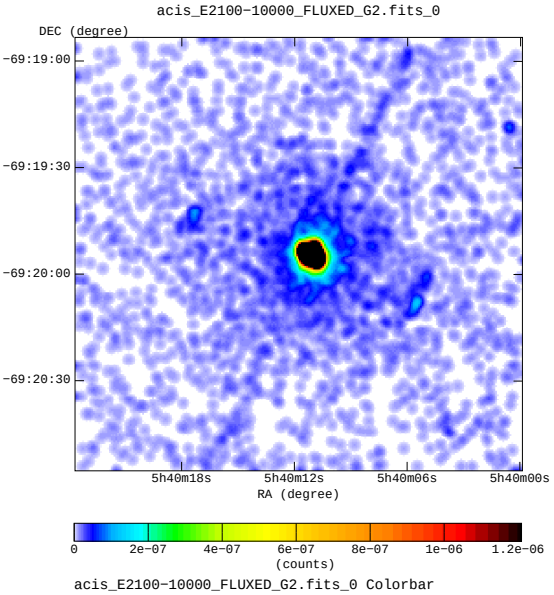


acis_E300-2100_FLUXED_G2.fits_0 Colorbar

Hard Band : 2100-10000 eV

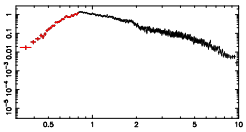


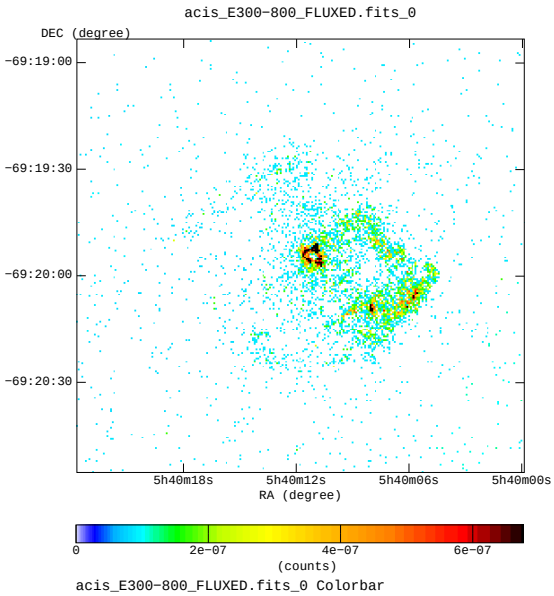


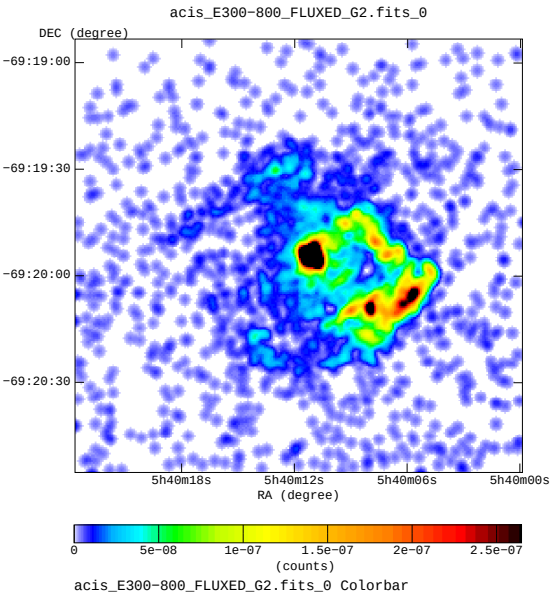


3.2 Band images used in true color image.

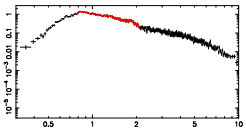
Red : 300-800 eV

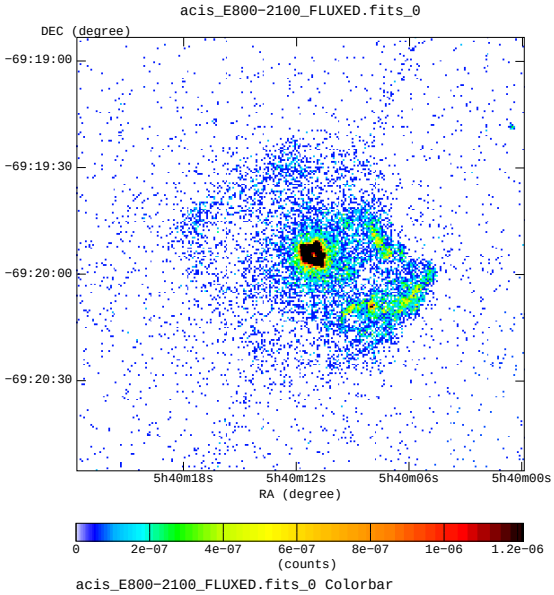


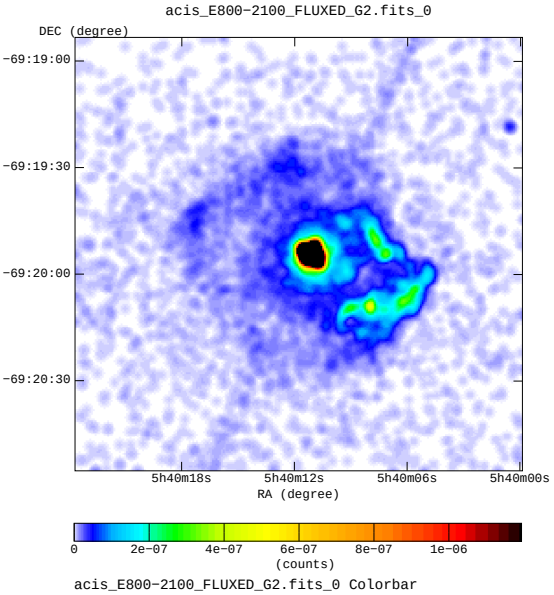




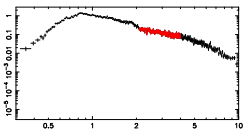
Green : 800-2100 eV

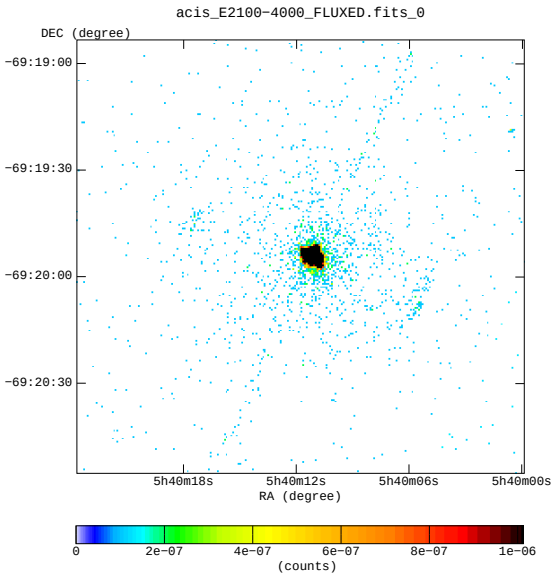


