

SNR 0519-69.0

1 Summary

- Common Name: 0519-69.0
- Distance: 50 kpc (distance to LMC, [Westerlund\(1990\)](#))
- Center of X-ray emission (J2000): (05 19 34.9, -69 02 07.3)
- X-ray size: $32'' \times 34''$
- Description: Lumpy shell with some central emission

1.1 Summary of Chandra Observations

Sequence	Obs ID	Instrument	Exposure _{uf} (ks)	Exposure _f (ks)	Date Observed	Aimpoint (J2000) (α , δ)
500005	118	ACIS-456789	40.6	39.0	2000-06-21	(05 19 34.0, -69 02 11.0)

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 ^{obs} (ergs cm ⁻² s ⁻¹)	F _X (ergs cm ⁻² s ⁻¹)	L _X (ergs s ⁻¹)
total	0.3 - 10.0	2.026e+05	5.195e+00	1.48e-11	3.69e-11	1.10e+37
(118)	0.3 - 2.1	1.985e+05	5.090e+00	1.36e-11	3.57e-11	1.06e+37
	2.1 - 10.	4.170e+03	1.070e-01	1.15e-12	1.21e-12	3.61e+35

- $N_{\text{H}} = 0.24 (10^{22} \text{ cm}^{-2})$
- Assumed distance: 50 kpc (distance to LMC, [Westerlund\(1990\)](#))
- nH was derived with two thermal plasma model

1.3 Nearby Sources

Obs ID	Position (J2000)	Size	Net Count	Count rate	Note
118					
	(05 18 03.6, -69 01 11.7)	< 8.0"	148.0	3.65e-03	
	(05 18 18.8, -69 02 17.0)	< 4.7"	166.0	4.09e-03	
	(05 18 31.1, -69 01 08.3)	< 3.3"	27.7	6.82e-04	
	(05 18 39.9, -69 02 56.2)	< 3.6"	21.0	5.17e-04	
	(05 18 42.9, -69 04 45.4)	< 3.9"	14.7	3.62e-04	
	(05 18 53.0, -69 02 17.6)	< 1.9"	85.8	2.11e-03	
	(05 19 01.8, -68 58 33.3)	< 3.0"	16.9	4.16e-04	
	(05 19 03.8, -68 59 10.6)	< 2.2"	27.3	6.72e-04	
	(05 19 06.6, -69 04 09.2)	< 1.9"	18.8	4.63e-04	
	(05 19 23.9, -69 05 20.7)	< 2.3"	28.6	7.04e-04	
	(05 19 30.5, -69 00 16.9)	< 2.1"	23.9	5.89e-04	
	(05 19 31.9, -69 00 09.5)	< 1.9"	20.0	4.93e-04	
	(05 19 42.3, -68 58 11.5)	< 3.7"	44.1	1.09e-03	
	(05 19 46.7, -68 59 12.7)	< 2.4"	19.5	4.80e-04	
	(05 19 47.7, -69 02 45.3)	< 2.1"	12.7	3.13e-04	
	(05 19 53.6, -68 59 12.1)	< 3.6"	23.0	5.66e-04	
	(05 19 54.7, -69 02 47.4)	< 2.3"	46.8	1.15e-03	
	(05 20 05.5, -68 58 27.5)	< 5.0"	97.5	2.40e-03	
	(05 20 10.6, -69 04 09.1)	< 5.1"	73.4	1.81e-03	
	(05 20 20.1, -69 02 25.0)	< 4.6"	94.3	2.32e-03	
	(05 20 20.5, -69 06 52.6)	< 8.5"	398.0	9.80e-03	
	(05 20 35.8, -69 00 38.0)	< 7.3"	41.1	1.01e-03	
	(05 20 50.4, -69 02 59.0)	< 9.8"	88.4	2.18e-03	
	(05 20 54.4, -69 05 42.9)	< 11.7"	34.6	8.52e-04	

(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

- Dickel and Milne, 1995 AJ, 109, 200 : ATCA
- Hughes et al., 1995 Apl, 444L, 81 : ASCA
- Westerlund, 1990 A&ARv, 2, 29 : Distance to LMC
- Williams et al., 2001 ysnr, conf, 185 : Chandra

2 Fit Detail

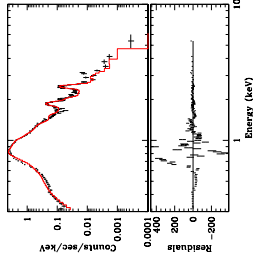
- See spectrum page for used regions.

nH was derived by fitting observed spectrum with two thermal plasma model.

