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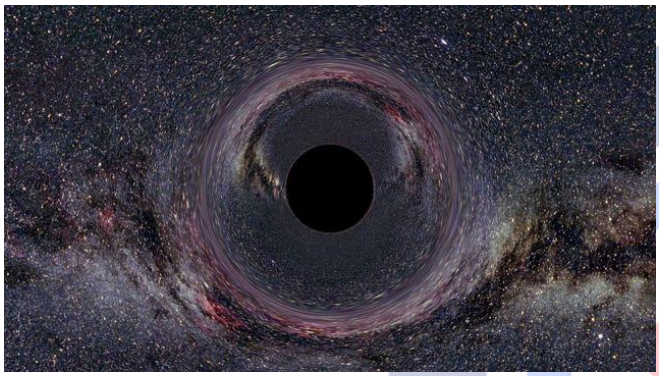
PRELIMS EDGE 2025 **18-07-2025**

TERMS IN NEWS

Blackholes



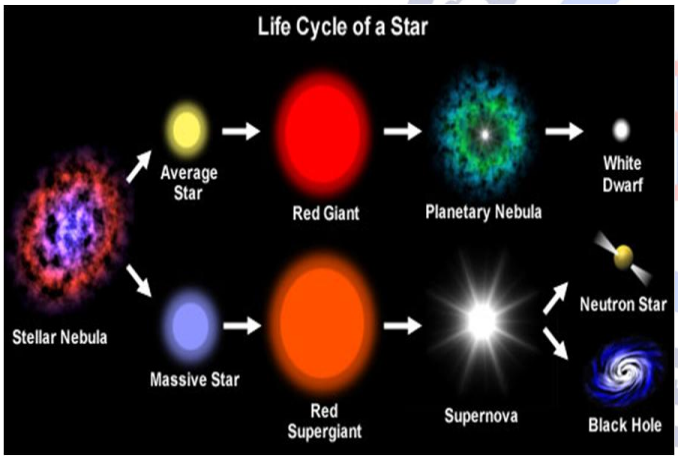
- Black holes are extraordinarily dense objects with gravity so strong that not even light can escape, making it difficult to spot them.
- They are formed when a massive star collapses in on itself at the end of its life, creating an incredibly dense object with a gravitational pull that is **so strong that it warps space-time around it.**
- **Albert Einstein** laid the foundation for the conceptual and mathematical framework that led to the prediction and eventual confirmation of black holes.
- His theory predicts that massive objects can warp spacetime which acts as the fundamental cause of the phenomena attributed to black holes. His theory also predicted singularity

Stages of Blackhole Formation

- **Stellar Life Cycle:** A star spends most of its life fusing hydrogen into helium in its core, a process that releases enormous amounts of energy and provides the outward pressure necessary to counterbalance the star's immense gravitational pull.
- **Exhaustion of Nuclear Fuel:** As the star consumes its nuclear fuel, it undergoes various stages of fusion, depending on its mass. Heavier elements are formed in the core through fusion, up to iron in the most massive stars.
- **Core Instability:** Once the core's fusion process produces iron, it no longer generates energy to support the star against gravitational collapse. This is because iron fusion consumes energy rather than releasing it, leading to a loss of equilibrium in the star's core.
- **Supernova Explosion:** The core's collapse triggers a supernova, an incredibly powerful explosion. The outer layers of the star are blown away into space, leaving behind the core.
- **Core Collapse:** What happens next depends on the mass of the remaining core:
    - If the core is less than about 2.5 times the mass of the Sun (the Tolman-Oppenheimer-Volkoff limit), it will likely form a neutron star.

- If the core's mass exceeds this limit, its gravity overwhelms all other forces, and it continues to collapse.

- **Formation of a Black Hole:** The core collapses to a point of infinite density, known as a singularity, where the laws of physics as we currently understand them break down. The gravitational pull becomes so strong that not even light can escape, forming a black hole.
- **Event Horizon Formation:** Around the singularity, an event horizon forms, which is the boundary beyond which nothing can escape the black hole's gravitational pull.
- The size of the event horizon, or the Schwarzschild radius, depends on the mass of the black hole.



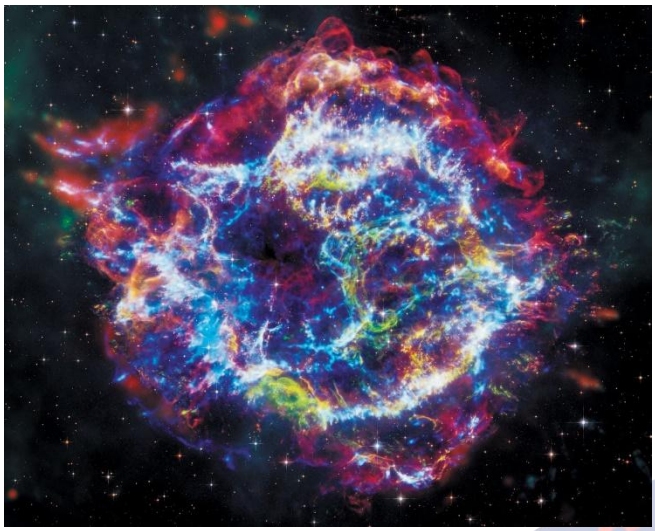
Types of Black Holes:

