

# Hear the Sound of a Black Hole Through NASA Sonification

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Black holes are some of the most extreme objects in the universe. These massive, incredibly dense objects have such a strong gravitational pull that they pull in anything that gets too close – including light. But that doesn't mean black holes are invisible. While black holes themselves can't be seen, the clouds of dust and gas around them can become extremely hot and glow brightly, allowing telescopes to 'see' the black hole in detail.

But it's not just images that help us experience black holes. NASA has created a collection of black hole "sonifications," turning these images into sound as an alternative way to convey data collected from telescopes like the James Webb Space Telescope, the Chandra X-ray Observatory, and the X-ray Polarization Explorer (IXPE).

The three audios shared below represent three different stages in the life cycle of a black hole.

First is WR 124, a Wolf-Rayet star, a potential precursor to a black hole. As these old, massive stars reach the end of their lives, they begin to eject layers of gas into space, forming complex clouds around them. Eventually, when enough material has been ejected, the star may collapse and become a new black hole.

The sounds start at the center, where the core of the star is. As you move outward, the X-ray data is represented by the sound of a harp, while the James Webb data is represented by the sound of a bell. Other infrared data, from three different telescopes, is represented by the sound of a string.

The second soundscape is of SS 433, a binary system consisting of a star similar to our Sun and a much more massive companion, believed to be a black hole or neutron star. The two objects orbit each other, creating variations in X-rays that can be detected by telescopes on Earth. Combining X-ray data with infrared and radio data, the soundscape moves from right to left across the image. Bright spots near the top of the image are represented by high notes, while radio, infrared, and X-ray light are represented by low, mid, and high tones, respectively. The stars in the background can be heard as drops of water falling.

Finally, Centaurus A is a nearby and famous galaxy known for its extreme brightness and intense radio emissions. At its center is a supermassive black hole, the star of this sonification. The black hole emits a jet that is the source of the radio waves. The sonification tracks the jet's impact in a clockwise radar fashion. The Chandra X-ray data is represented by wind chimes, while the IXPE X-ray data is represented by a continuous

wind sound.

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