2.1 component A:

- dominant at inner region
- parameters were derived from **bright shell at N**.
- Abundance of O-like element was set to zero assuming Typ1 I SN(**Hughes et al., 1995**).

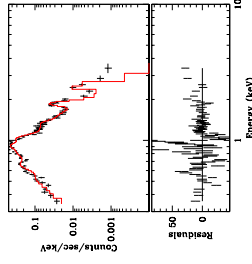
```
source=(xswabs * xsvraymond)
reduced  $\chi^2 = 7.41398$ 
nh = 0.2283 1.022/cm2
```



2.2 component B:

- dominant at outer region
- parameters were derived from **clump at NE**.

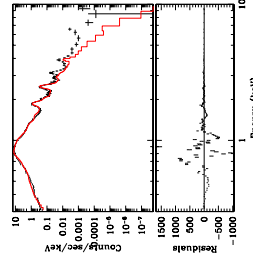
```
source=(xswabs * xsvraymond)
reduced  $\chi^2 = 3.24074$ 
nh = 0.3298 1.022/cm2
```



2.3 Total:

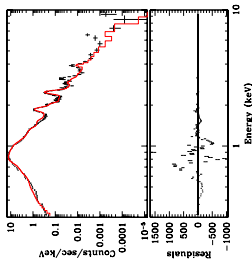
- Total spectrum was fitted with above two component.
- Only nH and normalization factor was thawed.
- **Williams et al.(2001)** derived nH=0.22 with vnpshock model.

```
source=(xswabs * (xsvraymond + xsvraymond))
reduced  $\chi^2 = 16.7657$ 
nh = 0.2446 1.022/cm2
```



2.4 One more hard component:

- For better estimation of flux
- ```
source=(xswabs * ((xsvraymond + xsvraymond) + xsraymond))
reduced $\chi^2 = 16.2199$
nh = 0.2446 1.022/cm2
```

