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Chandra Finds Sound Waves From Black Hole

By THE ASSOCIATED PRESS

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WASHINGTON (AP) -- When a black hole hums, it's in a deep B-flat, 57 octaves below middle-C and not within the hearing range of humans. This is according to scientists who used the Chandra X-ray Observatory to detect celestial ``singing'' in a cluster of galaxies.

Astronomers at the Institute of Astronomy in Cambridge, England, have identified and interpreted for the first time sound waves rumbling from the halo around a black hole 250 million light-years away. They found evidence of the sounds in Chandra X-ray images of the Perseus cluster, an immense grouping of galaxies held together by the gravity of a supermassive black hole.

Andy Fabian, a professor at the Institute of Astronomy, said a close study of the fine detail collected by Chandra shows ripples in the X-ray pattern that are caused by sound waves excited by the energy from the black hole.

He said the sound produced by the black hole is a B-flat, the same pitch as a key near middle-C on the piano. But the song of the Perseus Black Hole is 57 octaves below that middle-C, far below what the human ear can detect, Fabian said.

Squeezed and accelerated by the gravitational pull of the black hole and nearby galaxies, gases in the Perseus galactic cluster are heated to 50 million degrees, hot enough to generate X-rays. A surge of sound waves adds energy, causing a slight change in the pattern of X-rays.

In effect, Fabian said, the sound waves cause bright and dark emissions of X-rays moving in rings away from the black hole center like ripples on the surface of a pool.

``A three dimensional analogy is when a child takes a straw and blows into a glass of water, producing a sequence of bubbles,'' he said. ``That is like a sequence of sound waves.''

The distance between sound waves determines the pitch. For instance, in a very high pitched sound, such as an upper note of a violin, the sound waves are close together and cycle many times a second. Most sounds detectable by the human ear cycle very rapidly.

But the voice of the black hole could never be heard by the human ear because there are 10 million years between each of the sound waves, ``clearly not within human experience,'' Fabian said.

Bruce Margon of the Space Telescope Science Institute said the study by Fabian and his co-author Steve Allen, also of Cambridge, shows a new way that black holes use to dissipate energy.

``We've known that a black hole can give off energy as light and heat and now we are seeing a third way -- sound," Margon said.

He said that Perseus black hole may play only one note, but it has been playing for about 3 billion years.

``Although this symphony does not have a lot of variety, it is surely the longest lasting symphony that we know," said Margon.

Fabian said it is possible that other galactic clusters with black holes are singing in other tones.

``We would expect that every cluster and group of galaxies has its own note," said Fabian. ``So if you look at the whole universe, there are many tunes being played."

A black hole is a single point in space that is so dense with matter that its gravitational field will not permit the escape of anything, not even light. But the halo around a black hole is very hot and alive with light, X-rays and other forms of energy. The immense gravitation pull of a black hole causes gas and other matter to accelerate at a high rate of speed and to heat by millions of degrees. The action of the black hole also can create jets of matter that shoot out from opposite sides of the single point.

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