

Astronomers find clues to the origin of energetic cosmic X-ray flashes

प्रविष्टि तिथि: 19 JUN 2026 2:56PM by PIB Delhi

Astronomers have traced the mechanism behind a mysterious celestial non-repeating flash of X-ray called Fast X-ray Transients (FXTs) that was detected on November 7 last year. The study of the X-ray flash which they linked to collapse of a massive star or the merger of two neutron stars could help us better understand the physics of these extreme events.

FXTs are energetic, non-repeating flashes of X-rays associated with violent processes in the universe. They are a new class of transient sources in the sky, first discovered about a decade ago. These enigmatic events appear as sudden bursts of low energy X-rays, lasting from a few minutes to several hours, before fading rapidly from view.

Due to their brief duration, FXTs have long been challenging to study, leaving their origins uncertain. Over the years, astronomers have proposed several possible mechanisms to explain these mysterious flashes. Proposed progenitors of these events include supernova shock breakouts from core-collapse supernovae, neutron stars with extreme magnetic fields rotating every few milliseconds that are formed in the aftermath of binary neutron star mergers, and tidal disruption events involving white dwarfs and intermediate-mass black holes.

Many FXTs are associated with high-redshift long period gamma-ray bursts (LGRBs), while others lack any gamma-ray counterpart, suggesting low-luminosity GRBs or “orphan” afterglows.

A new study led by Deepak Eppachen and Arvind Balasubramanian, both postdoctoral fellows at the Indian Institute of Astrophysics, an autonomous institution under the Department of Science and Technology (DST), focuses on one such FXTs event designated EP241107a, detected on November 7, 2024 by the Einstein Probe mission. This Chinese space mission is designed to survey the dynamic high-energy sky, and is transforming the study of short-lived cosmic events.

Using a multi-wavelength approach, the team discovered a radio counterpart to the X-ray flash using the Karl G. Jansky Very Large Array, located in New Mexico, USA.

To augment this multi-wavelength study, the researchers also used several powerful ground-based facilities in India. At the Indian Astronomical Observatory in Hanle, Ladakh, the Himalayan Chandra Telescope (HCT) and the GROWTH India Telescope (GIT) took advantage of pristine skies to monitor the event in visible light. HCT is operated by the Indian Institute of Astrophysics (IIA) and the GIT is jointly operated by IIA and IIT Bombay. The Upgraded Giant Metrewave Radio Telescope, operated by the National Centre for Radio Astrophysics, was also used for follow up observations. The team additionally used the 10 metre Keck Observatory in Hawaii, along with the Southern Astrophysical Research Telescope, a 4.1 metre optical and near infrared facility located in Chile.

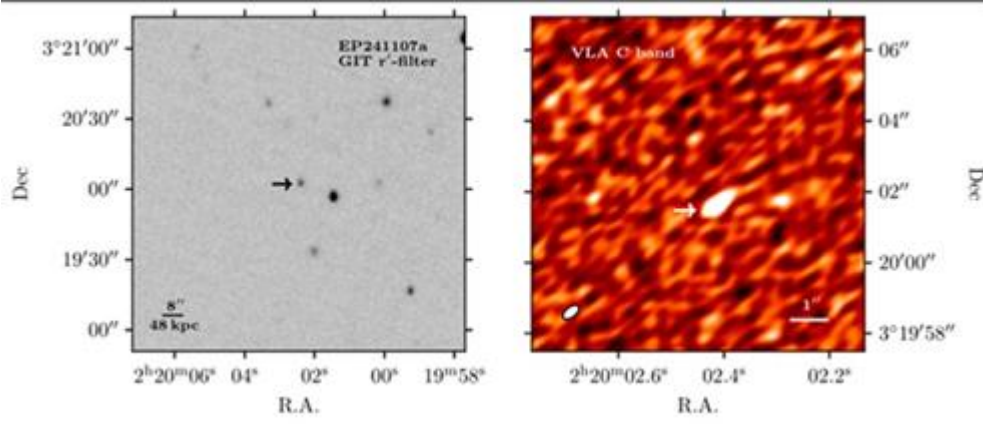


Fig: This image shows the detection of the counterpart (marked with arrows) to the fast X-ray transient EP241107a detected in optical –GROWTH India Telescope (left) and in radio –Very Large Array (right).

By comparing the optical and radio observations of EP241107a with those of other extragalactic transients, and by analysing the properties of its host galaxy, the researchers suggest that this event was linked to a gamma-ray-burst-like explosion, caused either by the collapse of a massive star or by the merger of two neutron stars. Detailed modelling of the afterglow indicates that the burst produced a powerful jet with kinetic energy comparable to the total energy emitted by all the stars in the Milky Way over several months, if assumed to be emitted equally in all directions.

The authors conclude that EP241107a most likely has a gamma-ray burst origin. EP241107a represents one of the rarest transient events studied in detail: an explosion not directly detected in gamma rays, yet clearly linked to a gamma-ray burst origin, sometimes referred to as an “orphan afterglow”. They explain that this event could represent a gamma-ray burst at the lower-energy end of the known gamma-ray burst population.

This study was published in the Monthly Notices of the Royal Astronomical Society, and is authored by Deepak Eappachen, Arvind Balasubramanian, G. C. Anupama, D. K. Sahu and Sudhanshu Barway of the Indian Institute of Astrophysics, and Vishwajeet Swain, V. Bhalariao, Tanishk Mohan and G. Waratkar of the Indian Institute of Technology Bombay.

The international team also includes researchers from the California Institute of Technology, the University of North Carolina at Chapel Hill, and the Center for Astrophysics, Harvard & Smithsonian.

Link to the paper: <https://academic.oup.com/mnras/article/545/1/staf2062/8339698>

NKR/FT/NM

(रिलीज आईडी: 2275128) आगंतुक पटल : 610
इस विज्ञप्ति को इन भाषाओं में पढ़ें: Urdu , हिन्दी