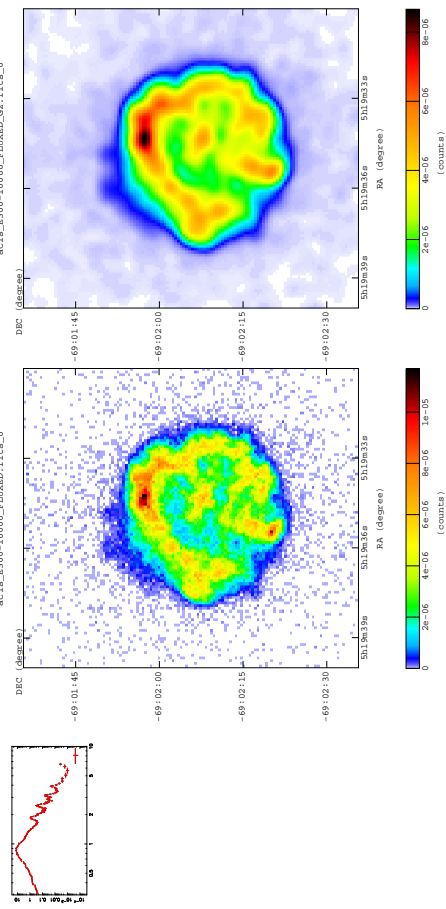


### 3 Chandra Images : Band Images

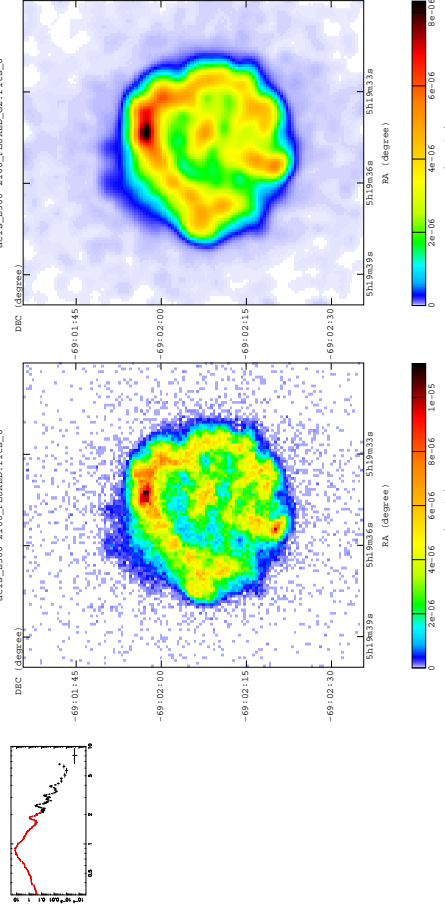
- Left : raw image, binned by 1x1 pixel
- Right : gaussian smoothed version of above (  $\sigma = 2$  pixel)

