

# Zooming in on the first-known repeating fast radio burst source and its putative hyper-nebula

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Fast radio bursts (FRBs) are enigmatic astrophysical transients; they are brief, intense flashes of radio emission from extragalactic sources. The extreme brightness and millisecond-duration timescales of FRBs indicate that they are likely produced by compact objects with large energy reservoirs, such as accreting black holes or magnetars (ultra-magnetic neutron stars). Although most FRBs appear to be one-off events, a small percentage have been observed to repeat, including FRB 20121102A, the first-known repeating FRB. Using the European Very Long Baseline Interferometry (VLBI) Network (EVN), we have conducted a follow-up study of FRB 20121102A and its associated persistent radio source (PRS), which is a putative hyper-nebula powered by the FRB source. Our observations, which include a half-dozen bursts from FRB 20121102A, have allowed us to better constrain the position of the FRB source and its potential offset from the PRS. By combining data from 2016 and 2022, we have also placed constraints on the proper motion of the FRB source. Furthermore, we have found that the brightness of the PRS has remained constant over a span of >6 years, providing important clues about the nature of FRB 20121102A and its local environment.

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