



Binary Merger of Gamma Ray Burst with Kilonova

Why in News?

Recently, a **rare astronomical event** involving a **compact binary merger emitting long [Gamma Ray Burst \(GRB\)](#) twinned with a kilonova emissions** was reported. This **never before scientifically accepted or proven combination** was also confirmed by **India's largest optical telescope, [Devasthal Optical Telescope \(DOT\)](#)**.

- The GRB lasted for over 50 seconds and **identified as GRB211211A**.
- Kilonovae occur when two compact objects, like **binary neutron stars or a neutron star and a black hole, collide**.

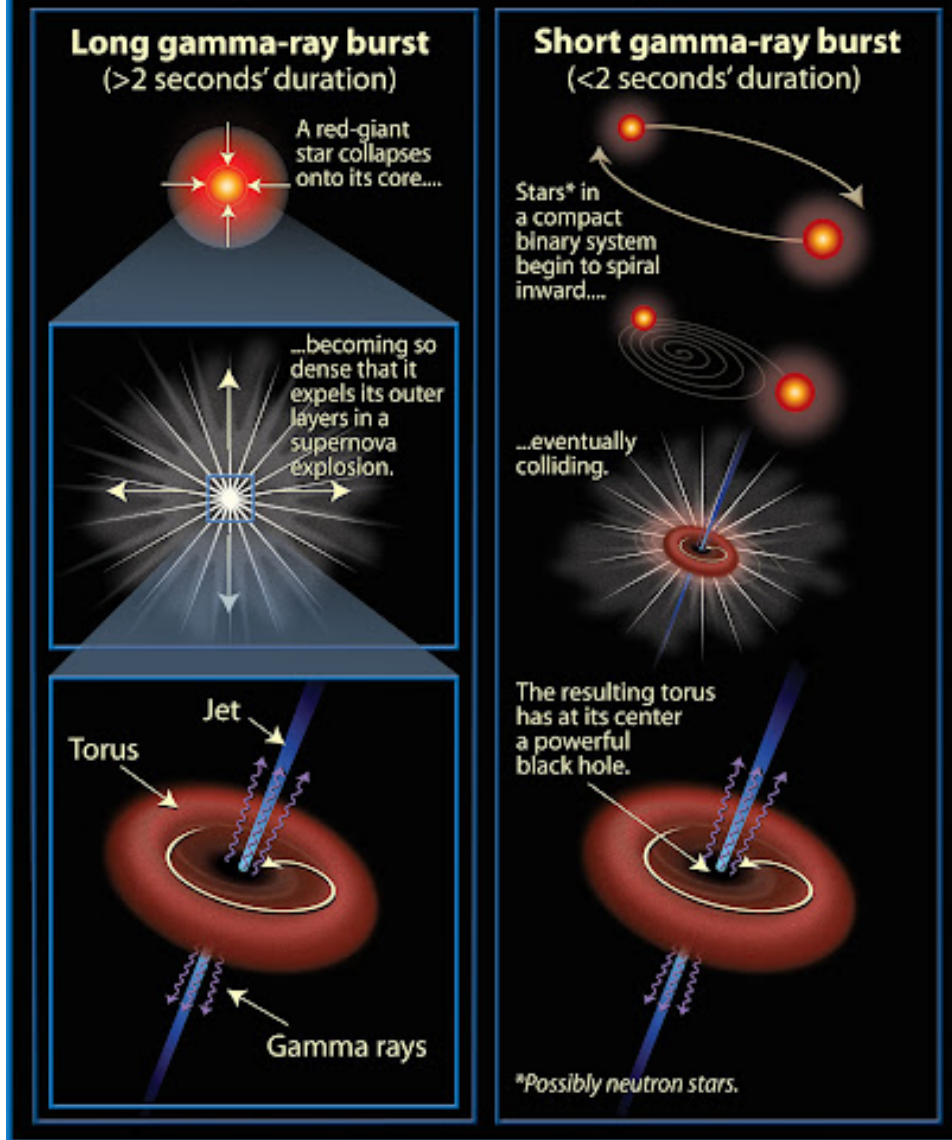
What are Gamma-Ray Bursts?

▪ About:

- GRBs are **massive but extremely bright, high-energy short gamma radiations** which get released **when massive stars collapse or die in the Universe**.
- They are the **most powerful events** in the universe, detectable across billions of **light-years**.
 - A light-year is the **distance a beam of light travels in a single Earth year**, or 9.5 trillion kilometers.
- Astronomers classify them as **long or short based on whether the event lasts for more or less than two seconds**.

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Gamma-Ray Bursts (GRBs): The Long and Short of It



▪ Long GRBs:

- They observe long bursts **in association with the demise of massive stars.**
- When a star much more massive than the Sun **runs out of fuel, its core suddenly collapses and forms a [black hole](#).**
 - Black hole refers to a **point in space where matter is so compressed** as to create a gravity field from which even light cannot escape.
- As matter swirls toward the black hole, some of that **escapes in the form of two powerful jets** that rush outward at almost the speed of light in opposite directions.
- Astronomers only detect a GRB **when one of these jets happens to point almost directly toward Earth.**
- Each jet drills through the star, producing a pulse of gamma rays – the highest-energy form of light – that can last up to minutes. **Following the burst, the disrupted star then rapidly expands as a [supernova](#).**
 - A supernova is the name given to an **exploding star that has reached the end of its life.**

▪ Short GRB:

- Short GRB, on the other hand, forms when pairs of compact objects – such as **[neutron stars](#), which also form during stellar collapse – spiral inward over billions of years and collide.**
 - A neutron star comprises one of the **possible evolutionary end-points of high**

mass stars.

UPSC Civil Services Examination, Previous Year Question (PYQ)

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)

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