#### 3.1 Wide Band Images

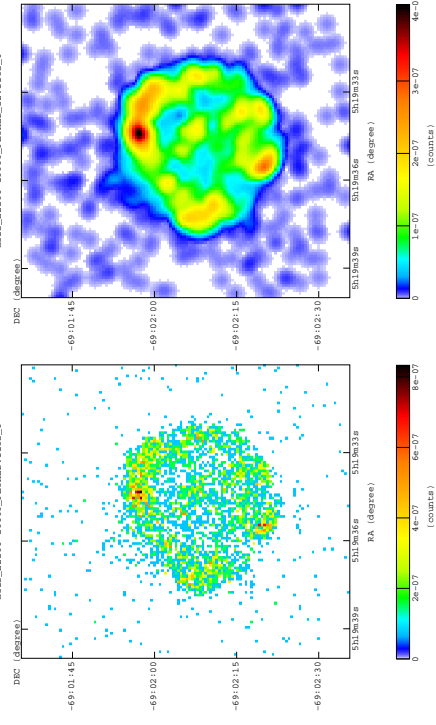
Total : 300-10000 eV



Soft Band : 300-2100 eV

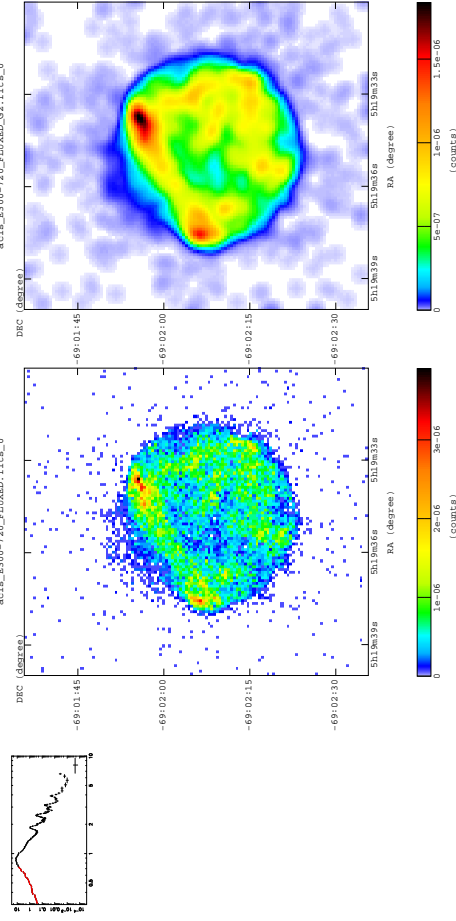


#### Hard Band : 2100-10000 eV

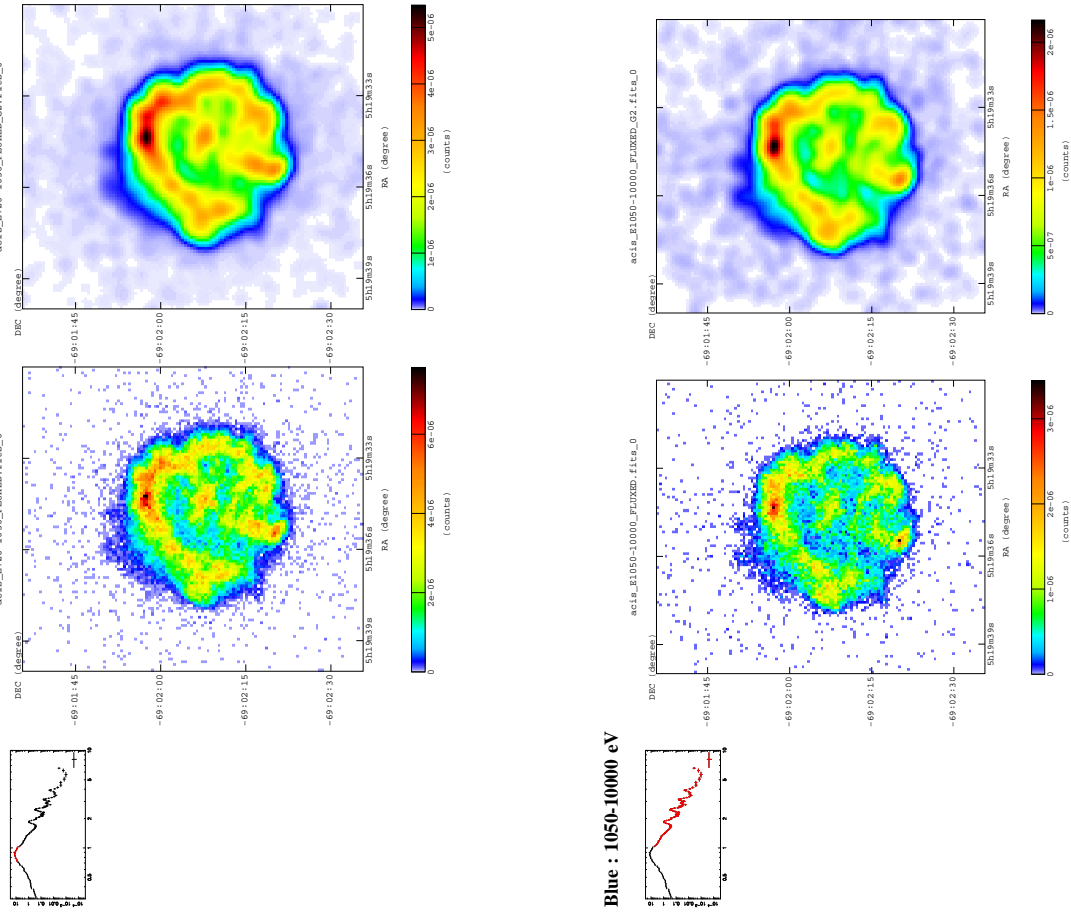


#### 3.2 Band images used in true color image.

Red : 300-720 eV

