



## Fast Radio Bursts

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### Why in News

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Recently, researchers from the **Pune-based Tata Institute for Fundamental Research (TIFR)** and the **National Centre for Radio Astrophysics (NCRA)**, have assembled the largest collection of **Fast Radio Bursts (FRBs)** catalogue.

- The data is from **Canadian Hydrogen Intensity Mapping Experiment (CHIME)**.
- In 2020, the **National Aeronautics and Space Administration (NASA)** spotted **FRB for the first time in the Milky Way.**

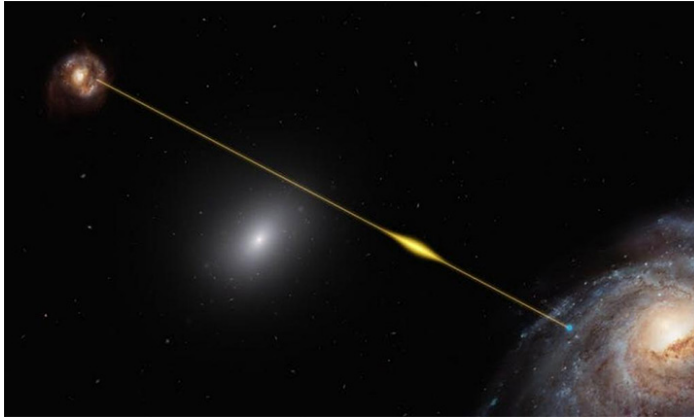
### Key Points

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- **Fast Radio Bursts:**

- FRB are **bright bursts of radio waves** (radio waves can be produced by astronomical objects with changing magnetic fields) whose **durations lie in the millisecond-scale**, because of which it is difficult to detect them and determine their position in the sky.

It was first **discovered in 2007**.



A defining property of these

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bursts is their **dispersion** (scattering or separation), the bursts **produce a spectrum of radio waves**, and as the waves travel through matter, they spread out or disperse with bursts at higher radio frequencies arriving at telescopes earlier than those at lower frequencies.

**Dispersion** can result in **signal degradation in many applications, especially over large distances**.

- This dispersion allows researchers to learn about two important things:
  - They can measure this dispersion to **learn about the stuff that radio bursts pass through as they travel toward Earth**
  - They can indirectly **determine how far apart things are**.

- **FRBs Catalogue & Findings:**

- The new catalogue significantly **expands the current library of known FRBs**, and is already **yielding clues as to their properties**.
- For instance, the newly discovered bursts appear to fall in **two distinct classes: those that repeat, and those that don't**.
  - The **repeaters looked different**, with **each burst lasting slightly longer** and emitting more focused radio frequencies than bursts from single, non-repeating FRBs.
  - These differences strongly suggest that emission from repeaters and non-repeaters is generated either by different physical mechanisms or in different astrophysical environments
- The bursts were **evenly distributed in space, seeming to arise from any and all parts of the sky**.
- Bright FRBs occur at a rate of about **800 per day** across the entire sky - the most precise estimate of FRBs overall rate to date.

- **Origin of FRBs:**
  - FRBs have been spotted in various and distant parts of the universe, as well as in our own galaxy. Their **origins are unknown and their appearance is highly unpredictable.**
  - The **CHIME** project has nearly quadrupled the number of fast radio bursts discovered to date.
    - The telescope has detected **535 new FRBs** in its first year of operation itself, **between 2018 and 2019.**
    - With more observations, astronomers hope soon to **find the origins of the FRBs.**
- **Chime:**
  - It is a **novel radio telescope that has no moving parts.** Originally **conceived to map the most abundant element in the universe - hydrogen** - over a good fraction of the observable universe, this unusual telescope is **optimized to have a high mapping speed.**
  - It is located at the **Dominion Radio Astrophysical Observatory**, operated by the **National Research Council of Canada in British Columbia, Canada.**
  - The telescope **receives radio signals each day from half of the sky as the Earth rotates.**
- **Significance of Studying FRBs:**
  - The unique properties of fast radio bursts and their host galaxies combined with recent technological advancements have given researchers **hope that these phenomena can be used to answer some long-standing questions** about the **universe.**
  - It can be **used to understand the three-dimensional structure of matter** in the universe and to learn about **poorly understood early moments in the evolution of the universe.**

Source: DTE