



## Smaller Black Hole in OJ 287 Galaxy

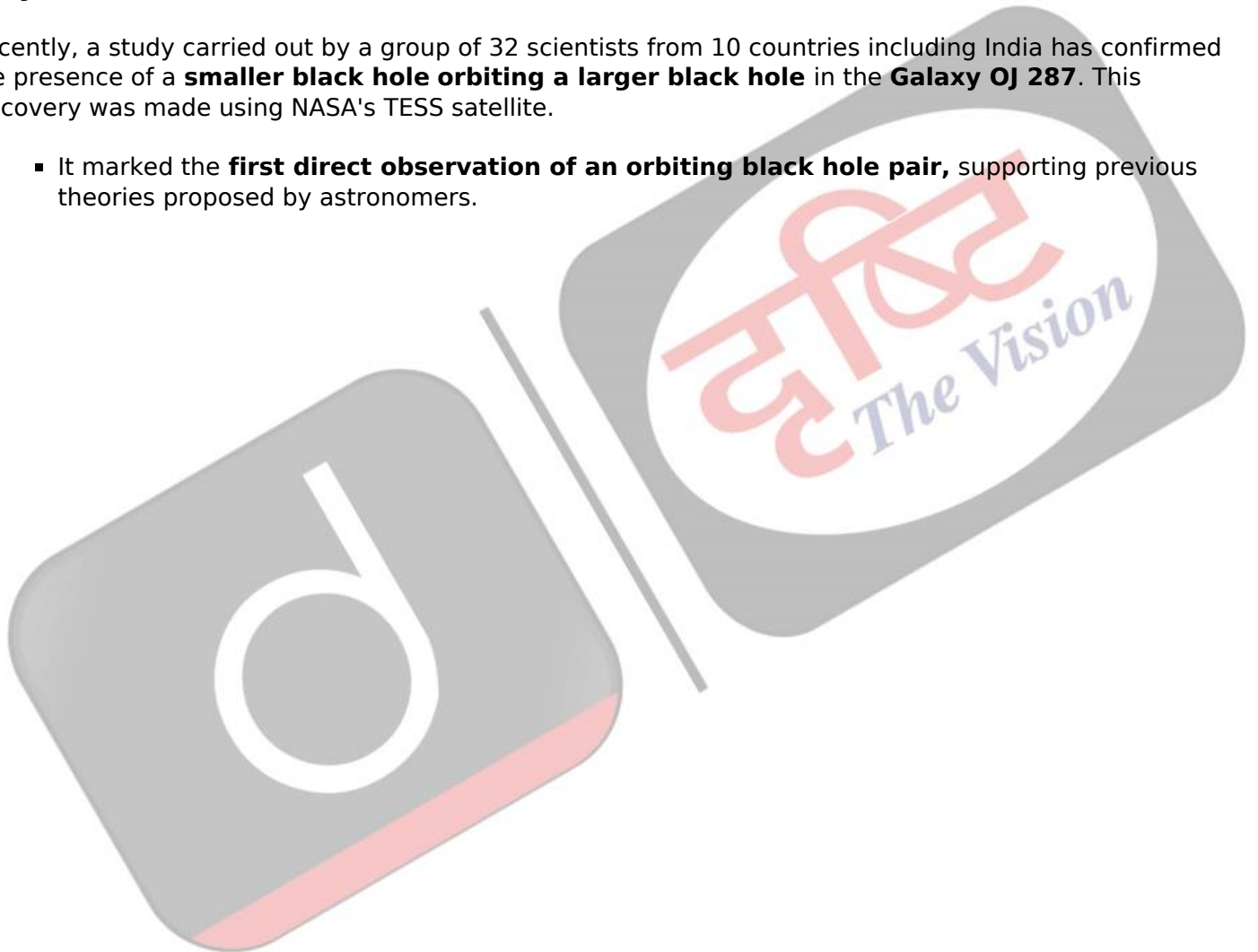
[Source: PIB](#)

### Why in News?

Recently, a study carried out by a group of 32 scientists from 10 countries including India has confirmed the presence of a **smaller black hole orbiting a larger black hole** in the **Galaxy OJ 287**. This discovery was made using NASA's TESS satellite.

- It marked the **first direct observation of an orbiting black hole pair**, supporting previous theories proposed by astronomers.