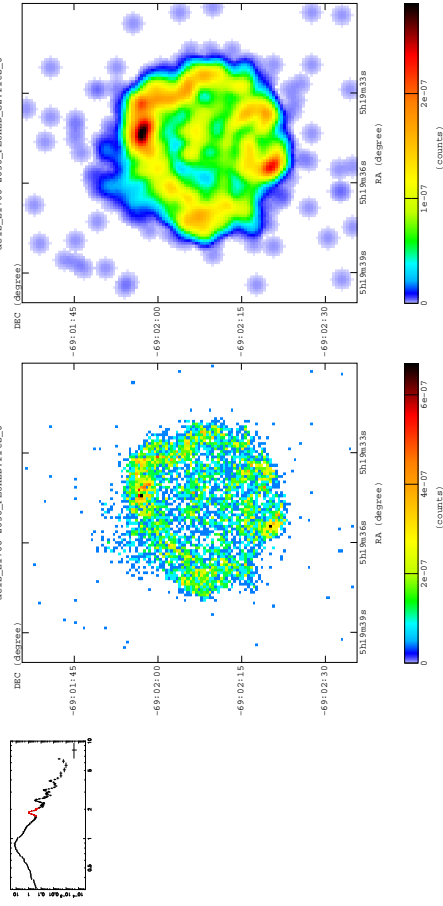


**Green : 720-1050 eV**

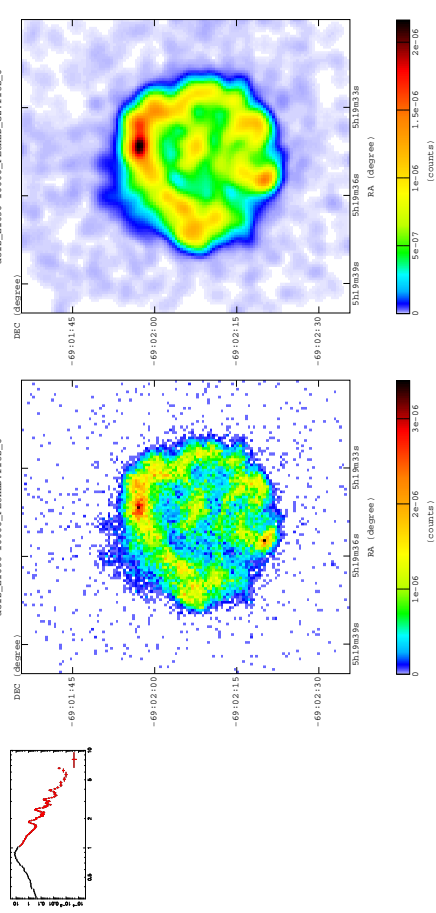


**3.3 Misc.**

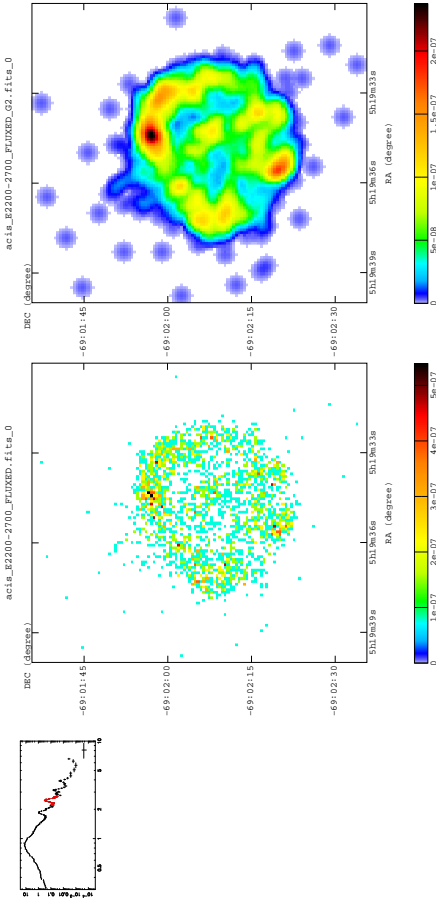
**: 1700-2050 eV**



**Blue : 1050-10000 eV**



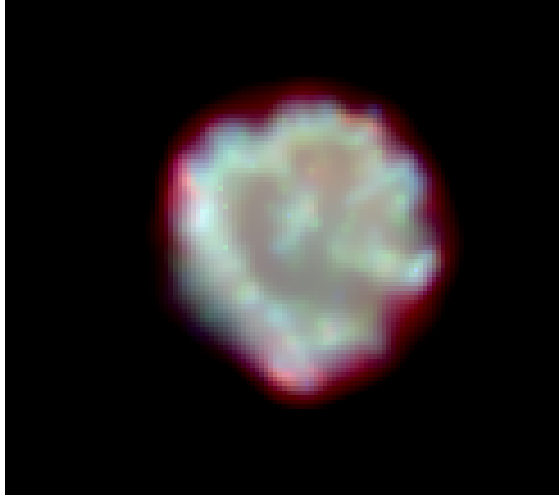
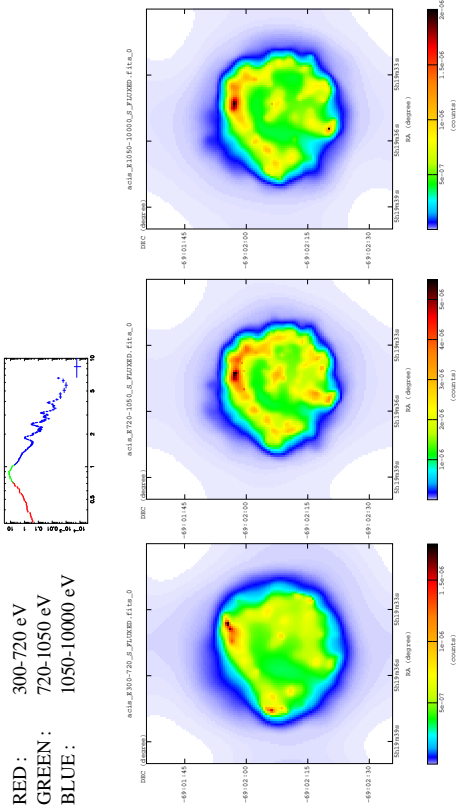
**: 2200-2700 eV**



