



Data Sonification: NASA

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Why in News

The National Aeronautics and Space Administration's (NASA) Chandra X-Ray Center (CXC) has unveiled a new 'sonification' project that transforms data from astronomical images into audio.

Key Points

- **Data Sonification:**
 - It refers to the use of **sound values to represent real data.**
 - It is the auditory version of data visualisation.
 - In NASA's **Chandra (sonification) project**, for instance, data is represented using a number of **musical notes.**
 - The birth of a star, a cloud of dust or even a black hole can be 'heard' as a high- or low-pitched sound.

- **Process of images into sound translation:**
 - Telescopes in space collect digital data, in the form of **ones and zeroes (binary)**, before converting them into images.
 - The images are **visual representations of light and radiation of different wavelengths** in space, that can't be seen by the human eye.
 - The Chandra project has created a celestial concert by translating the same data into sound. **Pitch and volume** are used to denote the **brightness and position** of a celestial object or phenomenon.
 - **Pitch** is related to frequency of sound waves. Changing the number of vibrations per second changes the pitch.
 - **Volume**, or loudness, is related to the strength, intensity, pressure, or power of the sound. Bigger/amplified vibrations result in bigger/louder sounds.
 - The data has been collected by NASA's Chandra X-Ray Observatory, Hubble Space Telescope and **Spitzer Space Telescope**.
 - Thus far, Project Chandra has released three examples - the Galactic Centre, Cassiopeia A, and Pillars of Creation Nebula.
 - **The Galactic Centre**
 - It is the rotational centre of the **Milky Way galaxy**.
 - It comprises a collection of celestial objects —
 - Neutron and **white dwarf stars**,
 - Clouds of dust and gas,
 - A supermassive black hole called **Sagittarius A***(weighs four million times the mass of the sun).
 - **Cassiopeia A**
 - Located around **11,000 light years away from Earth** in the **northern Cassiopeia constellation**.
 - Cassiopeia A is a well-known **remnant** of a once-massive star that was destroyed by a supernova explosion around 325 years ago.
 - **The Pillars of Creation**

The iconic Pillars of Creation is located in the **centre of the Eagle Nebula** (it is a constellation of stars), which is also known as **Messier 16**.

- **Significance of Data Sonification:**

- The sonification project was led by the Chandra X-ray Center in collaboration with NASA's **Universe of Learning Program (UoL)**, which aims to "incorporate NASA science content into the **learning environment effectively and efficiently** for learners **of all ages**".
- Over the years, NASA has been working towards making data about space accessible for a larger audience.
- Sonification projects like this allow audiences - including **visually-impaired communities** - to experience space through data.

Chandra X-ray Project

- The Chandra X-ray Observatory was launched by Space Shuttle Columbia in 1999.
- The Chandra X-ray Observatory is **part of NASA's fleet of "Great Observatories"** along with the Hubble Space Telescope, the Spitzer Space Telescope.
- The "X-ray universe" refers to the universe as observed with telescopes designed to detect X-rays. X-rays are produced in the cosmos when matter is heated to millions of degrees. Such temperatures occur where high magnetic fields, or extreme gravity, or explosive forces exist in space.
- The telescope is **named after the Nobel Prize-winning Indian astrophysicist Subrahmanyan Chandrasekhar**.
 - Subrahmanyan Chandrasekhar 's work implied that stars more massive than the so-called Chandrasekhar limit would eventually collapse to become objects so dense that not even light could escape it.

Chandrasekhar limit is the theoretical maximum mass a white dwarf star can have and still remain a white dwarf.
 - Although this finding was received with some skepticism at the time, it went on to form the foundation of the theory of black holes, eventually earning him a Nobel Prize in physics for **1983**.

The Hubble Space Telescope

- It is one of the largest and most versatile telescopes in service.
- It is a space telescope that was launched into **low Earth orbit** (540km above Earth) in 1990.
- Hubble's four main instruments observe in the near ultraviolet, visible, and near infrared spectra.

Black Holes

- The term '**black hole**' was coined in the mid-1960s by American Physicist John Archibald Wheeler.

- It refers to a point in space where the matter is so compressed as to create a gravity field from which even light cannot escape.
- Black-holes were **theorized by Albert Einstein in 1915.**

Supernova

- A supernova is the **explosion of a star.** It is the largest explosion that takes place in space.
- A supernova happens where there is a change in the core, or centre, of a star.

Neutron stars

- Neutron stars comprise one of the possible evolutionary end-points of high mass stars.
- Once the core of the star has completely burned to iron, energy production stops and the core rapidly collapses, squeezing electrons and protons together to form neutrons and neutrinos.
- A star supported by neutron degeneracy pressure is known as a ‘neutron star’, which may be seen as a pulsar if its magnetic field is favourably aligned with its spin axis.

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