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# BLACK HOLES

## ABOUT

- A place in space with **extremely high gravity pull**; even light can't escape (hence, **invisible**)
- The strong gravity is due to matter being squeezed into a tiny space

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

## DETECTION

- By seeing how stars very close to black holes act differently than other stars
- In April 2019, scientists at the **Event Horizon Telescope Project** released the first-ever image of a Black Hole (shadow, more precisely)

## Albert Einstein and Black Hole

- First predicted their existences in **Theory of General Relativity**
- It showed that when a massive star dies, it leaves behind a small, dense remnant core

India's first dedicated satellite, **AstroSat** observed for the very first-time rapid variability of high energy X-ray emission from a black hole system

## TYPES

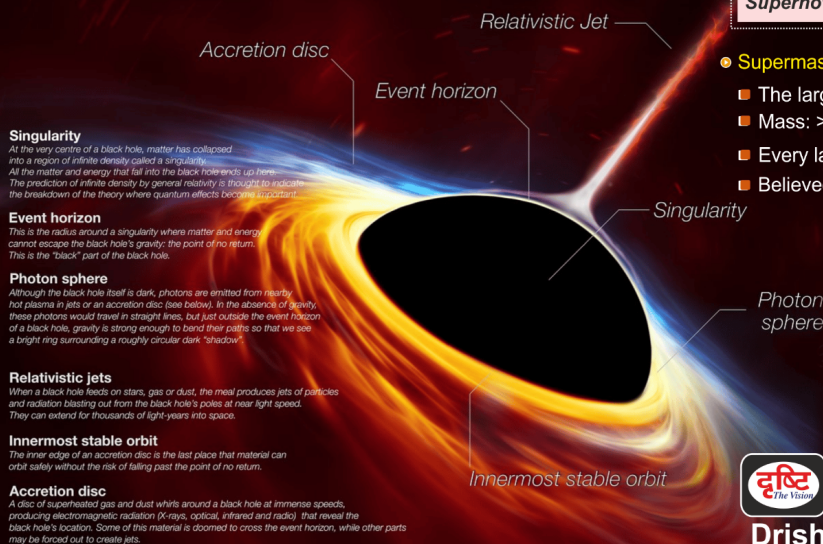
- **Miniature (Hypothetical):**
  - The smallest; size of just 1 atom
  - Mass: varies from 1/100th of a milligram to the mass of a large mountain
  - Believed to be formed when universe began
- **Stellar:**
  - Mass: **20x the mass of sun**
  - Believed to be formed due to **Supernovae explosion**

Supernova is an exploding star that has reached the end of its life

- **Supermassive**
  - The largest
  - Mass: >1 million suns together
  - Every large galaxy has a supermassive black hole at its centre
  - Believed to be made at the same time as their home galaxy

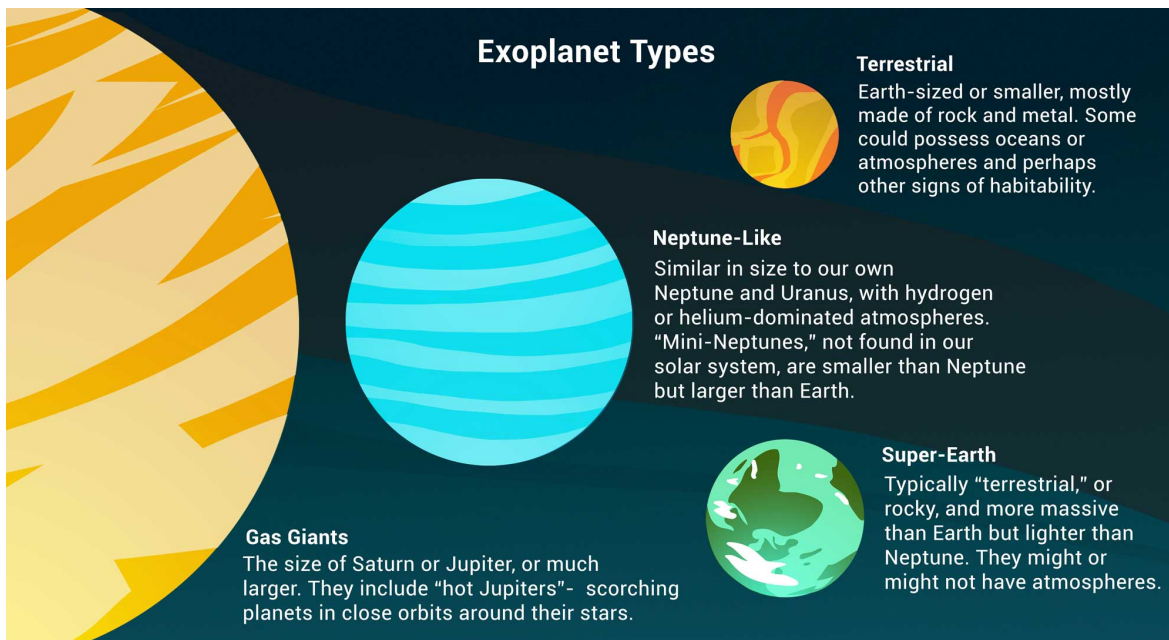
Sagittarius A is the supermassive black hole at the centre of Milky Way (mass: ~about 4 mn suns)

The Sun will never turn into a black hole as it is not big enough to make a black hole