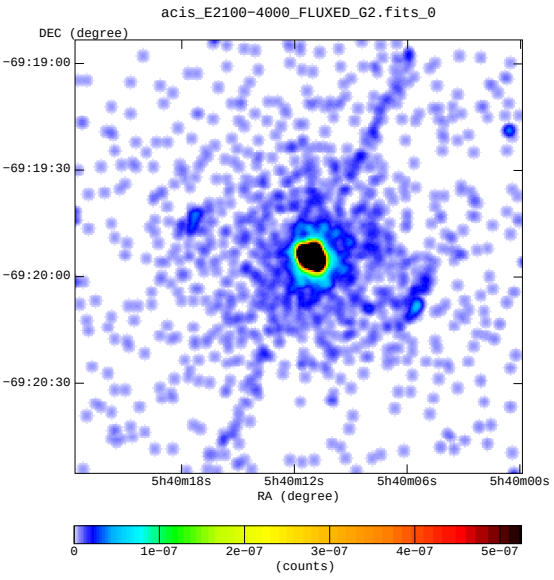




Blue : 2100-4000 eV

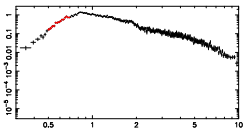


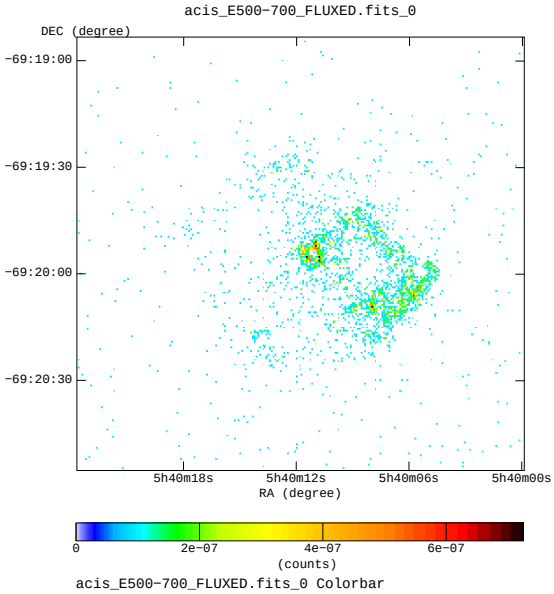




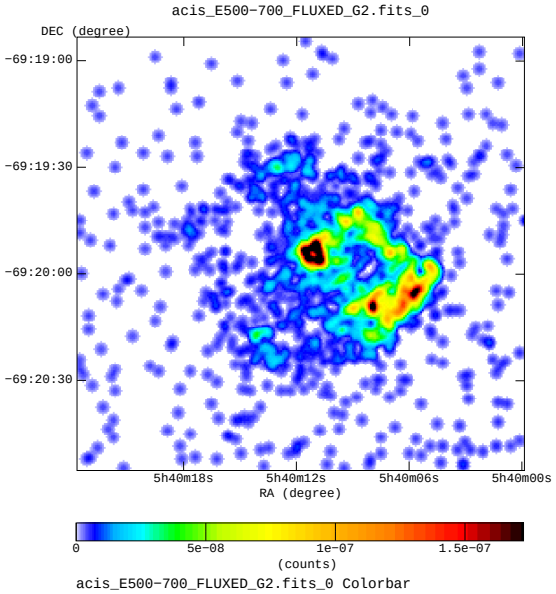
3.3 Misc.

: 500-700 eV



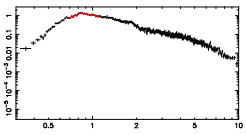


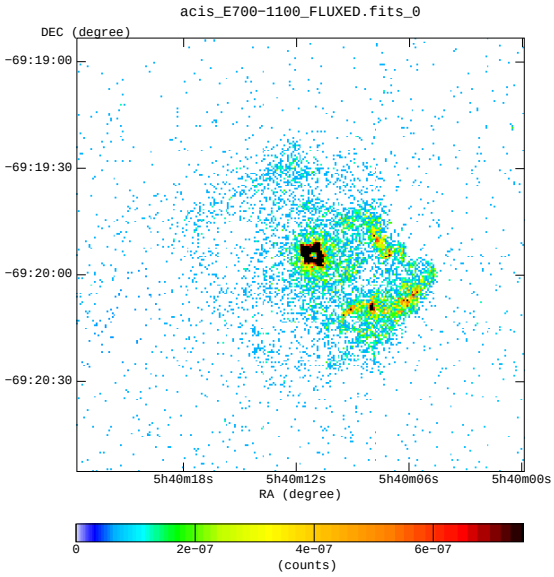
acis_E500−700_FLUXED.fits_0 Colorbar



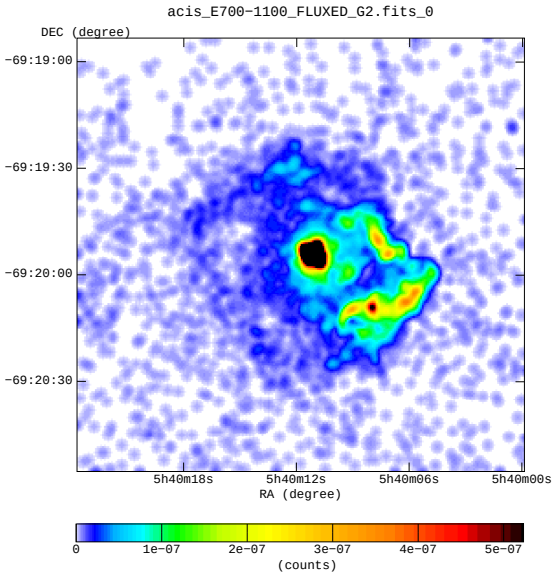
acis_E500−700_FLUXED_G2.fits_0 Colorbar

: 700-1100 eV





acis_E700−1100_FLUXED.fits_0 Colorbar



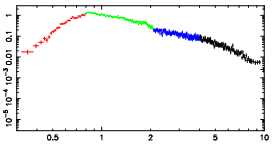
acis_E700−1100_FLUXED_G2.fits_0 Colorbar

