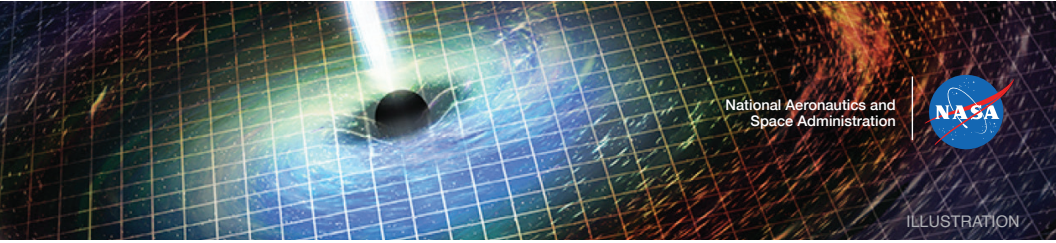

M87: Chandra Captures X-rays in Coordination with EHT

The Event Horizon Telescope (EHT), a network of radio antennae around the globe, captured the first image of a black hole event horizon.

This black hole is located in Messier 87, or M87, which is about 60 million light years from Earth. NASA's Chandra X-ray Observatory studied M87 many times over its 20-year mission so far and sees a much wider field-of-view than the EHT. In the image below, the "+" marks the spot in the Chandra image on the left for the location of the EHT image on the right (not to same scale).

Astronomers used Chandra to obtain data of M87 during the April 2017 observing run by the EHT. These X-ray data, in combination with the radio image from the EHT and other observations, will help scientists learn more about high-energy emission and the physics of accretion and ejection at the event horizon, the boundary between what can and cannot escape the gravitational pull of a black hole.

Chandra can view the full length of the jet of high-energy particles launched by the intense gravitational and magnetic fields around the black hole at M87. This jet (seen in detail from Chandra, below left), extends more than 1,000 light years from the center of the galaxy.

This dark portrait of the event horizon was obtained of the supermassive black hole in the center of the galaxy Messier 87 by the Event Horizon Telescope (EHT), an international collaboration. It took a remarkable effort and coordination from scientists and organizations around the world to even have a chance to make this happen. The result being heralded stems from an observing campaign during April 2017, when this global network of radio dishes observed M87 together.

Thanks to heroic efforts by schedulers at

QUICK FACTS

- The Event Horizon Telescope (EHT), a network of radio antennae around the globe captured the first image of a black hole event horizon.
- This black hole is located in Messier 87, or M87, which is about 60 million light years from Earth.
- Chandra has studied M87 many times over its 20-year mission and sees a much wider field-of-view than the EHT.
- By combining Chandra data with the EHT image, scientists can learn more about the giant black hole and its behavior.

Chandra, EHT, and NASA's Nuclear Spectroscopic Telescope Array (NuSTAR) mission, as well as by the EHT's Multiwavelength Working Group, Chandra was used to observe M87 and other targets during the EHT campaign. While Chandra can't see the shadow itself, its field of view is much larger than the EHT's, so Chandra can view the full length of the jet of high-energy particles launched by the intense gravitational and magnetic fields around the black hole.

To use an analogy, consider a trumpeter in a concert hall: the EHT data, taken from radio telescopes around the globe, provide a close-up view of the mouthpiece (the origin of the sound, like the "central engine" of M87). The Chandra data, by contrast, reveal the sound waves as they travel down the trumpet and reverberate around the concert hall. (As with many analogies, the scale is not exact.) We need both of these pieces in order to understand the sound completely.

"Chandra's X-ray observations coordinated with EHT represent an exciting opportunity to connect the dots between high-energy emission and the physics of accretion and ejection at the event horizon."

Belinda Wilkes, Chandra Director

Surrounding the elliptical galaxy is a reservoir of multimillion-degree gas, which glows brightly in X-ray light. Chandra's studies of this hot gas have given astronomers insight into the behavior and properties of the giant black hole.

Scientists used Chandra and NuSTAR to measure the X-ray brightness of the jet, a data point that EHT scientists used to compare their models of the jet and disk with the EHT observations. Future questions the Chandra data may help explore include: How do black holes accelerate some particles to the very high energies that scientists have seen? How does the black hole produce the spectacular jets that Chandra and Hubble have studied for many years? Can data from Chandra and NASA's NuSTAR observatory help play a role in determining more about the physics in this environment?

Scientists will be poring over the EHT image and the papers that are being published in connection with this result for weeks, months, and even years to come. As they do, they will continue to pull in every resource they can — including famed black hole hunter, the Chandra X-ray Observatory — to learn as much as they can about these exotic and fascinating objects.