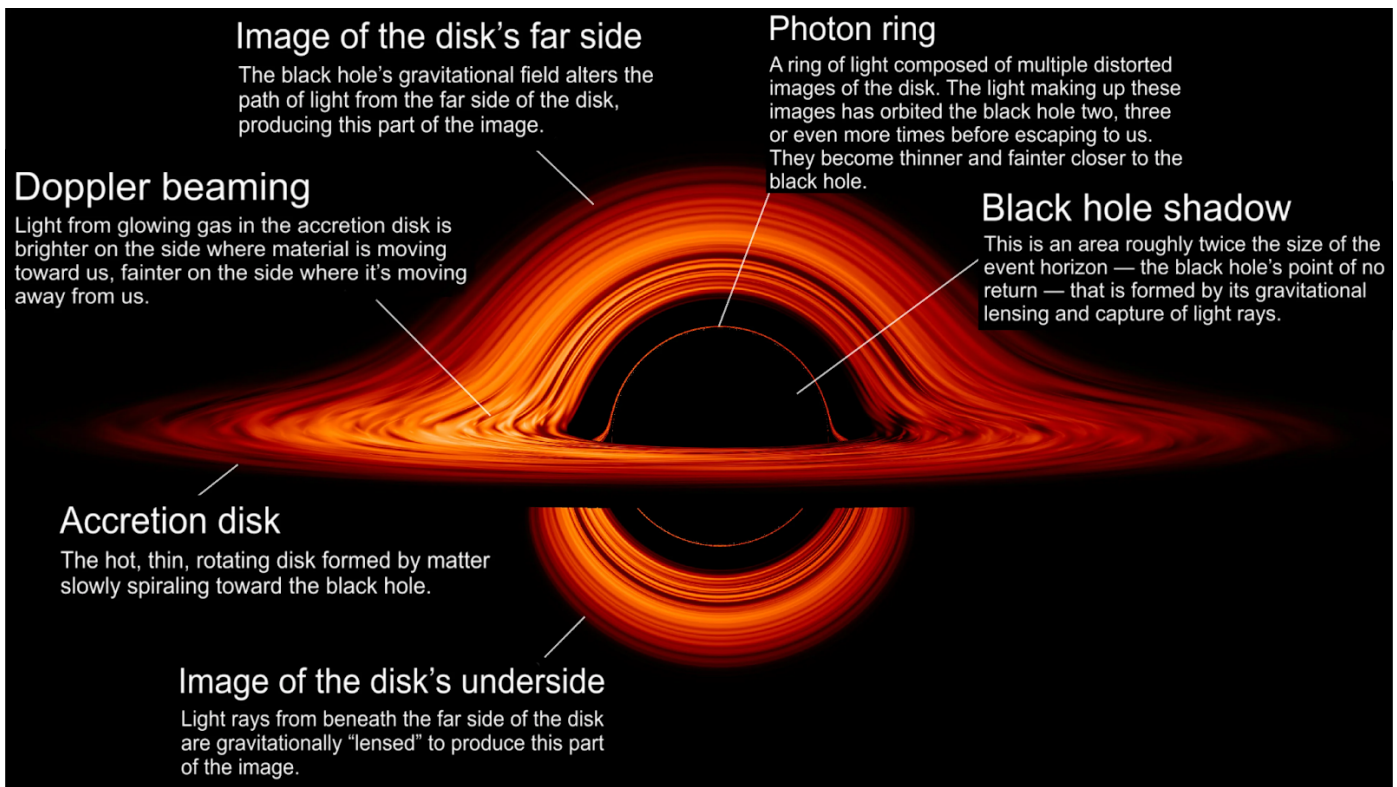
## Note:

- NASA's **Transiting Exoplanet Survey Satellite (TESS)**, launched in April 2018, discovers exoplanets by monitoring the brightness of over 200,000 stars to detect periodic dips caused by planetary transits.
- **Black holes** are highly dense objects with such **strong gravity that they prevent light from escaping**, making them challenging to detect.
  - They form when a **massive star collapses at the end of its life**, resulting in a dense entity that significantly warps the surrounding space-time.
- **Exoplanets** are planets that orbit other **stars and are beyond our solar system**.



## What are the Implications of these Findings?

- **Black Hole Growth and Mergers:** This discovery suggests that **black holes grow by accreting mass and merging**, which is crucial for understanding supermassive black hole evolution.
- **Accretion Disks and Jet Formation:** The interaction of the smaller black hole with the larger one's accretion disk provides insights into jet formation, key to understanding **active galactic nuclei (AGN)** and galaxy evolution.
- **Gravitational Waves and Cosmic Events:** The emission of **nano-Hertz gravitational waves** offers new **opportunities to study cosmic events** and black hole pair dynamics, aiding in **understanding black hole merger rates and galaxy evolution**.
- **Insights into Dark Matter and Energy:** Studying black hole behaviour may provide indirect **insights into [dark matter](#) and [dark energy](#)**.



Read More: [Exoplanet](#), [Black Hole Gaia BH3](#)

## UPSC Civil Services Examination, Previous Year Question (PYQ)

**Q. The term 'Goldilocks Zone' is often seen in the news in the context of (2015)**

- (a) the limits of habitable zone above the surface of the Earth
- (b) regions inside the Earth where shale gas is available
- (c) search for the Earth-like planets in outer space
- (d) search for meteorites containing precious metals

**Ans: (c)**

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