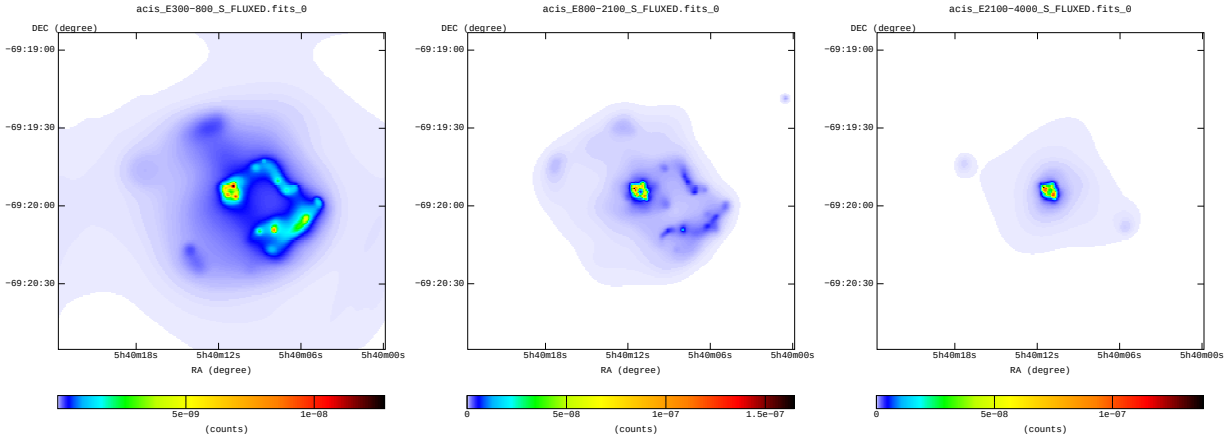
4 Chandra Images : True Color

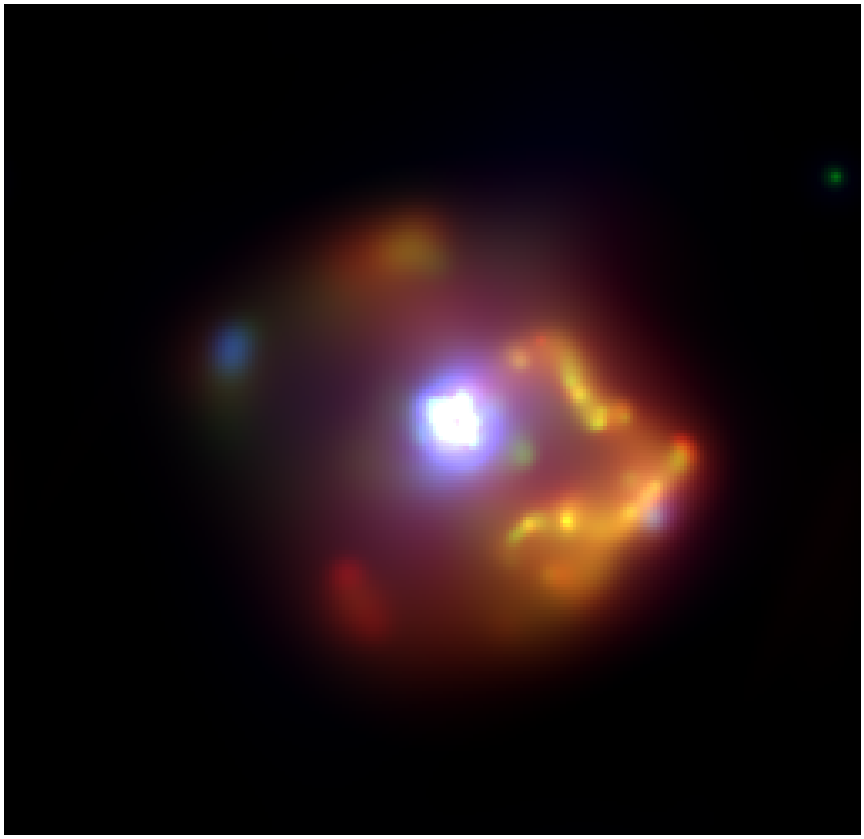
- Individual images are adaptively smoothed.
- Warning : the adaptive smoothing process sometimes produces artifacts.

- convolution method : fft
- kernel type : gauss
- significance (min , max) : (3 , 5)

RED : 300-800 eV
GREEN : 800-2100 eV
BLUE : 2100-4000 eV







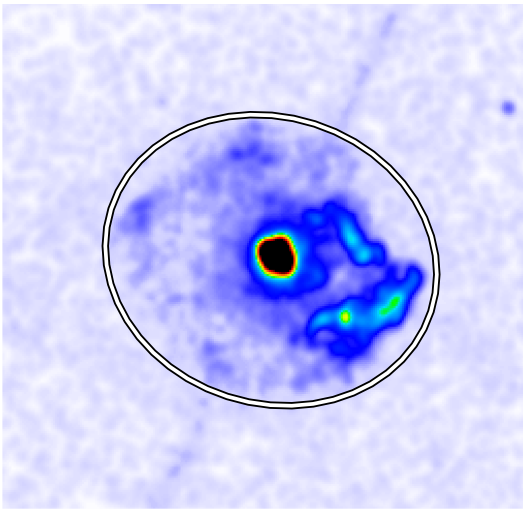
5 Chandra Spectrum

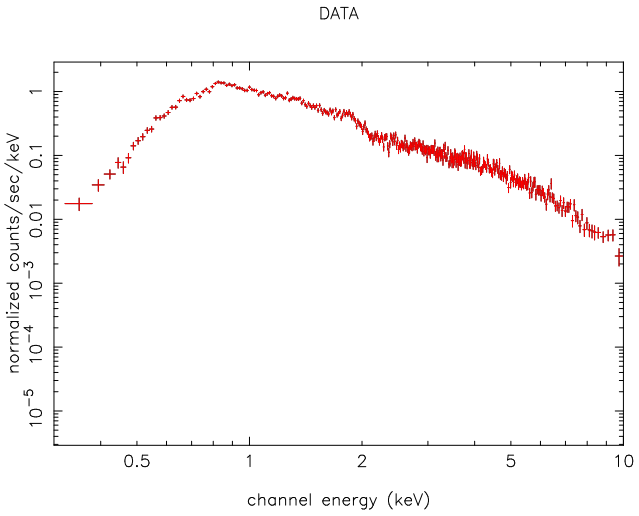
- Images show Regions used to extract spectra
- Regions with red strikes are excluded

