Chandra’s X-ray guide to Centaurus A

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Abstract

Centaurus A is the closest radio-loud active galactic nucleus (AGN). At a distance of 3.8 Mpc, the angular resolution of 0.5 arcsec of Chandra/ACIS translates to ~10 pc. This gives us the unique opportunity to disentangle the X-ray emission from different components. We analyze archival data (2000-2013) and study timing and spectral properties of the core region and the diffuse gas in Cen A. Using the soft X-ray emission lines, we study the nature of this diffuse material. The core region of Cen A emits time- and spectrally-variable hard X-rays. We report that a circumnuclear “halo” (up to 0.2 kpc away from the core) also emits an Fe Kα line, and we investigate the nature of this emission.

The Iron Kα Emission

Table 1. Equivalent widths of the Fe Kα line in annulus regions around the center of Centaurus A.

<table>
<thead>
<tr>
<th>Energy (keV)</th>
<th>Equivalent width of Fe Kα line (10^{19} cm^{-2})</th>
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<tbody>
<tr>
<td>6.7 keV</td>
<td>2.1 &lt; W_{Fe Kα} &lt; 3.1</td>
</tr>
<tr>
<td>6.8 keV</td>
<td>2.1 &lt; W_{Fe Kα} &lt; 3.2</td>
</tr>
<tr>
<td>6.9 keV</td>
<td>2.1 &lt; W_{Fe Kα} &lt; 3.3</td>
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Circumnuclear gas around AGN (accretion disks, torus) usually shows Fe Kα emission at 6.4 keV. For Cen A, we report for the first time an extended Fe Kα emission region. We show that the Fe Kα line is not only emitted by the core, but also by a “halo” surrounding the core and extending up to at least 0.2 kpc. We find time- and spatially-variable Fe Kα emission flux (see Table 1 and Fig. B3), and are currently investigating the role of variable point sources (LMXBs and transient BH XRBs, e.g., Burke et al., 2013).

Conclusion and Outlook

- Chandra images reveal the extended emission at soft X-rays.
- Extended Fe Kα emission: Scattering off surrounding medium? Jet-plasma interaction? Point sources?
- The jet is not visible at energies above ~5 keV.
- Chandra/LETGS observations will allow us to study soft diffuse emission in detail.
- Further investigation of the origin of the hard X-ray emission and a possible link to the iron-line variability.

References

Graefε, C., et al., 2018, Nat, 558, 715