#### 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 : 300-720 eV  
 GREEN : 720-1050 eV  
 BLUE : 1050-10000 eV

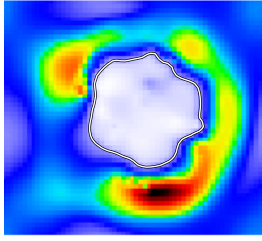
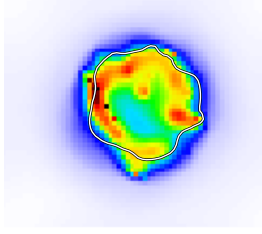
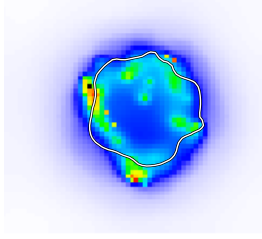
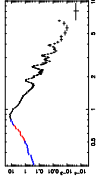


#### 5 Chandra Images : Equivalent Width Map

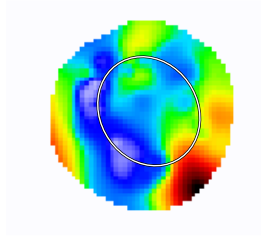
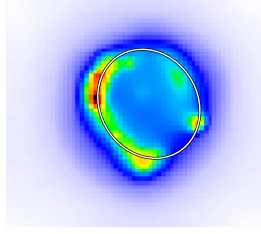
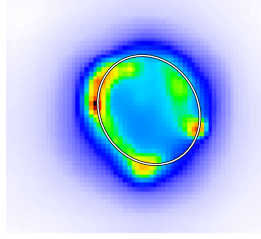
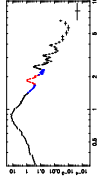
##### 5.1 Equivalent Width Images

- 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 : 300-500 eV  
 line : 500-720 eV  
 continuum : 720-800 eV



