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Pin-pointing the positions of repeating FRBs using the European VLBI Network

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Fast radio bursts (FRBs) are bright pulses of coherent radio emission with durations of only a few milliseconds, and originating at extragalactic distances (for a review, see [1]). The majority of FRBs appear as one-off events, but the discovery of FRB 121102 revealed that at least a subset of FRBs exhibit a repeating nature [2]. One of the most compelling problems in the field today is whether all FRBs have the ability to produce multiple bursts, or if there are sub-populations of repeating and non-repeating FRBs. To tackle this question, and understand the origin(s) of FRBs, we have to precisely localise FRBs to study their host galaxies and local environments.
The European VLBI Network (EVN) is a global network of radio telescopes that uses very long baseline interferometry (VLBI) to achieve angular resolution on the order of milli-arcseconds. The EVN has been used successfully in the past to precisely localise bursts (to a specific star-forming region within the host galaxy) from the first repeating fast radio burst source, FRB 121102, and to study its persistent radio counterpart [3]. The physical origin of the bursts and the persistent radio counterpart are still a mystery. In addition to the real-time correlation observing mode (e-EVN), baseband data can be buffered to study fine time and frequency structures of the bursts, as well as their polarisation properties.
We are using the same techniques used to study FRB 121102, to perform follow-up observations of repeating FRBs. I will discuss our approach to localising repeating FRBs using the EVN and present the localisation of a second repeater, FRB 180619.J0158+65 [4]. The source is located at the apex of a v-shaped star-forming region in the arm of a nearby (~149 Mpc) spiral galaxy (Figure 1). The metallicity of the host combined with the lack of detection of a persistent radio counterpart contrast with what is observed in the case of FRB 121102. This environment also contrasts with the location of three localised so-far non-repeating FRBs. Our results show that FRBs can originate in a diverse set of galaxy types and local environments.

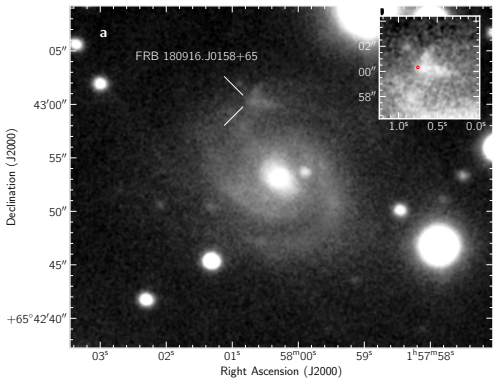

Figure 1. An optical image of the spiral host galaxy of FRB 180619.J0158+65 with an inset zooming in on the v-shaped star-forming region in the spiral arm, taken with Gemini-North. The EVN position of FRB 180916.J0158+65 is highlighted using the white lines and red circle [4].

References

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