

National Aeronautics and Space Administration



# *A Universe of* SOUND



[www.nasa.gov](http://www.nasa.gov)



Sonification is the process that translates data into sound, and a new project brings our high-energy Universe to listeners for the first time. Scientists are using NASA's Chandra X-ray Observatory and other instruments around the world and in space to help us experience the cosmos through sound. Whether it comes from vocal chords in our throats or the surface of the Sun, sound plays a valuable role in our understanding of the world and cosmos around us.

#### Explore the sonifications

In each data sonification in this handout, astronomical data collected by NASA's Chandra X-ray Observatory and other telescopes are converted into sounds. These data sonifications map the data from these space-based telescopes into a form that users can hear instead of only see, embodying the data in a new form without changing the original content. Listen to these sonifications and more at [chandra.si.edu/sound](http://chandra.si.edu/sound)



To listen to the sounds of the universe, scan the code.



#### WHAT IS SOUND

*Every sound begins with a vibration. When those vibrations travel through the air, they can enter the human eardrum where they are eventually turned into electrical signals that our brain interprets as sound. These vibrations can come from many sources here on Earth, as well as those in our Solar System and even across our Universe.*

#### Westerlund 2 Sonification

This is a cluster of young stars – about one to two million years old – located about 20,000 light-years from Earth. In its visual image form, data from Hubble (green and blue) reveals thick clouds where stars are forming, while X-rays seen from Chandra (purple) penetrate through that haze. In the sonified version of this data, sounds sweep from left to right across the field of view with brighter light producing louder sound. The pitch of the notes indicates the vertical position of the sources in the image with the higher pitches towards the top of the image. The Hubble data is played by strings, either plucked for individual stars or bowed for diffuse clouds. Chandra's X-ray data is represented by bells, and the more diffuse X-ray light is played by more sustained tones.



#### M16/Pillars of Creation Sonification

In the "Pillars of Creation" (image above) piece, the sounds are generated by moving horizontally across the image from left to right as seen in both optical and X-ray light. As with the sonification of the Galactic Center, the vertical position of the recorded light controls the pitch, but in this case it varies over a continuous range of pitches. Particular attention is paid to the structure of the pillars which can be heard as sweeps from low to high pitches and back. The two different "melodies" of optical and X-ray light can be enjoyed individually or simultaneously.



## Galactic Center Sonification

The center of our Milky Way galaxy is too distant for us to visit in person, but we can still explore it. The sonic translation begins on the left side of the image and moves to the right, with the sounds representing the position and brightness of the sources. The light of objects located towards the top of the image are heard as higher pitches while the intensity of the light controls the volume. Stars and compact sources are converted to individual notes while extended clouds of gas and dust produce an evolving drone. The crescendo happens when we reach the bright region to the lower right of the image. This is where the

4-million-solar-mass supermassive black hole at the center of the Galaxy, known as Sagittarius A\*, resides, and where the clouds of gas and dust are the brightest.

Users can listen to data from this region, roughly 400 light years across, either as “solos” from NASA’s Chandra X-ray Observatory, Hubble Space Telescope, and Spitzer Space Telescope, or together as an ensemble in which each telescope plays a different instrument.

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