Detection of Multiple Radio Bursts from FRB 121102 using the Deep Space Network

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*on **29 Oct 2019; 03:19 UT***
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We report the detection of multiple bright radio bursts from the repeating fast radio burst (FRB) source FRB 121102 using the 70 m diameter Deep Space Network (DSN) radio telescope (DSS-43) in Tidbinbilla, Australia [1]. We carried out a continuous 5.7 hour observation of the position of FRB 121102 [2, 3], starting at 06 September 2019 17:27:55 UTC, following alerts that the source is now in an active state (e.g., ATels #13064, #13073, #13090, #13098). Dual circular polarization S-band data (center frequency: 2.25 GHz, bandwidth: ~120 MHz) were recorded in a digital polyphase filterbank with a time and frequency resolution of roughly 64 microseconds and 1 MHz, respectively.

We dedispersed the data with trial dispersion measures (DMs) between 500 and 700 pc cm^-3. Single pulse searches were performed using a Fourier domain matched filtering algorithm, where each dedispersed time-series was convolved with boxcar templates with logarithmically spaced widths between 64 microseconds and 20 ms. FRB candidates with detection signal-to-noise (S/N) ratios above 6.0 were saved and classified using a GPU-accelerated machine learning pipeline based on the FETCH (Fast Extragalactic Transient Candidate Hunter) package [4].

Multiple bright radio bursts were detected at S-band with a DM near the nominal DM of FRB 121102. An example of one of the most energetic bursts can be viewed using the link below. We

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show the dynamic spectrum and burst profile after dedispersing the data with a DM of 563.7 +/- 0.1 pc cm^-3, which maximized the peak S/N of the pulse and is apparently higher than the DM (560.5 pc cm^-3) found from bursts detected between 2016 and 2017 [5]. The peak flux density of this burst is 8.1 +/- 1.6 Jy, and the pulse fluence is 13.8 +/- 0.4 Jy ms. This particular burst displays two prominent temporal components, as well as microstructure and spectral-temporal features reminiscent of other bursts from FRB 121102 (e.g., see [5]) and other FRBs (e.g., FRB 170827 [6]). Frequency structure is apparent in the dynamic spectrum, with an extent that varies between ~1-10 MHz across the frequency band. Further data analysis is ongoing.

We thank the DSN (Deep Space Network) and Canberra Deep Space Communication Complex (CDSCC) teams for scheduling and carrying out these observations.

References:

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FRB 121102 Burst (Deep Space Network, DSS-43, 2.25 GHz)

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