5.1 ObsID 119

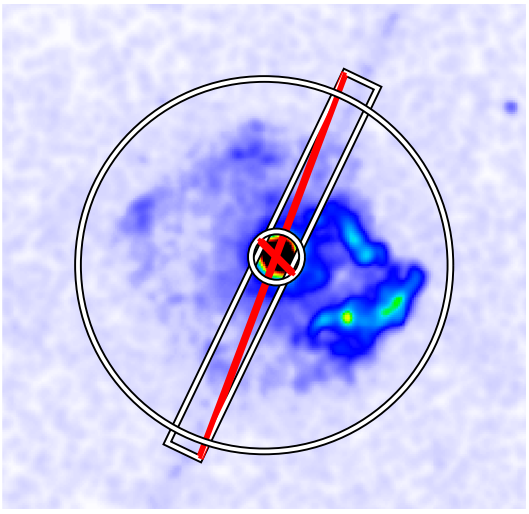
- Background was subtracted from the region around the SNR.

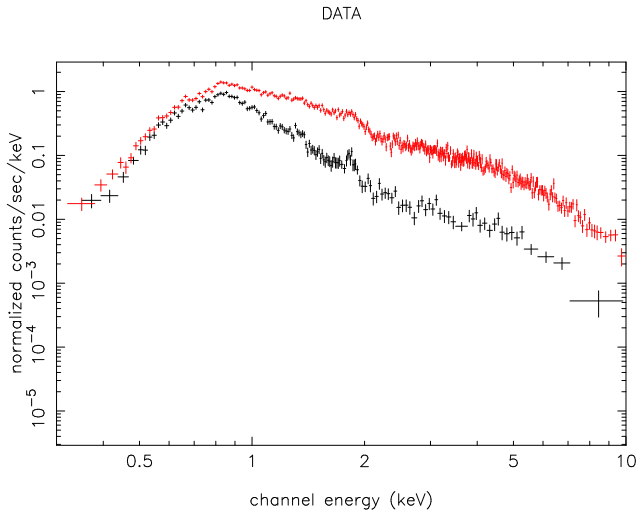
total



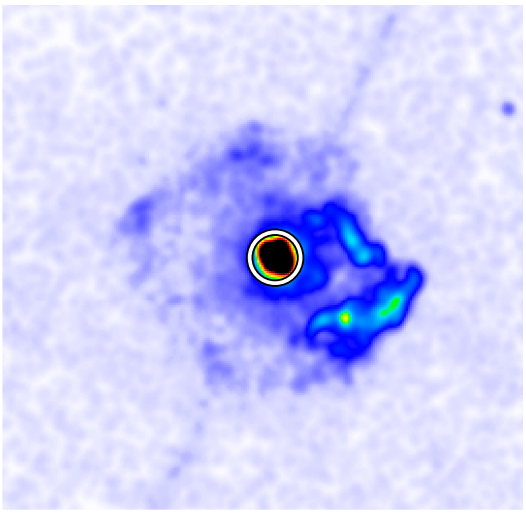


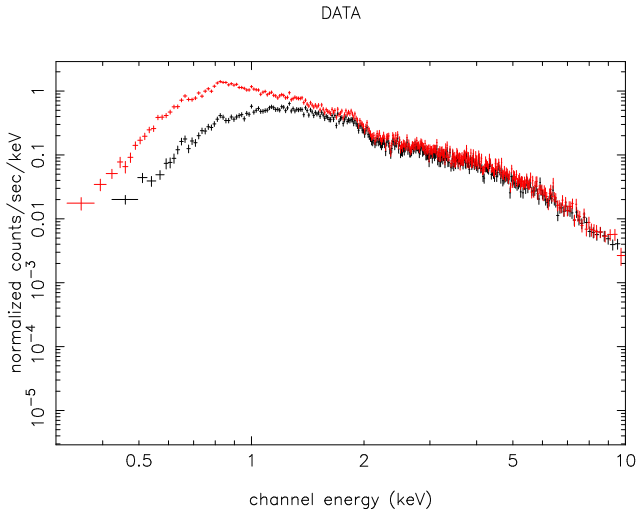
shell

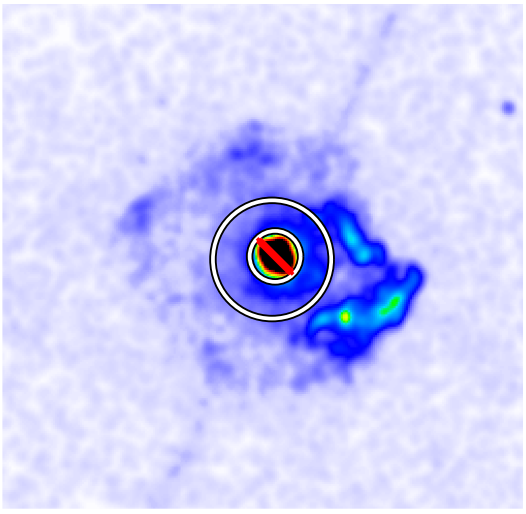


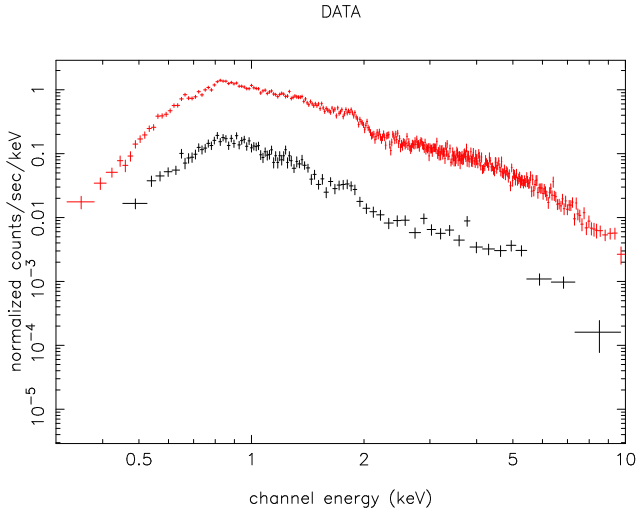


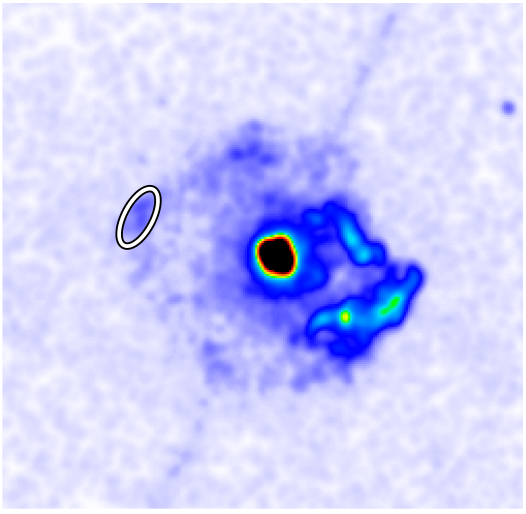
central source

