The X-ray Emission Properties of G308.3-1.4 and Its Central X-ray Sources

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INTRODUCTION

G308.3 – 1.4 as a promising SNR Candidate

ROSAT IMAGE

Poor Spatial Resolution
Could not confirm any Identification
INTRODUCTION

G308.3 – 1.4 as a promising SNR Candidate

ROSAT IMAGE

Poor Spatial Resolution
Could not confirm any Identification

Chandra ACIS-I IMAGE

SUB-ARSEC RESOLUTION
We initiate an extensive identification campaign of unidentified extended ROSAT All-Sky Survey (RASS) object with the state-of-art X-ray telescopes.

Energy Coverage
- $0.1 \sim 2.4$ KeV
- $0.5 \sim 8$ KeV

Spatial Resolution
- $\sim 96''$
- Better then 100 times $0.5''$

Does not allow to determine whether an present in hard X-ray band

First detailed investigation for the nature of G308.3-1.4 with Chandra observation
The hardness distribution of X-rays

- Incomplete X-ray shell structure

- Clear correlation between X-ray emission and the radio feature
X-ray Spectrum of G308.3-1.4

Emission lines from various metallicities can be clearly observed.

Solid Evidence for Hot Plasma Emission
X-ray/Radio emission and the semi elliptical infrared feature are spatially anti correlated.

When it exploded, Shocked wave could blow out a cavity in the cloud.

Observed depression of IR emission in SW

22um image by Wide-field Infrared Survey Explorer (WISE)
Scenario

Provide a possible explanation of the asymmetric morphology in SW

Cloud could stop the propagation of SNR shock in NE

Lead to absence of radio /X-ray shell in NE

22um image by Wide-field Infrared Survey Explorer (WISE)
Central Compact Object

- Close to the center of SNRs

- High X-ray to optical/radio ratio
  \[(fx / fopt > 10^3)\]

- No long term temporal variability
  (Except for the CCO in RCW 103)

Cassopeia-A
## Central Compact Object

There are only 11 CCOs have been uncovered so far.

<table>
<thead>
<tr>
<th>CCO</th>
<th>SNR</th>
<th>Age (kyr)</th>
<th>Period</th>
<th>Distance (kpc)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1E 161349-5055.1</td>
<td>RCW103</td>
<td>2</td>
<td>6.67h</td>
<td>3.3</td>
</tr>
<tr>
<td>1E 1207.4-5209</td>
<td>G296.5+10.0</td>
<td>7</td>
<td>424ms</td>
<td>2.2</td>
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<tr>
<td>CXOU J185238.6+004020</td>
<td>Kes 79</td>
<td>7</td>
<td>105ms</td>
<td>7.1</td>
</tr>
<tr>
<td>CXOU J232327.8+584842</td>
<td>Cas A</td>
<td>0.3</td>
<td>...</td>
<td>3.4</td>
</tr>
<tr>
<td>RX J0822.0_4300</td>
<td>Puppis A</td>
<td>3.7</td>
<td>122ms</td>
<td>2.2</td>
</tr>
<tr>
<td>RX J1713.4-3949</td>
<td>G347.3_0.5</td>
<td>2</td>
<td>...</td>
<td>1.3</td>
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<tr>
<td>CXOU J085201.4-461753</td>
<td>Vela Jr.</td>
<td>1</td>
<td>...</td>
<td>1</td>
</tr>
<tr>
<td>CXOU J160103.1-513353</td>
<td>G330.2+0.1</td>
<td>...</td>
<td>...</td>
<td>5</td>
</tr>
<tr>
<td>XMMU J172054.5-372652</td>
<td>G350.1-0.3</td>
<td>...</td>
<td>...</td>
<td>4.5</td>
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<tr>
<td>XMMU J17320.3-344518</td>
<td>G353.6-0.7</td>
<td>...</td>
<td>...</td>
<td>3.2</td>
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<tr>
<td>CXOU J181852.0-150213</td>
<td>G15.9+0.2</td>
<td>...</td>
<td>...</td>
<td>8.5</td>
</tr>
</tbody>
</table>

We can not even determined of those object consist of homogenous class.