continuum : 1430-1670 eV  
 line : 1670-2080 eV  
 continuum : 2080-2330 eV



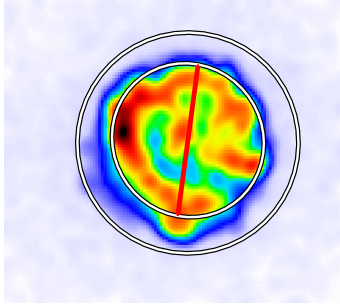
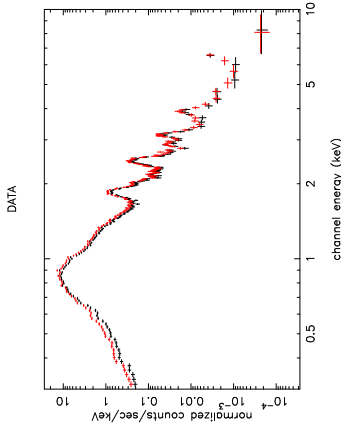
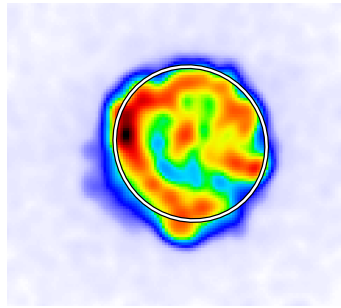
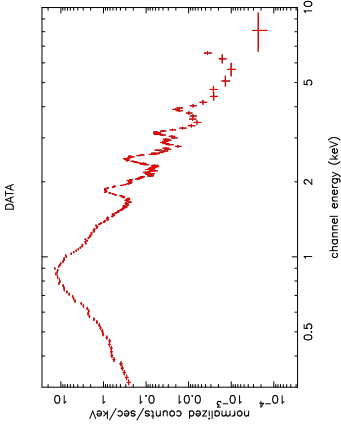
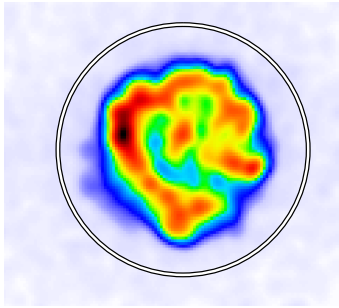
**6 Chandra Spectrum**

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

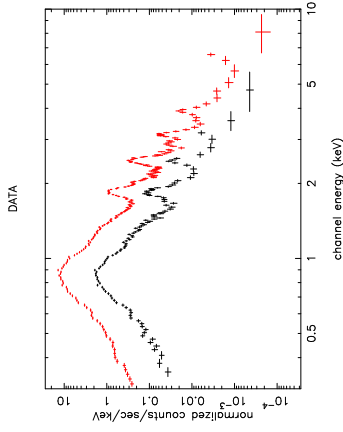
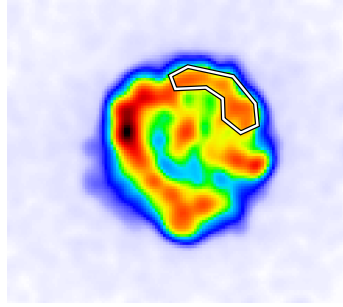
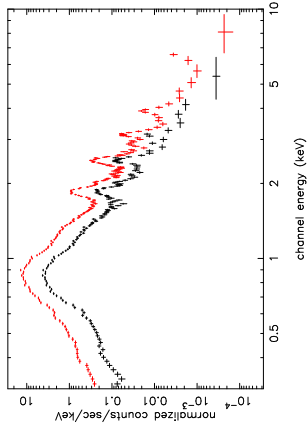
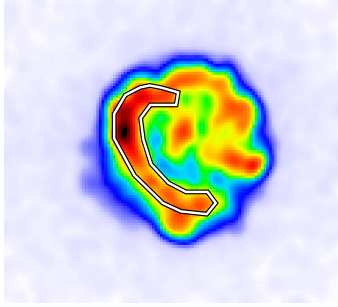
**6.1 ObsID 118**

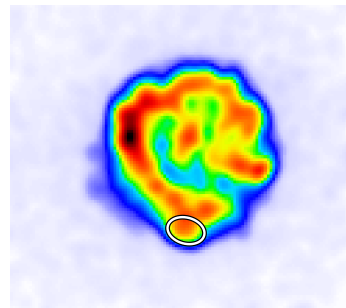
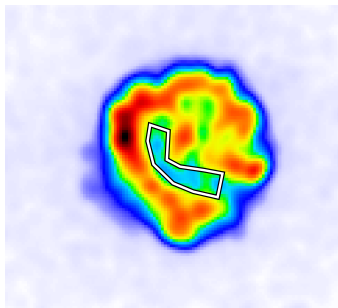
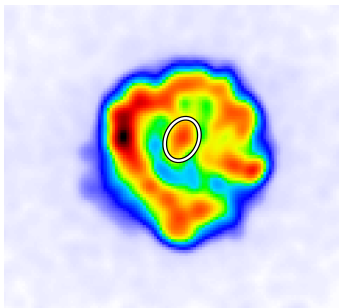
- Background was subtracted from the region around the SNR.

