G332.4-0.4

1 Summary

- Common Name: RCW 103
- Distance: 3.3 kpc (Caswell et al., 1975)
- Position of Central Source (J2000): (16 17 36.5, -51 02 41.2)
- X-ray size: 9.3'x8.9'

1.1 Summary of Chandra Observations

<table>
<thead>
<tr>
<th>Sequence</th>
<th>Obs ID</th>
<th>Instrument</th>
<th>Exposure$_{uf}$ (ks)</th>
<th>Exposure$_{f}$ (ks)</th>
<th>Date Observed</th>
<th>Aimpoint (J2000)</th>
</tr>
</thead>
<tbody>
<tr>
<td>500010</td>
<td>970</td>
<td>ACIS-23678</td>
<td>18.9</td>
<td>18.9</td>
<td>2000-02-08</td>
<td>(16 17 36.5, -51 02 26.7)</td>
</tr>
</tbody>
</table>

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

- Most part of the remnant is covered by chip ACIS-S3 (CCD ID=7)
- ACIS-S2 covers some northern part while some eastern and western part are not covered in this observation

1.2 Chandra Counts and Fluxes

<table>
<thead>
<tr>
<th>Region</th>
<th>Energy Range (keV)</th>
<th>Signal (counts)</th>
<th>Rate (counts s$^{-1}$)</th>
<th>$F_X^0$ (ergs cm$^{-2}$ s$^{-1}$)</th>
<th>$F_X$ (ergs cm$^{-2}$ s$^{-1}$)</th>
<th>$L_X$ (ergs s$^{-1}$)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total (970)</td>
<td>0.3 - 10.0</td>
<td>1.106e+06</td>
<td>5.842e+01</td>
<td>1.75e-10</td>
<td>1.70e-08</td>
<td>2.21e+37</td>
</tr>
<tr>
<td></td>
<td>0.3 - 2.1</td>
<td>1.079e+06</td>
<td>5.701e+01</td>
<td>1.58e-10</td>
<td>1.70e-08</td>
<td>2.21e+37</td>
</tr>
<tr>
<td></td>
<td>2.1 - 10.0</td>
<td>2.720e+04</td>
<td>1.437e+00</td>
<td>1.73e-11</td>
<td>2.13e-11</td>
<td>2.77e+34</td>
</tr>
<tr>
<td>Shell (970)</td>
<td>0.3 - 10.0</td>
<td>1.086e+06</td>
<td>5.736e+01</td>
<td>1.68e-10</td>
<td>1.70e-08</td>
<td>2.26e+37</td>
</tr>
<tr>
<td></td>
<td>0.3 - 2.1</td>
<td>1.064e+06</td>
<td>5.620e+01</td>
<td>1.55e-10</td>
<td>1.70e-08</td>
<td>2.26e+37</td>
</tr>
<tr>
<td></td>
<td>2.1 - 10.0</td>
<td>2.232e+04</td>
<td>1.179e+00</td>
<td>1.32e-11</td>
<td>1.66e-11</td>
<td>2.16e+34</td>
</tr>
<tr>
<td>Around central source (970)</td>
<td>0.3 - 10.0</td>
<td>2.016e+04</td>
<td>1.065e+00</td>
<td>6.94e-12</td>
<td>5.67e-11</td>
<td>7.36e+34</td>
</tr>
<tr>
<td></td>
<td>0.3 - 2.1</td>
<td>1.534e+04</td>
<td>8.105e-01</td>
<td>2.89e-12</td>
<td>5.21e-11</td>
<td>6.76e+34</td>
</tr>
<tr>
<td></td>
<td>2.1 - 10.0</td>
<td>4.884e+03</td>
<td>2.58e-01</td>
<td>4.08e-12</td>
<td>4.69e-12</td>
<td>6.08e+33</td>
</tr>
</tbody>
</table>

$NH = 1.04 \times 10^{22}$cm$^{-2}$

Assumed distance: 3.3 kpc (Caswell et al., 1975)

$nH$ was derived by fitting the shell region with two thermal plasma model.

1.3 Nearby Sources

<table>
<thead>
<tr>
<th>Obs ID</th>
<th>Position (J2000)</th>
<th>Size</th>
<th>Net Count</th>
<th>Count rate</th>
<th>Note</th>
</tr>
</thead>
<tbody>
<tr>
<td>970</td>
<td>(16 17 23.7, -50 51 49.8)</td>
<td>&lt;14.4'</td>
<td>144.0</td>
<td>7.6e-03</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(16 17 28.0, -50 55 48.1)</td>
<td>&lt;4.7'</td>
<td>65.3</td>
<td>3.45e-03</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(16 17 29.4, -50 55 11.4)</td>
<td>&lt;6.2'</td>
<td>1610.0</td>
<td>8.5e-02</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(16 18 20.7, -51 07 37.3)</td>
<td>&lt;9.5'</td>
<td>163.0</td>
<td>8.6e-03</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(16 18 49.3, -51 04 24.9)</td>
<td>&lt;20.7'</td>
<td>60.0</td>
<td>3.17e-03</td>
<td></td>
</tr>
</tbody>
</table>

(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

- Caswell et al., 1975 A&A, 45, 239 : Parkes HI absorption
2  Fit Detail

- See spectrum page for used regions.

2.1 Shell:
- Two thermal plasma model.
  
  $\text{source}=\text{xswabs} \ast (\text{xraymond} + \text{xraymond})$
  
  reduced $\chi^2 = 30.9262$
  
  $nh = 1.0408 \times 10^{22}/\text{cm}^2$

2.2 Central source:
- $nh$ fixed at the value derived above.
- Power-law model used
  
  $\text{source}=\text{xswabs} \ast \text{powlaw1d}$
  
  reduced $\chi^2 = 2.72424$
  
  $nh = 1.0408 \times 10^{22}/\text{cm}^2$

2.3 Total:
- $nh$ fixed at the value derive above.
- Twh thermal plasma model with power-law
  
  $\text{source}=\text{xswabs} \ast ((\text{xraymond} + \text{xraymond}) + \text{powlaw1d})$
  
  reduced $\chi^2 = 31.5457$
  
  $nh = 1.0408 \times 10^{22}/\text{cm}^2$

3  CHANDRA IMAGES : BAND IMAGES

3.1 Wide Band Images

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

Total : 300-10000 eV
3 CHANDRA IMAGES : BAND IMAGES

Hard Band : 2100-10000 eV

Green : 700-1690 eV

Red : 300-700 eV

Blue : 1690-3000 eV

3.2 Band images used in true color image.
3.3 Misc.

: 1230-1410 eV

: 1690-1970 eV

: 1970-2320 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:** 700-1690 eV  
**BLUE:** 1690-3000 eV

5 Chandra Spectrum

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

5.1 ObsID 970

- Background was subtracted from the region around the SNR.

![Image of Chandra Images: True Color](image)

![Image of Chandra Spectrum](image)
Central source
6 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 (2.0 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)