The sample of CCOs has to be enlarged.
Compact Objects in G308.3-1.4

Source Detection - 17 X-ray sources

<table>
<thead>
<tr>
<th>Source</th>
<th>Net count rate (10^-3 cts s^-1)</th>
<th>S/N^a</th>
<th>PSF RATIO^b</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>0.85±0.31</td>
<td>3.13</td>
<td>2.26</td>
</tr>
<tr>
<td>2</td>
<td>1.45±0.40</td>
<td>4.38</td>
<td>2.64</td>
</tr>
<tr>
<td>3</td>
<td>0.92±0.34</td>
<td>3.06</td>
<td>4.19</td>
</tr>
<tr>
<td>4</td>
<td>1.29±0.40</td>
<td>3.76</td>
<td>3.74</td>
</tr>
<tr>
<td>5</td>
<td>6.47±0.78</td>
<td>13.31</td>
<td>1.64</td>
</tr>
<tr>
<td>6</td>
<td>1.15±0.36</td>
<td>3.77</td>
<td>7.13</td>
</tr>
<tr>
<td>7</td>
<td>12.96±1.03</td>
<td>26.20</td>
<td>5.25</td>
</tr>
<tr>
<td>8</td>
<td>0.71±0.28</td>
<td>2.87</td>
<td>3.19</td>
</tr>
<tr>
<td>9</td>
<td>1.32±0.38</td>
<td>4.25</td>
<td>10.30</td>
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<tr>
<td>10</td>
<td>1.46±0.42</td>
<td>4.24</td>
<td>1.96</td>
</tr>
<tr>
<td>11</td>
<td>1.61±0.38</td>
<td>6.00</td>
<td>4.53</td>
</tr>
<tr>
<td>12</td>
<td>2.14±0.45</td>
<td>6.74</td>
<td>1.46</td>
</tr>
<tr>
<td>13</td>
<td>1.95±0.47</td>
<td>5.32</td>
<td>3.04</td>
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<td>14</td>
<td>1.19±0.37</td>
<td>3.71</td>
<td>3.46</td>
</tr>
<tr>
<td>15</td>
<td>1.06±0.36</td>
<td>3.40</td>
<td>2.41</td>
</tr>
<tr>
<td>16</td>
<td>2.45±0.73</td>
<td>3.63</td>
<td>12.21</td>
</tr>
<tr>
<td>17</td>
<td>3.19±0.89</td>
<td>3.84</td>
<td>11.03</td>
</tr>
</tbody>
</table>
CCO Candidate in G308.3-1.4

X-ray spectra of the emission from the position of source #7 as observed with ACIS-I with the best-fit double blackbody model.
CCO Candidate in G308.3-1.4

Source # 7

Closet Object from the geometric center of the remnant

Column absorption of this object inferred from spectral fit is not far from the value inferred from the remnant spectrum.
CCO Candidate in G308.3-1.4

Source #7 flux variability has also been detected.

It is possible that src #7 in G308.3-1.4 can be the second example.

X-ray source in RCW 103 so far the only CCO

long-term flux variability.
We have performed a detailed spectro-imaging X-ray study of the **SNR candidate G308.3-1.4 with Chandra**.

An incomplete shell-like X-ray structure, which is **well-correlated with radio shell**, has been revealed.

Its X-ray spectrum has shown the presence of a hot plasma accompanied with metallic emission lines.

All these observational evidences clearly suggest **G308.3-1.4 is indeed a SNR**.
Summary

In conclusion,

This proposed alternative window of **SNRs** and **compact objects**.

Survey has been demonstrated to be fruitful by our **pilot target G308.3-1.4**
Thank you 😊