



# Centaurus A



## **Centaurus A: A New Look at an Old Friend**

**Centaurus A is a galaxy famous for a gargantuan jet blasting out of its supermassive black hole.**

**The data in this image were taken from Chandra's archive and are equivalent to over 9 and a half days of observations.**

**Archived data also allow for ongoing scientific studies, including new results on the black holes and neutron stars in Centaurus A.**

Just weeks after NASA's Chandra X-ray Observatory began operations in 1999, the telescope pointed at Centaurus A (Cen A, for short). This galaxy, at a distance of about 12 million light years from Earth, contains a gargantuan jet blasting away from a central supermassive black hole.

Since then, Chandra has returned its attention to this galaxy, each time gathering more data. And, like an old family photo that has been digitally restored, new processing techniques are providing astronomers with a new look at this old galactic friend.

This image of Cen A contains data from observations, equivalent to over nine and a half days worth of time, taken between 1999 and 2012. In this image, the lowest-energy X-rays Chandra detects are in red, while the medium-energy X-rays are green, and the highest-energy ones are blue.

As in all of Chandra's images of Cen A, this one shows the spectacular jet of outflowing material—seen pointing from the middle to the upper left—that is generated by the supermassive black hole at the galaxy's center. This high-energy snapshot of Cen A also highlights a dust lane that wraps around the waist of the galaxy. Astronomers think this feature is a remnant of a collision that Cen A experienced with a smaller galaxy millions of years ago.

The data housed in Chandra's extensive archive on Cen A provide

a rich resource for a wide range of scientific investigations. For example, researchers published findings in 2013 on the point-like X-ray sources in Cen A. Most of these sources are systems where a compact object—either a black hole or a neutron star—is pulling gas from an orbiting companion star. These compact objects form by the collapse of massive stars, with black holes resulting from heavier stars than neutron stars.

The results suggested that nearly all of the compact objects had masses that fell into two categories: either less than twice that of the Sun, or more than five times as massive as the Sun. These two groups correspond to neutron stars and black holes.

This mass gap may tell us about the way massive stars explode. Scientists expect an upper limit on the most massive neutron stars, up to twice the mass of the Sun. What is puzzling is that the smallest black holes appear to weigh in at about five times the mass of the Sun. Stars are observed to have a continual range of masses, and so in terms of their progeny's weight we would expect black holes to carry on where neutron stars left off.

Although this mass gap between neutron stars and black holes has been seen in our galaxy, the Milky Way, this Cen A result provides the first hints that the gap occurs in more distant galaxies. If it turns out to be ubiquitous, it may mean that a special, rapid type of stellar collapse is required in some supernova explosions.

NASA's Marshall Space Flight Center in Huntsville, Alabama, manages the Chandra program for NASA's Science Mission Directorate in Washington. The Smithsonian Astrophysical Observatory in Cambridge, Massachusetts, controls Chandra's science and flight operations.

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**SCALE:** Image is about 16.7 arcmin across  
(about 58,000 light years across)

**COORDINATES (J2000):** RA 13h 25m 27.62s  
Dec -43° 01' 08.80"

**CONSTELLATION:** Centaurus

**OBSERVATION DATE:** 21 pointings between  
12/05/99 and 08/29/12

**OBSERVATION TIME:** 229 hours 57 min  
(9 days 13 hours 57 min)

**COLOR CODE:** Red 0.5-1.0 keV, Green 1.0-1.5 keV,  
Blue 1.5-2.0 keV

**DISTANCE ESTIMATE:** About 11 million light years