- **Stellar Black Hole:** It is formed by the collapse of a single massive star.
- **Intermediate Black Hole:** Their masses are between 100 and 100,000 times that of the sun.
- **Supermassive Black Hole:** Their masses ranging from millions to billions of times that of the sun, found at the centres of most galaxies including our own **Milky Way galaxy.**

Anatomy of a Blackhole

- **Event horizon:** The boundary around a black hole beyond which nothing can escape, not even light. It's the point of no return.
- **Singularity:** The core of the black hole where all its mass is concentrated. At this point, density and gravity are thought to be infinitely large, and the laws of physics as we know them cease to operate.
- **Accretion disk:** When a black hole pulls in matter from a nearby star or gas cloud, this matter forms a rotating disk around the black hole, known as an accretion disk.
- **Particle Jets:** Some black holes emit powerful jets of particles and radiation from their poles. These jets can extend for thousands of light-years.
- **Hawking radiation:** A theoretical prediction by Stephen Hawking that black holes can emit radiation due to quantum effects near the event horizon. This radiation could eventually lead to the evaporation of the black hole over extremely long timescales.
- **Gravitational Time dilation:** Near a black hole, time passes slower due to its intense gravitational field, as predicted by Einstein's theory of general relativity.
- **Information Paradox:** A theoretical dilemma concerning what happens to information about matter that falls into a black hole. It questions whether information is lost or preserved, challenging principles of quantum mechanics.

Supernova Explosion



- It is the **dramatic instance of a star exploding as it interacts with another, nearby star.**
- It's a one of many, repeated moments during the long, slow, death of two neighboring stars in the same system.
- Astronomers are waiting for the fiery explosion of **T Coronae Borealis, also dubbed the "Blaze Star" and known to astronomers as "T CrB".**
- For T CrB, this nova event happens roughly every 80 years — it's like Halley's Comet event every 76 years — so, astronomers call T CrB a "recurrent" nova.
- They believe T CrB's prior eruptions were observed as long ago was December 1787 and even in October 1217 AD.
- When T CrB erupts, its luminosity will increase dramatically, making it visible to the naked eye for several days.

Process

- The system contains two stars — a white dwarf and a red giant.
- The white dwarf is an incredibly dense remnant of a once larger star. It's about the size of planet Earth but with the same mass as our sun.
- Its neighbor, the **red giant**, is in its final years of existence and is slowly being stripped of hydrogen by the gravitational pull of the denser white dwarf.
- This star **"cannibalism"** causes a tremendous buildup of pressure and heat, which eventually triggers a huge thermonuclear explosion.
- The explosion doesn't completely destroy the stars, however, and so this event repeats over time. It can carry on for hundreds of thousands of years.
- Different nova events have different cycles, ranging from a few years to hundreds of thousands of years.

SPECIES IN NEWS

Grandala

- It is a species of bird in the thrush family Turdidae.
- Scientific Name: Grandala coelicolor
- It is the only species placed in the genus Grandala.
- It is an arboreal insectivore.

Distribution

- It ranges across the northeastern Indian Subcontinent and some adjoining regions,

existing primarily in the low-to-mid altitudes of the Himalayas.
- It is found in Bhutan, India, Myanmar, and Nepal, as well as Tibet and other areas of China.
- Habitat: Alpine and subalpine regions, typically found at elevations between 3,000 to 5,000 meters.

Features

- Body length – 20.5-23 cm, weight from 38 to 52 g.
- The plumage of the male is blue-gray, only the tail and wings are black.
- The plumage of the female is brownish with white stripes; rump gray-blue; the tip and underside of the wing feathers are white.
- They are known for their unique flock-forming behavior during non-breeding seasons. These spectacular flocks can sometimes be composed of up to 200 individuals.

Conservation Status

- It is classified as 'Least Concern'under the IUCN Red List

Kashmir Stag

- It is also called **Hangul** which is a subspecies of Central Asian red deer endemic to Kashmir and surrounding areas.
- It is found in dense riverine forests in the high valleys and mountains of Jammu and Kashmir and northern Himachal Pradesh.
- In Kashmir, it is found primarily in the **Dachigam** National Park where it receives protection.
- A small population has also been witnessed in Overa-Aru Wildlife Sanctuary in south Kashmir.
- Conservation status
- **IUCN:** Critically Endangered
- **CITES :** Appendix I

Dachigam National Park

- The actual beauty of the park lies in the deep valleys, rocky outcrops, steep wooded slopes and rolling alpine pastures.
- Being located in a mountainous area, Dachigam National Park faces a huge variation in altitude that ranges from 1600 m to 4200 m above sea level.
- This variation in altitude categorises Dachigam National Park into two regions- the upper region and the lower region.
- **Flora:** It is extremely rich in Wild Cherry, Pear, Plum, Peach, Apple, Apricot, Walnut, Chestnut, Oak and Willow etc.
- **Fauna:** Hangul (Kashmir Stag), Musk deer, Brown Bear, Leopards, Jungle Cats, Himalayan black bear, and a few species of wild goats like the markhor and ibex.

