

A Repeating Fast Radio Burst

Prof. Vicky Kaspi leads a group of graduate and postdoctoral researchers at the MSI, who observe of pulsars and related objects including magnetars and Fast Radio Bursts. This year they discovered a repeating Fast Radio Burst in data from the Aracebo Observatory.

What question were you trying to answer?

Fast Radio Bursts (FRBs) are a new astrophysical mystery. FRBs consist of short (few millisecond) bursts of radio waves. These events are very common in the sky: our best estimates suggest that several thousand go off every day across the whole sky. However, the origin of FRBs is unknown. They appear to come from extragalactic distances, suggesting a very luminous, but mysterious source.

We were trying to understand the nature of FRBs and specifically whether they repeat. Some models of FRBs have them being the result of a cataclysmic event such as the merger of two neutron stars. If these models are correct, then FRBs should never show repetition. So searching for repetition is a very important test of FRB models.

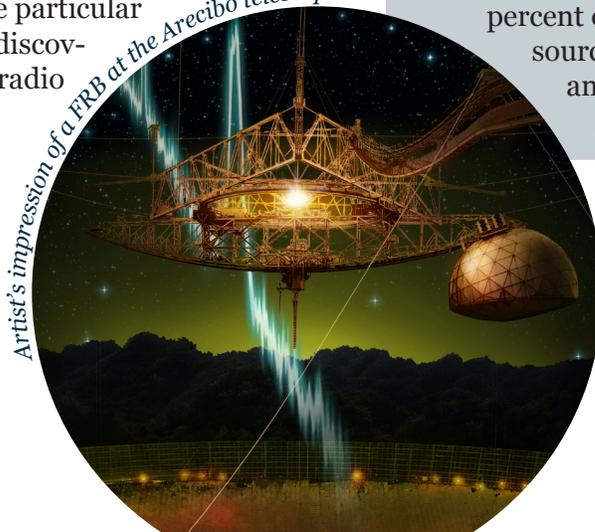
Why did you find this question interesting?

It is rare in science to be presented with so fresh and interesting a puzzle as we have in FRBs. The FRB phenomenon must represent a very common occurrence in the Universe, and yet is totally unpredicted. This serves as an important reminder that we must remain humble about our understanding of the Universe — there's a lot out there that is still surprising to us!

What did you find?

We discovered that one particular FRB, a source that we discovered using the 305-m radio telescope in Arecibo, Puerto Rico, repeats! This came as a shock to us since previous searches for repeat bursts from the locations of other FRBs came up empty. We

Artist's impression of a FRB at the Arecibo telescope



found no fewer than 10 new bursts from this source in follow-up observations made over a few weeks, and have subsequently seen many more from this source. Interestingly, the source seems to show these bursts in clusters: sometimes it is totally quiet and emits nothing, and other times it will burst several times in just a few minutes.

What does doing your research look like?

While we use observations from the Arecibo radio telescope, locally, at McGill, our research involves using a large super computer, along with enormous data files. In the end, our research 'looks' like representations of our data sets in different types of plots, scoured by small groups of people who also discuss the nuances in these plots and in how the data were obtained, and what new data we need to make more progress in understanding.

What role did collaboration play in your research?

Our research was part of the international PALFA collaboration which is led out of MSI. It was with the help of our colleagues that we were able to write a publication for the magazine *Nature* in a fairly short time, and garner significant interest from the public and press. We have also recently put together a detailed follow-up publication on the source.

Why this is important

FRBs are a mysterious astrophysical phenomenon. Previous follow-up observations have failed to find additional bursts at the same location as the original detections. This first detection of a repeating Fast Radio Burst helps put important constraints on how they originate — it eliminates at least 50 percent of all models. We now know that the source of (at least some FRBs) must be an energetic event on an object that survives the original burst.

Spitler, L. G., P. Scholz, J. W. T. Hessels, R. D. Ferdman, V. M. Kaspi, E. C. Madsen, C. Patel, et al. (2016), *A repeating fast radio burst*, *Nature* (London) 531, 202–205.