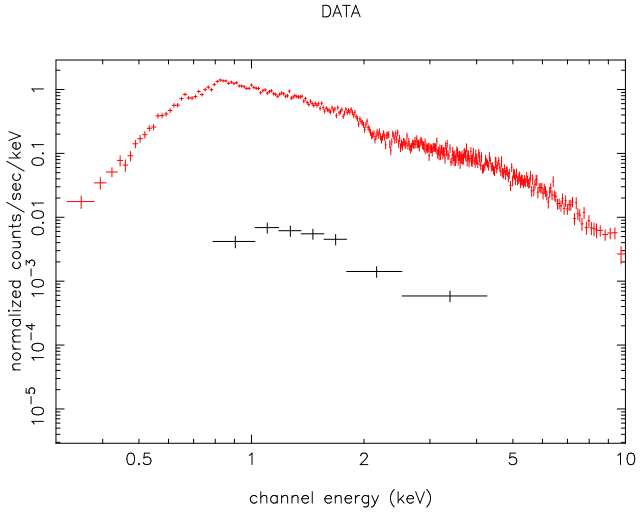


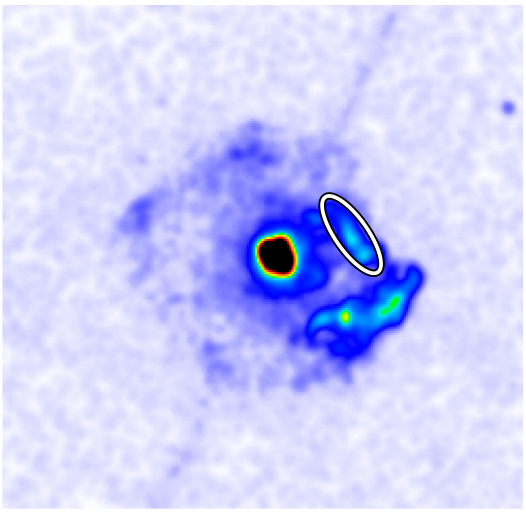


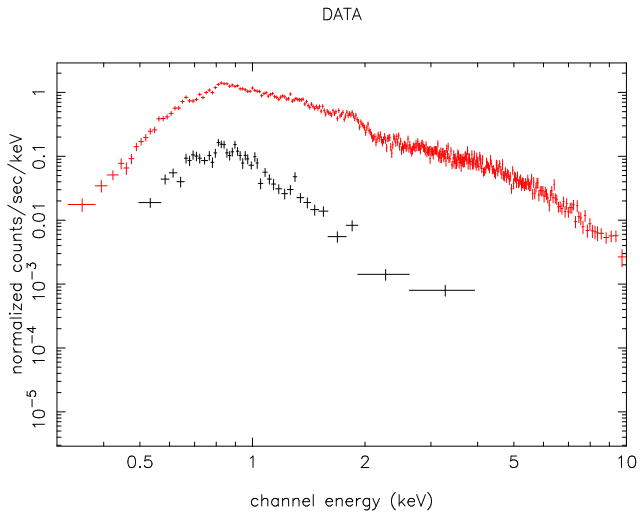


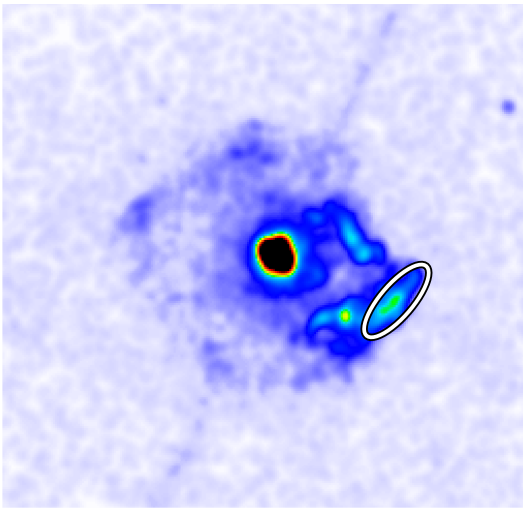


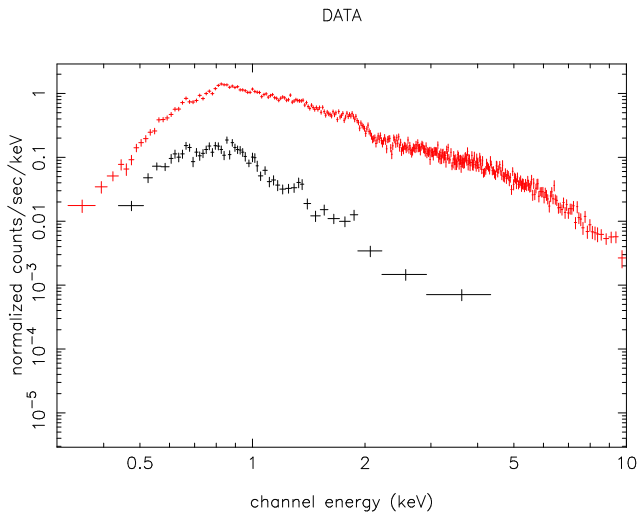




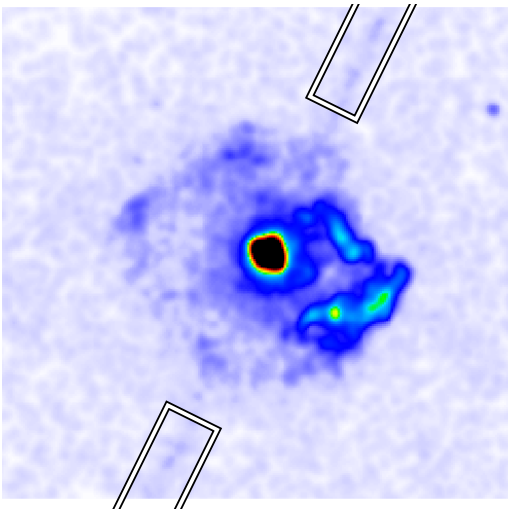


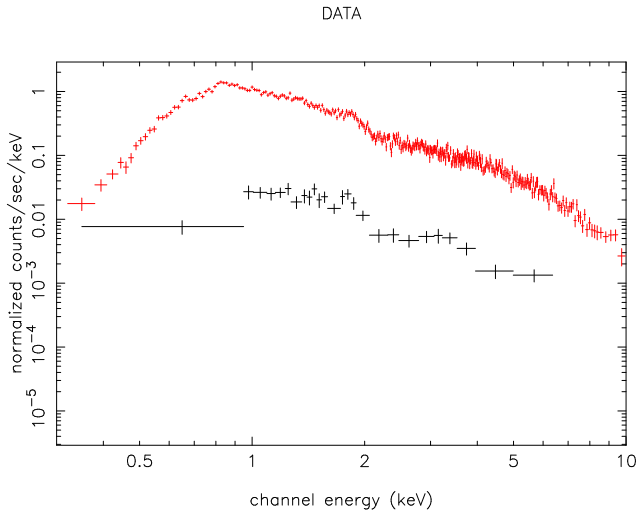






trail of the central source



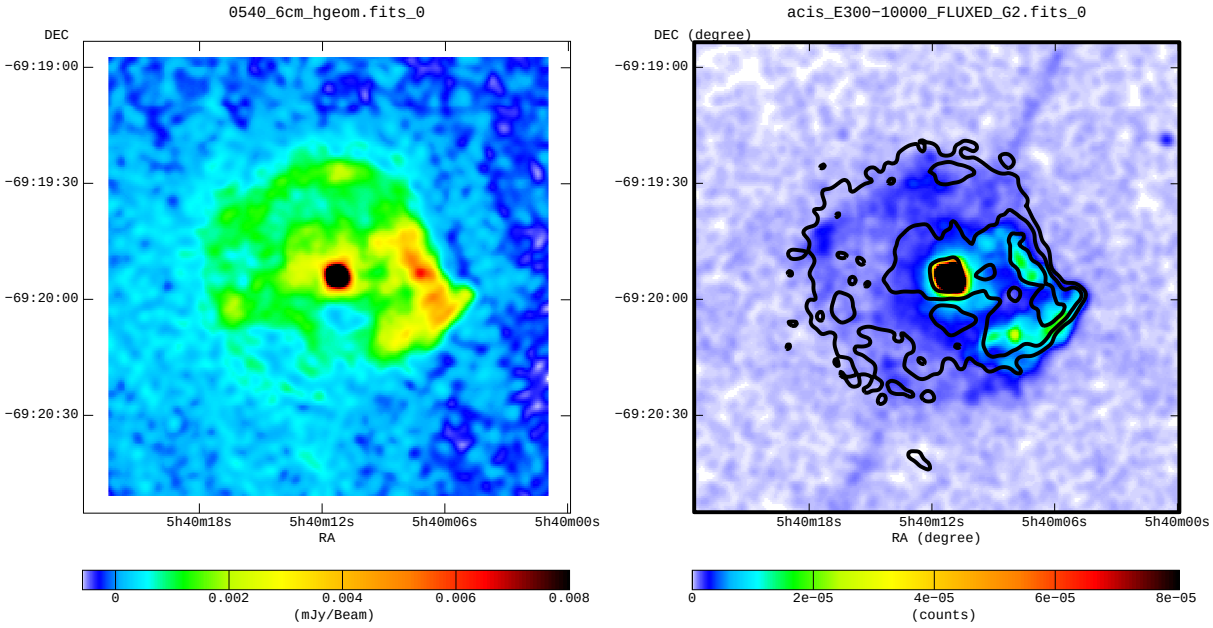


6 Radio Image

