Challenging Big Bang Theory

Source: TH

Why in News?

Recent observations from the **James Webb Space Telescope (JWST)** have revealed the **existence of massive, fully-formed galaxies** and **black holes** as early as **400-650 million years** after the **Big Bang**.

- This challenges the **Big Bang Theory's** standard model, which posits that galaxies took **billions of years** to form after the universe's creation.

What are Key Highlights of the Study?

- **Challenge to Big Bang Theory: NASA's JWST** has discovered a surprising number of massive, fully-formed galaxies **just 400-650 million years after** the Big Bang. This challenges the Big Bang Theory, which states that the universe started as an extremely **hot and dense point (singularity) 13.8 billion years ago**, and galaxies were thought to form much later, over billions of years.
    - These early, mature galaxies don't fit with the current understanding of how the universe evolved.
- **Black Holes as Indicators: Black holes** (referred as little red dots), especially supermassive ones at the centres of galaxies, serve as **key indicators** of a galaxy's formation and evolution.
    - The amount of heat and light emitted by the blackhole helps in accurately **measuring the mass of stars** in galaxies.
- **Reason for Massive Galaxies in Early Universe:** One possible explanation for a larger number of massive galaxies in the early universe is that these galaxies **manufactured stars more efficiently** than the galaxies of today.
- **Role of JWST:** It has a **6.5 m** wide primary mirror and is specifically designed for **infrared observations** with a focus on studying the **early universe.**
    - Observations in the **infrared spectrum** allows researchers to **detect light** from the **earliest galaxies** and see through **dust clouds** and identify **celestial objects** that are otherwise **obscured**.

Big Bang Theory

- **Origin of the Universe:** Proposed by **Georges Lemaître** in 1927, the **Big Bang Theory** explains how the universe began as a **single, infinitely small and hot point** that expanded and stretched to create the vast universe.
- **Evidence and Confirmation: Edwin Hubble** later confirmed this idea by observing galaxies **moving away from us**, indicating that the universe is still expanding.
    - **Visible and ultraviolet light** from distant galaxies shift to the **infrared wavelengths** as the universe expands.
- **Formation of Celestial Bodies:** As the universe expanded, it **cooled**, allowing particles to form atoms, which then combined to create celestial bodies such as **planets, asteroids, comets, and black hole.**

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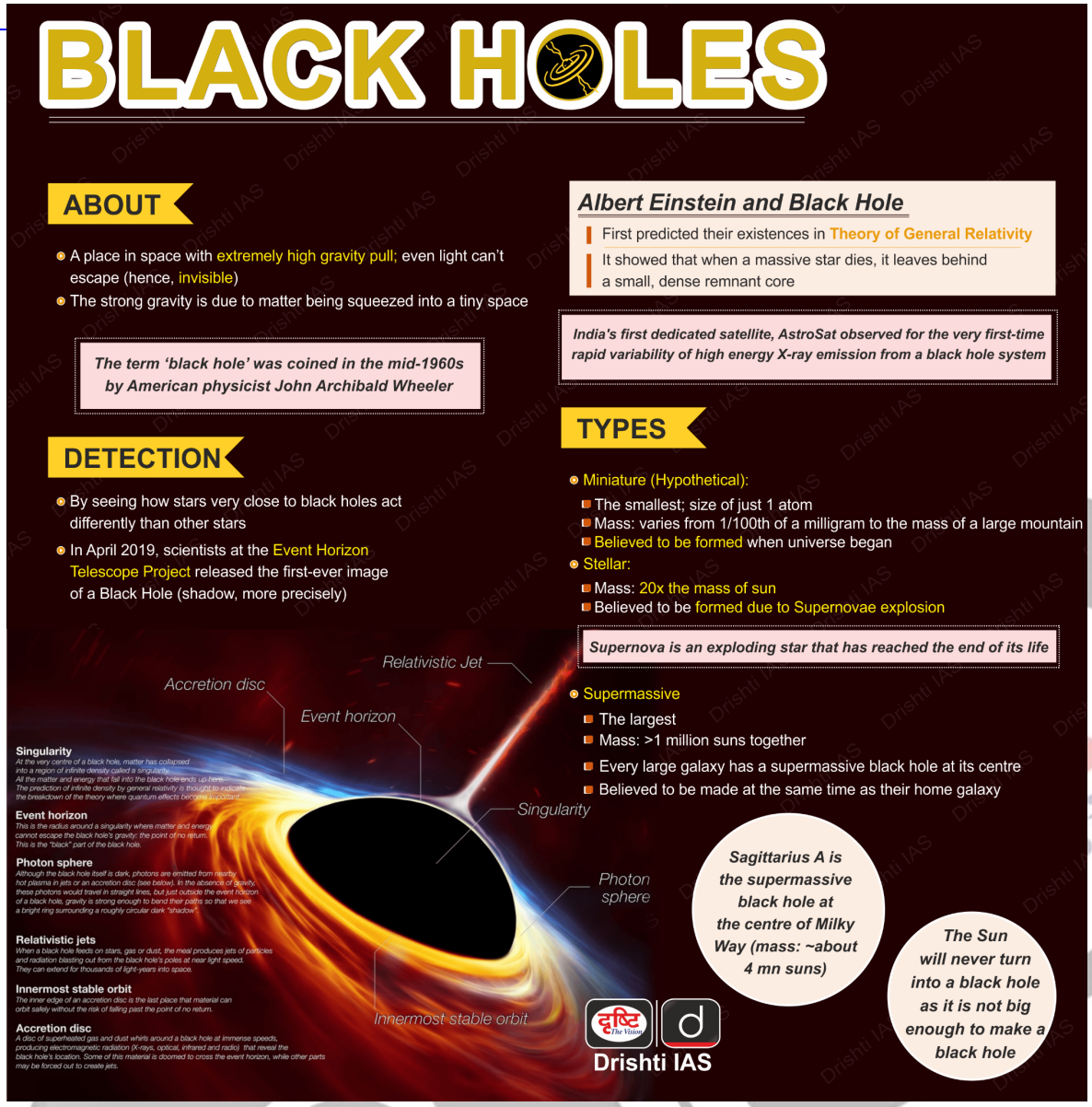

UPSC Civil Services Examination, Previous Year Question (PYQ)

Prelims:

Q.The terms 'Event Horizon', 'Singularity', 'String Theory' and 'Standard Model' are sometimes seen in the news in the context of (2017)

(a) Observation and understanding of the Universe

(b) Study of the solar and the lunar eclipses

(c) Placing satellites in the orbit of the Earth

(d) Origin and evolution of living organisms on the Earth

Ans: (a)

Q. Which of the following is/are cited by the scientists as evidence/evidences for the continued expansion of 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 can be cited as evidence

Ans: (a)

Q. Which of the following pairs is/are correctly matched? (2008)

Theory/Law	**Associated Scientist**
1. Continental Drift :	Edwin Hubble
2. Expansion of Universe :	Alfred Wegener
3. Photoelectric Effect :	Albert Einstein

Select the correct answer using the code given below:

Code:

(a) 2 and 3 only

(b) 3 only

(c) 2 only

(d) 1 only

Ans: (b)