PLACES IN NEWS

Senegal

Location

- It is a **West African country.**
- It is located in the **Northern and Western hemispheres** of the Earth.
- It lies in the **Sahel region** and forms a **transitional zone between the arid Sahara (desert) to the north** and the belt of humid savannas to the south.
- **Rivers:** The Senegal River and its tributaries are important for drainage.

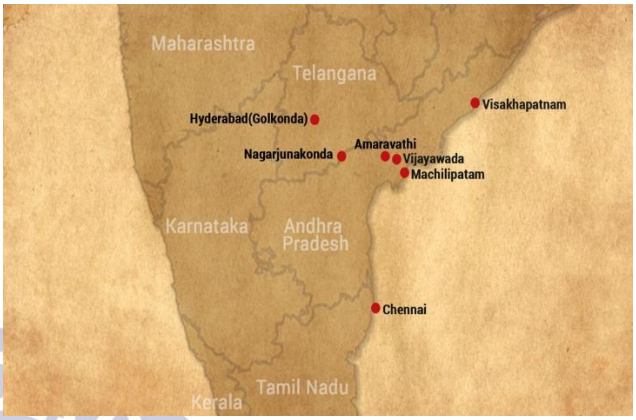
Neighbouring Countries:

- Senegal is bordered by **four countries; Mauritania, Mali, Guinea, and Guinea-Bissau** and its western border lies with the **Atlantic Ocean**.
- Senegal also shares its borders with **Gambia,** which is geographically enclaved within Senegal.

Important Ports of Senegal

- Its Coastline stretches along the Atlantic Ocean, and has significant ports like **Dakar, Kaolack, Ziguinchor and Saint-Louis.**

Machilipatnam Port



- **Location:** It is a port city located at the mouth of the **River Krishna** on the Bay of Bengal in the Krishna district of **Andhra Pradesh**.
- It was also known as **Masulipatnam or Bandar or Masuala** in ancient times.
- **Ancient existence:** The port's existence dates back to at least the **Satavahana period (3rd century BCE**), mentioned as **Maisolos by Ptolemy** and as **Masalia** in the Periplus of the Erythraean Sea (1st century CE).
- **Medieval era:** Under **Qutb Shahi rule** (16th–17th centuries), it became the principal port for the **Kingdom of Golkonda,** exporting textiles from the Krishna-Godavari delta.
- **European era:** It was also **one of the first places** where the East Indian Company **set up a factory** in the country, in the early 17th century.
- **Economic importance:** It was a vital centre for trade with ancient Rome, Persia, China, Southeast Asia, and later, European traders. The port specialized in exporting:

- **Muslin** (fine cotton cloth, for which the word "muslin" is derived)
- Spices, **textiles**, diamonds, turmeric, sugar, elephants, and other goods.
- It is known for its handloom industry, which produces **Kalamkari textiles.**

Decline

- The port **lost prominence to Madras (Chennai)** due to changing British colonial trade policies and **siltation**
- **Current development:** A **modern Greenfield Port** is under rapid construction at **Manginapudi**, near Machilipatnam.

PRACTICE QUESTIONS

Q1: Which among the following do not share borders with Senegal?

A. Mali
B. Guinea
C. Mauritania
D. Lesotho

Q2: Kashmir Stag (Hangul) is a subspecies of Central Asian red deer endemic to Kashmir and surrounding areas. It is found in dense riverine forests in the high valleys and mountains of Jammu and Kashmir and northern Himachal Pradesh.

Which among the following is the primary location at which we can spot the Hangul in India?

A. Dachigam National Park
B. Manas National Park
C. Kanha National Park
D. Panna National Park

Q3 : It is the dramatic instance of a star exploding as it interacts with another, nearby star.

Which among the following is the correct option that fits the above description?

A. Blackhole
B. Supernova
C. Pulsars
D. Entanglement

Q4 : The terms Core Collapse, Event Horizon, Singularity etc are related to which of the following?

A. Blackholes
B. Dark matter
C. Big Bang
D. Space Expansion

Q5 : Consider the following ancient Indian port cities

1. Tamralipti
2. Sopara
3. Machilipattanam
4. Muziris

Arrange the above ancient Indian Ports from North to South

A. 1-2-3-4
B. 4-3-2-1
C. 1-3-2-4
D. 1-4-2-3

Answers

1. D
2. A
3. B
4. A
5. A