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

6-cm

-. 6-cm flux density: 520 mJy (whole source), 59 mJy (central source)
-. Image from **Manchester et al.(1993)**

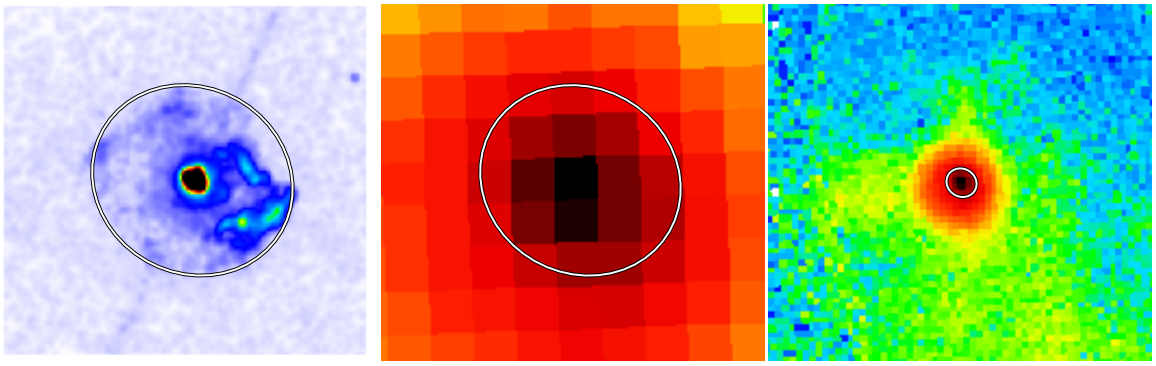


Summary of Observation	
Telescope	Australia Telescope Compact Array
Date	1990 May 6, May 19m June 3, August 19
Frequency	time-shared between 4.786 and 5.814 GHz
Beam size	2.7” x 2.7”
1 sigma noise ..	0.2 mJy / beam

