



## 3-D Map of the Universe

**For Prelims:** [Dark Energy](#), [space Technology](#), lunar mission, [Radio Telescopes](#), optical telescope, [ISRO](#), [NASA](#), [ESA](#), TIFR, DESI

**For Mains:** Discuss the type and nature of Dark Energy.

**Source:** [IE](#)

### Why in News?

Recently, the most comprehensive three-dimensional map of the universe has been released by an international team of researchers.

- Scientists believe that this development could reveal some clues about **Dark Energy**.
- This map, derived from the first year of observations by **the Dark Energy Spectroscopic Instrument (DESI)**, offers insights into the **spatial distribution of galaxies** and holds promise in unravelling the mysteries of [Dark Energy](#).

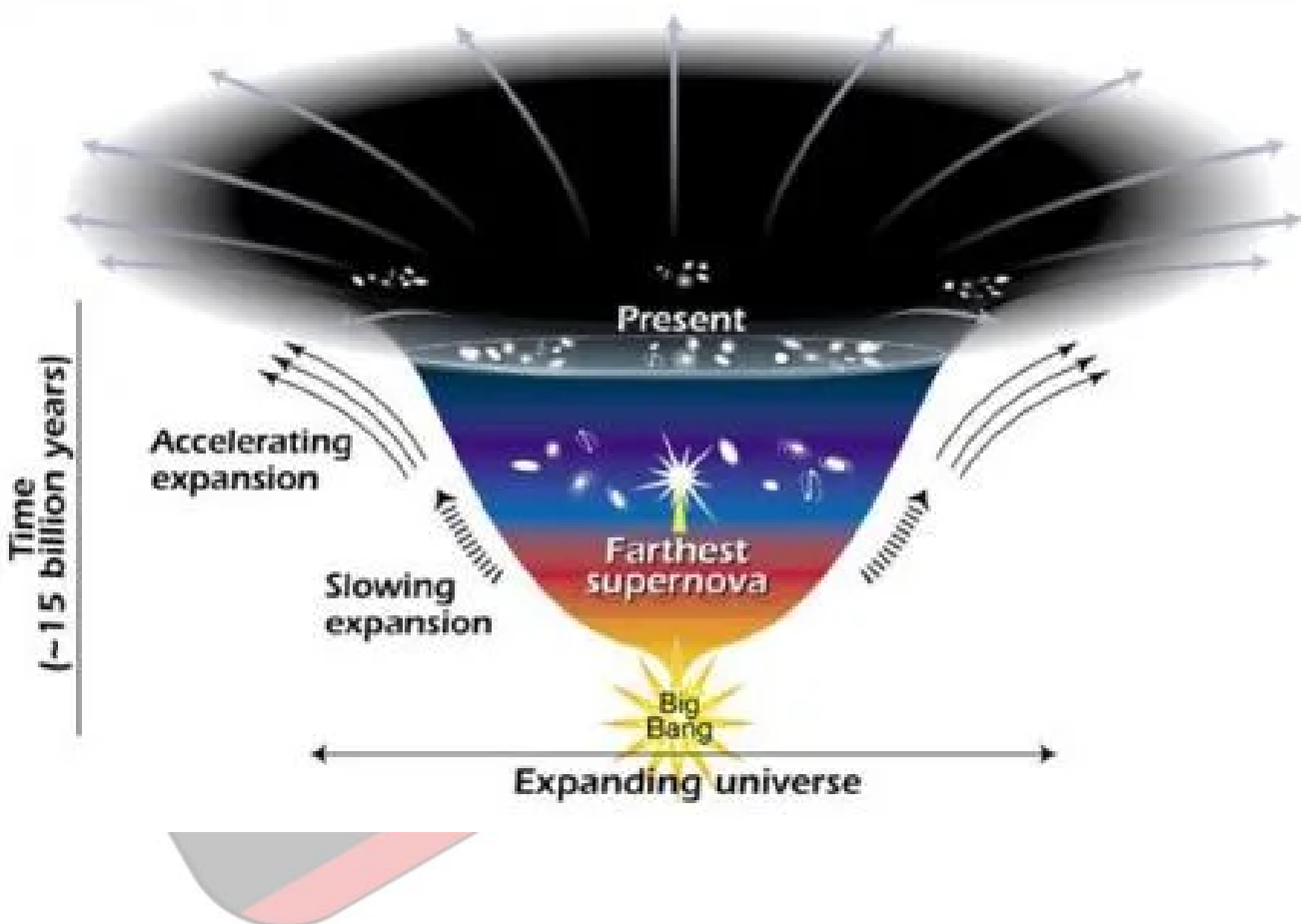
### What are the Universe's Fundamental Components?

- The universe is made up of three components:
  - Normal or visible matter (5%)
  - Dark matter (27%),
  - Dark energy (68%)
- **Normal Matter:**
  - Normal matter makes up everything we can directly observe.
  - It is composed of atomic particles like protons, neutrons, and electrons.
  - It can exist as gas, solid, liquid, or plasma of charged particles.
- **Dark Matter:**
  - Like ordinary matter, dark matter **takes up space and holds mass**.
  - Dark matter is **invisible and does not interact with light**, making it impossible to directly observe.
  - **It exerts gravitational influence**, as evidenced by its impact on the motion of stars, gas, and galaxies.
  - Dark matter is believed to **form halos around galaxies**, and it is more **prevalent in dwarf galaxies compared to larger ones**.
- **Dark Energy:**
  - Dark energy is a mysterious force **that counteracts gravity, causing the expansion of the universe to accelerate**.
  - Despite being invisible like dark matter, dark energy has a different effect, **pushing galaxies apart instead of pulling** them together.
  - The discovery of dark energy in 1998 was based on measurements of cosmic expansion, which revealed an increasing rate of expansion.
- **Nature of Dark Energy:**

- The recent findings have raised the tantalising possibility that dark energy – a mysterious, repulsive force that drives the process – **is not constant throughout time as has previously been suggested.**
- **Dark Energy is detected by its effect** on the rate at which the universe expands and its effect on the rate at which large-scale structures such as galaxies and clusters of galaxies form through gravitational instabilities.

### Dark Energy Spectroscopic Instrument (DESI):

- **DESI is a unique piece of equipment** that, once fitted over a telescope, can capture **light from 5,000 galaxies at the same time.**
  - It is a collaboration of **more than 900 researchers** in institutions across the world. From India, **TIFR (Tata Institute of Fundamental Research)** is the only participating institution.
- Using DESI, which is mounted over the **Mayall 4-Meter Telescope in Arizona, US**, researchers have been able **to measure light from six million galaxies** – some of which existed as far back as **11 billion years ago.**
- This was used to prepare **the most detailed map of the universe as yet.**



Read more: [Dark Energy](#), [Dark Matter](#)

### UPSC Civil Services Examinations, Previous Year Questions

**Q.1 Which of the following is/are cited by the scientists as evidence/evidence for the continued expansion of the universe? (2012)**

1. Detection of microwaves in space
2. Observation of redshift phenomenon in space

3. Movement of asteroids in space
4. Occurrence of supernova explosions in space

**Select the correct answer using the codes given below:**

- (a) 1 and 2
- (b) 2 only
- (c) 1, 3 and 4
- (d) None of the above

**Ans: (a)**

**Q.2. In the year 2008, which one of the following conducted a complex scientific experiment in which sub-atomic particles were accelerated to nearly the speed of light? (2008)**

- (a) European Space Agency
- (b) European Organization for Nuclear Research
- (c) International Atomic Energy Agency
- (d) National Aeronautics and Space Administration

**Ans: b**

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