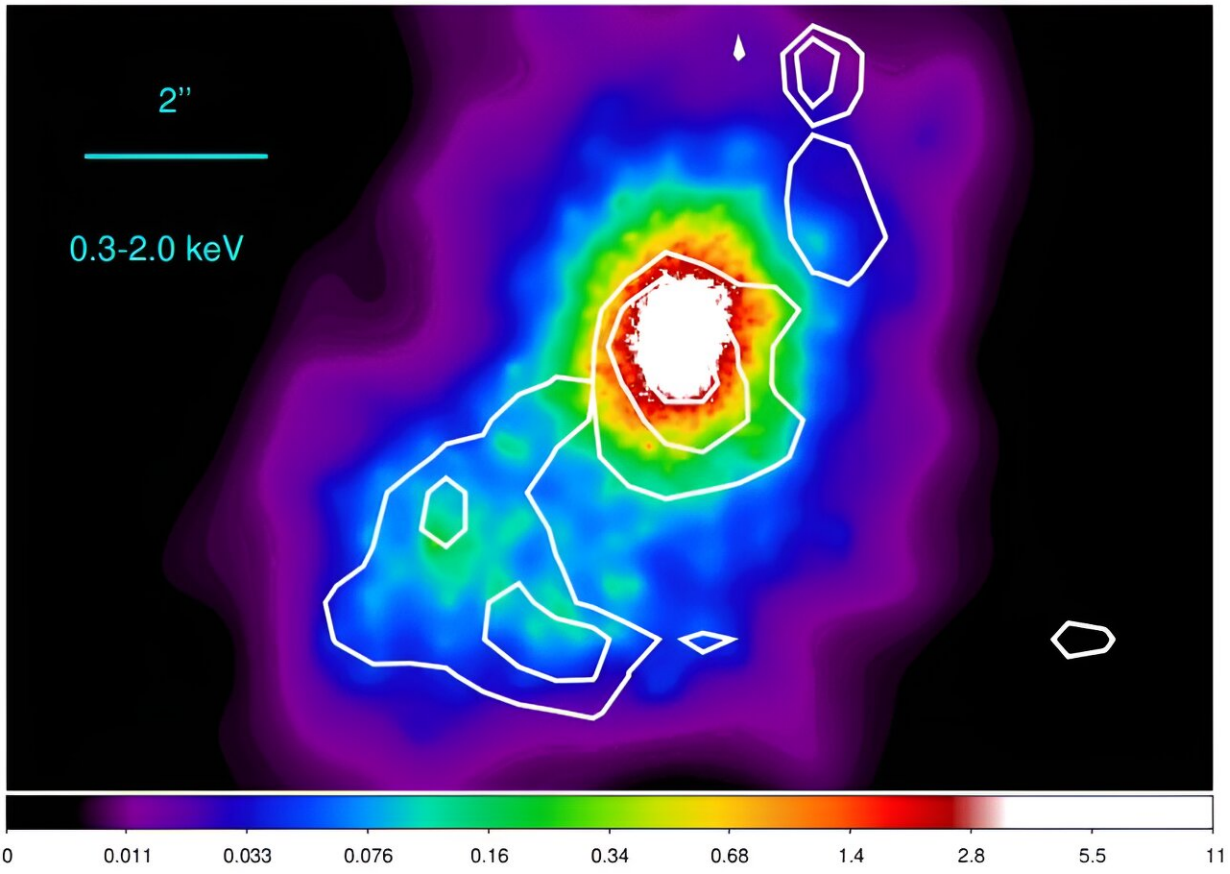
Study explores spectacular ionization cones of the galaxy NGC 5252

January 25 2024, by Tomasz Nowakowski



Chandra ACIS-S image showing the nuclear region of NGC 5252 in soft X-ray band (0.3–2.0 keV). The image is overlaid with the contours of [OIII] emission from the continuum subtracted HST image. Credit: *arXiv* (2024). DOI: 10.48550/arxiv.2401.09172

The nearby lenticular galaxy NGC 5252 hosts extremely extended cones of ionized material. Recent observations conducted by an international team of astronomers have inspected these remarkable structures, providing important insights into their properties. Results of the observational campaign were published January 17 on the pre-print server *arXiv*.

Ionization cones are cones of ionized material extending from active galactic nuclei (AGN). They reach sizes of tens of thousands of light years and are observed mainly in type II Seyfert galaxies. Studies of these structures could help us better understand the interactions between AGN and their host galaxies.

One of the largest ionization cones in the local universe is located in NGC 5252—a type 1.9 Seyfert galaxy at a distance of about 329 million light years away. Previous observations of the ionization cones in NGC 5252 have found that they extend over 130,000 light years across and are composed of several arcs confined in a bi-cone encircling the galaxy's nucleus.

Recently, a group of astronomers led by Chen Wang of the Xiamen University in China, took a closer look at these cones, investigating them in X-rays. For this purpose they employed NASA's Chandra X-ray observatory.

"With a total exposure time of 230 ks, the full data set of Chandra observations used in this work is nearly four times deeper than the previous one, enabling us to investigate the spatially resolved properties of the extended emission to a large radial distance from the nucleus," the researchers explained.

The observations conducted by Wang's team detected the outermost X-ray arc of the cones reaching out to approximately 65,000 light years

from the nucleus of NGC 5252. In general, the X-ray images show that the cone structures mostly follow the direction of the optical ionization cones in the southeast and northwest direction.

Chandra data suggest that the observed extended soft X-rays are due to photoionization and the ionizing source of the cones is the AGN of NGC 5252. Moreover, it was found that as distance from the nucleus increases, the photoionization parameter of ionized gas in the sub-cones stays constant or slightly decreases.

Chandra observations also show that the inferred luminosity of NGC 5252's nucleus used to be much higher than its current luminosity. The astronomers estimate that it may have decreased by about 98% during the past 64,000 years. They assume that a minor merger event may have caused such a change in luminosity.

Based on the collected data, the authors of the paper conclude that NGC 5252 resembles a quasar relic with a supermassive black hole (SMBH) as massive as one billion suns. They suppose that the galaxy went through a minor merger and switched to a low accretion rate state.

More information: Chen Wang et al, Deep Chandra Observation of the Remarkable Ionization Cones of NGC 5252, *arXiv* (2024). DOI: 10.48550/arxiv.2401.09172

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