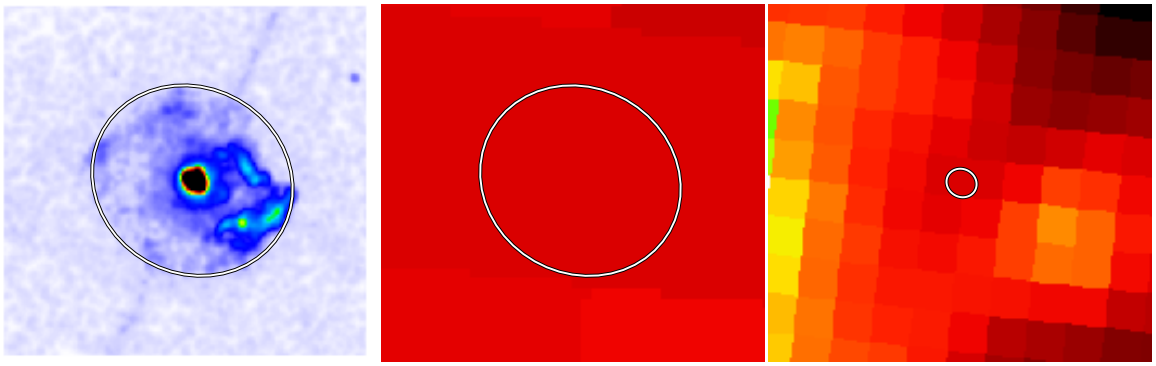
7 Images from Survey Missions

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

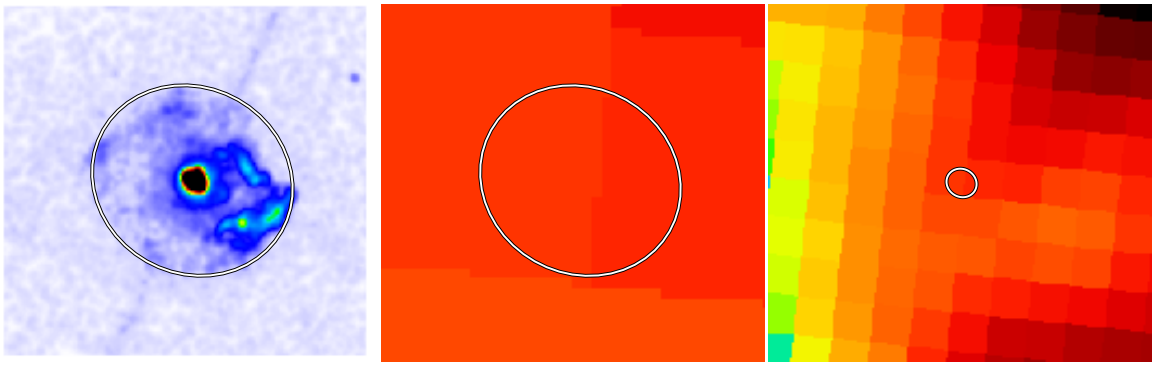
ROSAT PSPC (1.0 deg): X-ray (0.1-2.4 keV)



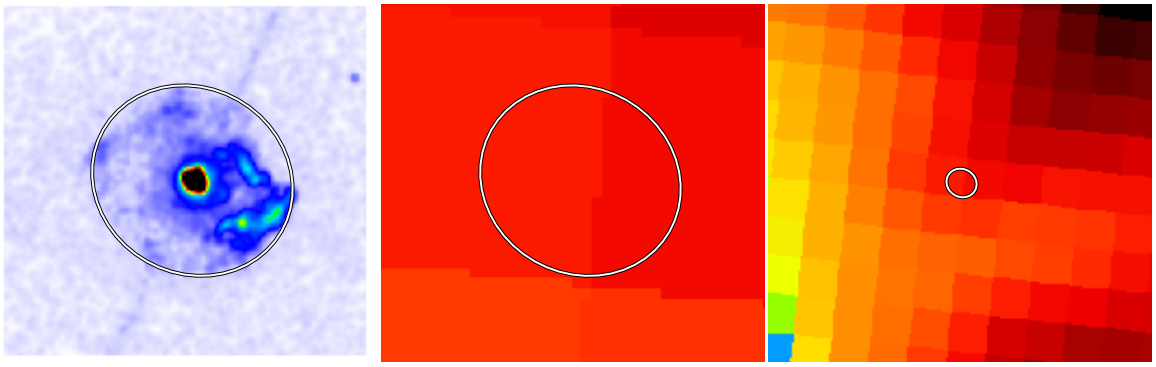
IRAS 12 micron: Infrared (12 micron)



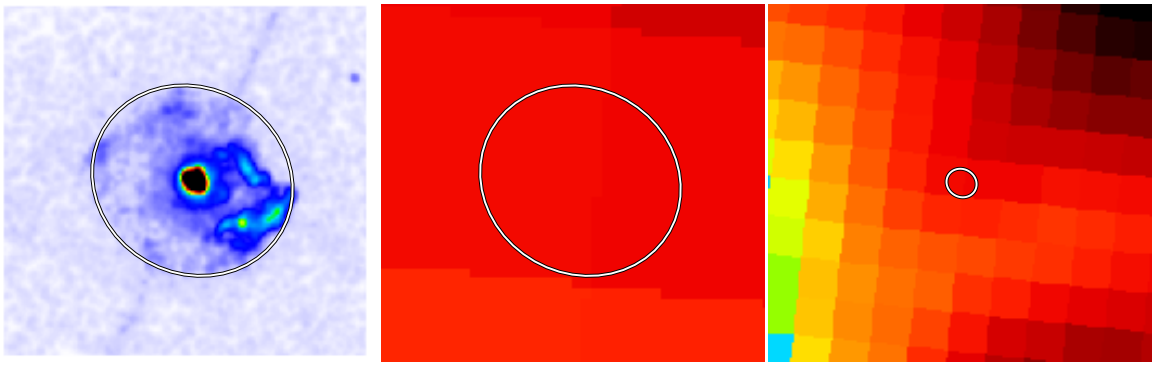
IRAS 25 micron: Infrared (25 micron)



