Data Sonification

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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.

What is the project?

- Users can now 'listen' to images of the Galactic Centre, the remains of a supernova called Cassiopeia A, as well as the Pillars of Creation Nebula, which are all located in a region around 26,000 light-years away from Earth.
- The data has been collected by NASA's Chandra X-Ray Observatory, Hubble Space Telescope and Spitzer Space Telescope – each of which is represented by a different musical 'instrument'.

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.

How did NASA translate astronomical images into sound?

- NASA's distant telescopes in space collect inherently digital data, in the form of ones and zeroes, before converting them into images.
- The images are essentially 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 of sorts by translating the same data into sound. Pitch and volume are used to denote the brightness and position of a celestial object or phenomenon.

- So far, the astronomers behind Project Chandra have released three examples made using data collected from some of the most distinct features in the sky – 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, which is also known as Messier 16.
  - The Hubble Star Telescope was used for images of the celestial structure, which comprises wispy towers of cosmic dust and gas.
  - Here too, different colours are used to represent elements – blue for oxygen, red for sulphur and green for both nitrogen and hydrogen.
  - Like with the Galactic Centre, this sound translation also plays from left to right. However, the sound has an eerie effect, with sharp whistles representing stars and low howls

indicating the presence of gas clouds.

Significance of the project

- The sonification project 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.
- The 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