**total**

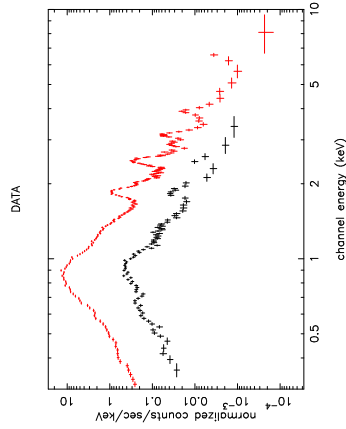
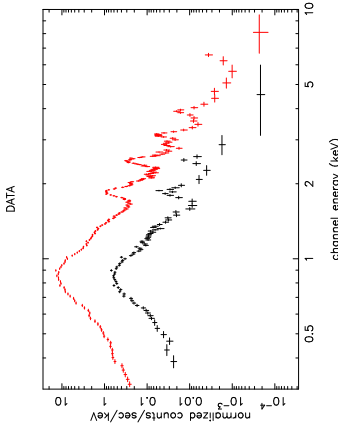
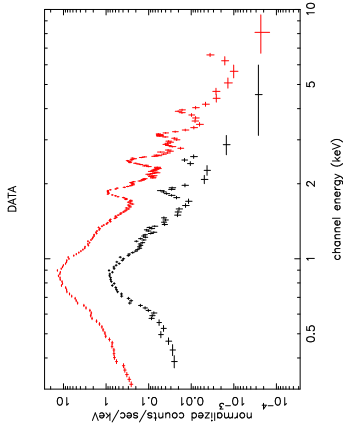


**bright shell at N**





clump at NE

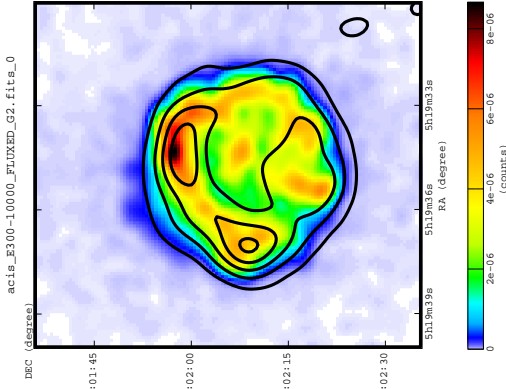
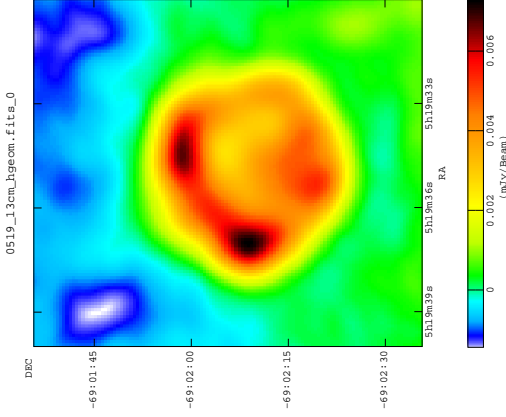


7 Radio Image

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

13-cm

- 13-cm flux density: 0.07 Jy
- Image from Dickel and Milne(1995)



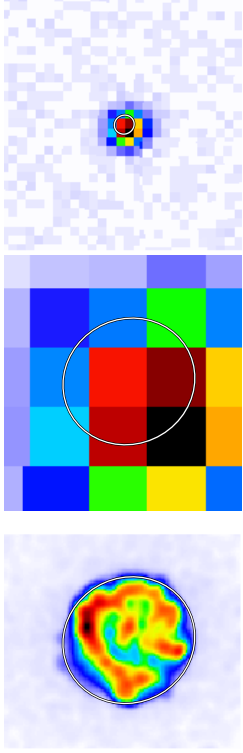
Summary of Observation

|                  |                                   |
|------------------|-----------------------------------|
| Telescope .....  | Australia Telescope Compact Array |
| Date .....       | 1992 March 22, April 2            |
| Frequency .....  | 2.368 GHz                         |
| Beam size .....  | 3.0"x3.0"                         |
| 1 sigma noise .. | 0.07 mJy / beam                   |

## 8 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)



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

