Local Bubbles

Why in News?

Recently, new research on a **giant cosmic cavity** that surrounds the **solar system** could reveal the **universe's secrets,** including questions about the **origins of stars.**

- Researchers from the **Center for Astrophysics (CfA) | Harvard & Smithsonian** have generated a **3D magnetic map** of the cavity called **Local Bubble.**

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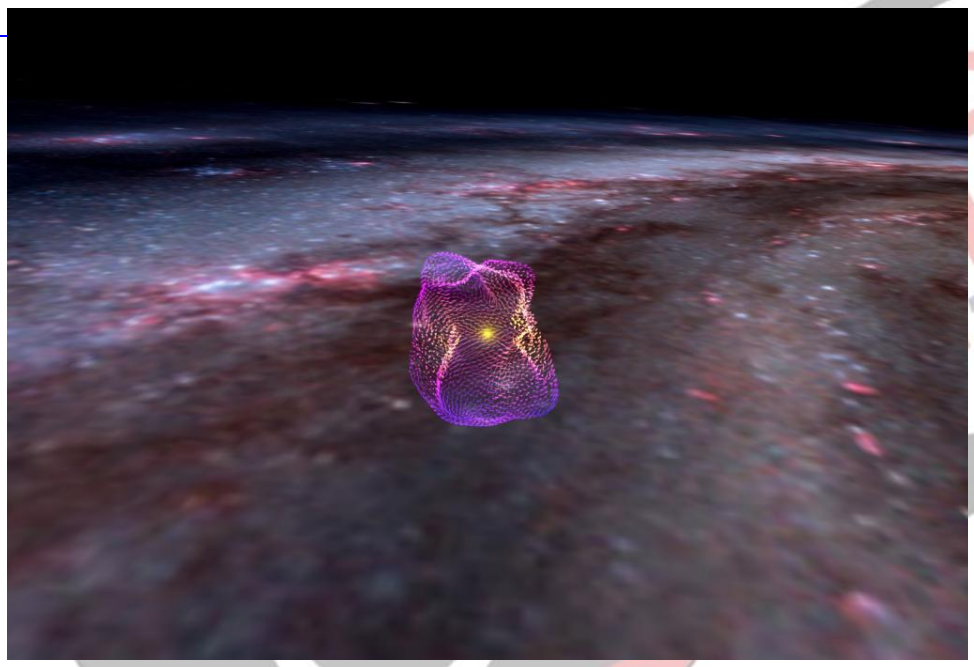

What are Local Bubbles?

- The **Local Bubble** is a **1,000-light-year-wide cavity** or a **superbubble**. Other **superbubbles** also exist in the **Milky Way.**
- The Local Bubble is a large, low-density region in the interstellar medium (ISM) of our galaxy, the **Milky Way.**
    - The interstellar medium is the material which fills the space between the stars.
- It's a cavity that is thought to have been created by a series of **supernovae explosions** that occurred about **30 to 50 million years ago.**

What is a Supernova?

- A **supernova** is a **powerful and luminous explosion** that occurs at the end of the life of a massive star.
- It is caused by the **collapse of the core of the star**, which can trigger a **massive release of energy.**

- **Supernovae** are also important for the **enrichment of the interstellar medium** with heavy elements and for the propagation of **cosmic rays.**
- There are **two main types of supernovae:**
    - **Type I:**
        - It is a supernova caused by the thermonuclear explosion of a **white dwarf star** that is part of a binary system.
        - The white dwarf accretes material from its companion star, and when its mass exceeds a certain limit, it becomes unstable and detonates.
    - **Type II:**
        - It is caused by the **gravitational collapse** of the **core of a massive star.**
        - When a star has exhausted the **nuclear fuel** in its core, its outer layers collapse inward, and the core becomes incredibly hot and dense.
        - This causes a **huge release of energy,** which causes the star to explode.
        - The explosion is so powerful that it can **outshine an entire galaxy for a brief period of time**, and the explosion debris can cause the formation of **nebulae, dust** and **heavy elements.**

How 3D Map of a Gigantic Cavity of Local Bubbles Observed?

- They used **Gaia** and **Planck** space based observatories launched by the **European Space Agency (ESA).**
- **Gaia** was used to **identify the location** and **local concentration** of **cosmic dust.**
    - This helped them trace the boundaries of the **Local Bubble.**
- Planck provided information on the **magnetic alignment of cosmic dust.**
- This alignment can indicate the **orientation of the magnetic field** acting on the dust particles, allowing the researchers to **generate a 3D magnetic field orientation** on the surface of the **Local Bubble.**

UPSC Civil Services Examination, Previous Year's Question (PYQs)

Q. Recently, scientists observed the merger of giant 'blackholes' billions of light-years away from the Earth. What is the significance of this observation? (2019)

(a) 'Higgs boson particles' were detected.
(b) 'Gravitational waves' were detected.
(c) Possibility of inter-galactic space travel through 'wormhole' was confirmed.
(d) It enabled the scientists to understand 'singularity'

Ans: (b)

Source: DTE