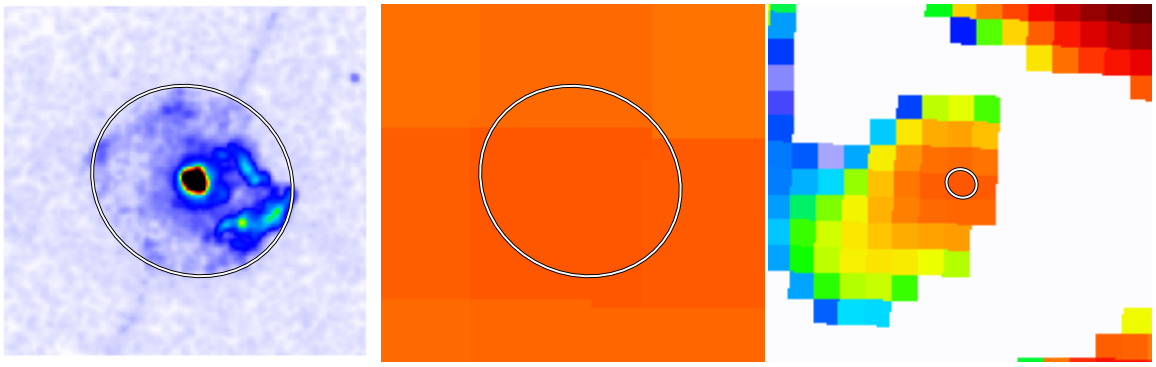
IRAS 60 micron: **Infrared (60 micron)**



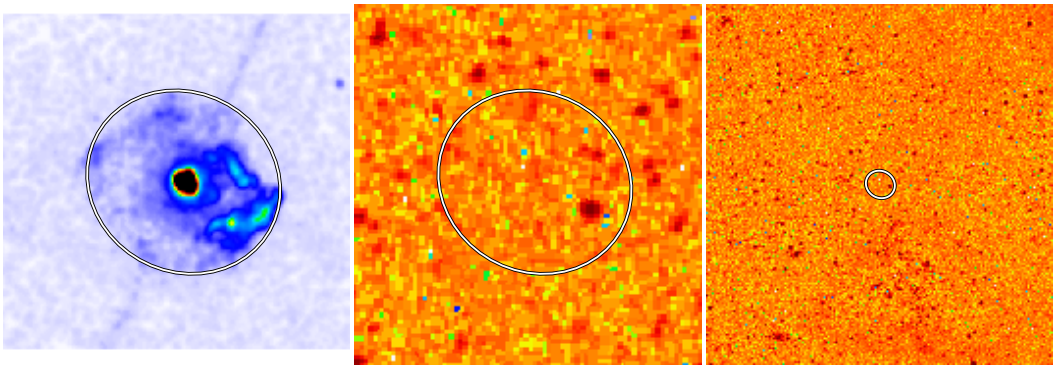
IRAS 100 micron: **Infrared (100 micron)**



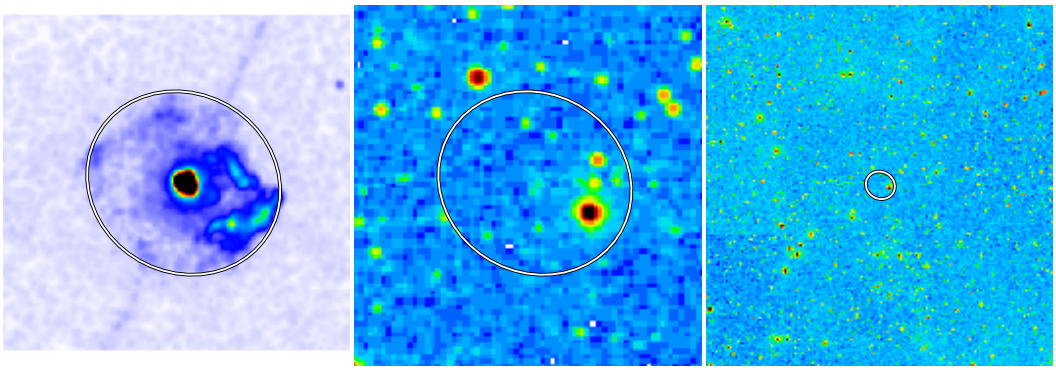
4850 MHz: **Radio (4850 MHz continuum)**



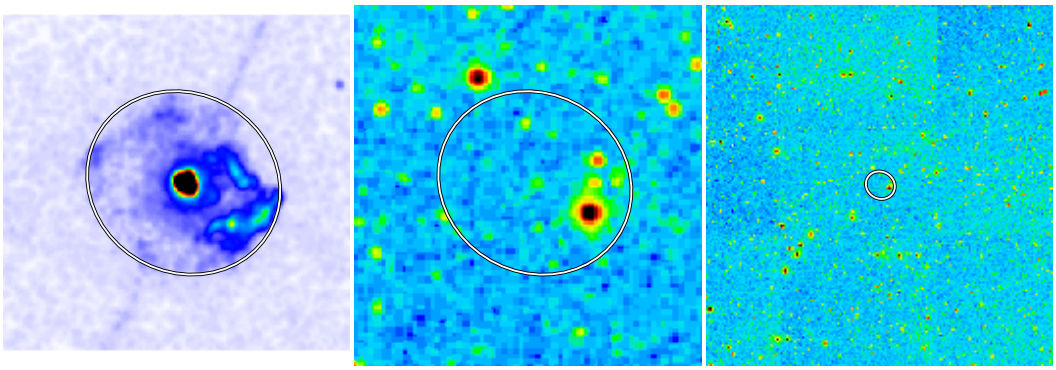
Digitized Sky Survey: **Optical (J or E band images with a few exceptions)**



The Two Micron All Sky Survey (J-band): IR (1.25 microns)



The Two Micron All Sky Survey (H-band): IR (1.65 microns)



The Two Micron All Sky Survey (K-band): IR (2.17 microns)