# Searching for a Signal from a Repeating FRB

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# Collaborators

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# Fast Radio Bursts

Lorimer Burst

- FRB 010724 (24 July 2001)
- Parkes Observatory, archival pulsar survey data
- Lorimer et al., Science 318, 5851 (2007)

Single dispersed pulse

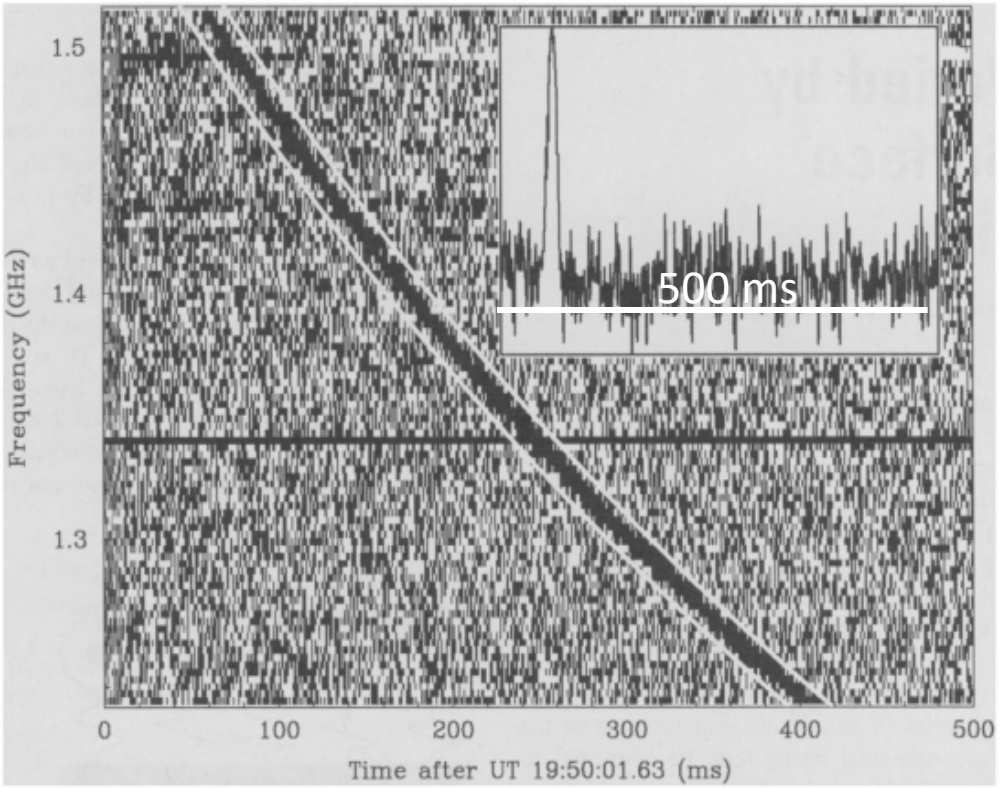
Dispersion delay $\Delta t \propto \frac{\mathrm{DM}}{\nu^2}$

DM $= \int n_e \, dl = 375$ pc cm$^{-3}$

30 Jy, 1.4 GHz

Pulse width $W = 5$ ms

$W \propto \nu^{-4.8 \pm 0.4}$ (Kolmogorov)



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# FRBs To Date

Hundreds have been discovered

Most appear to be extragalactic (DM > 100 $cm^{-3}$ pc, isotropic sky distribution)

Unresolved point sources

Most detected at ~1 GHz, some at ~400 to 800 MHz

Most are non-repeating, “one-shot” sources

Some tens of FRBs appear to be non-periodic repeaters

Some exhibit periodicity

- FRB 180916 (~16 day periodicity)
- FRB 121102 (~157 day periodicity)

Explanations include extraterrestrials!

More plausible explanations are

- Compact-object mergers
- Magnetars arising from core collapse supernovae
- (One is identified with the magnetar SGR 1935+2154 in our Galaxy)

# FRB 180916.J0158+65

Canadian Hydrogen Intensity Mapping Experiment Fast Radio Burst Collaboration (CHIME/FRB)

Nature 582, 351 (2020)

In a nearby spiral galaxy ($z = 0.034$)

$16.35 \pm 0.18$ day period (binary orbit?)

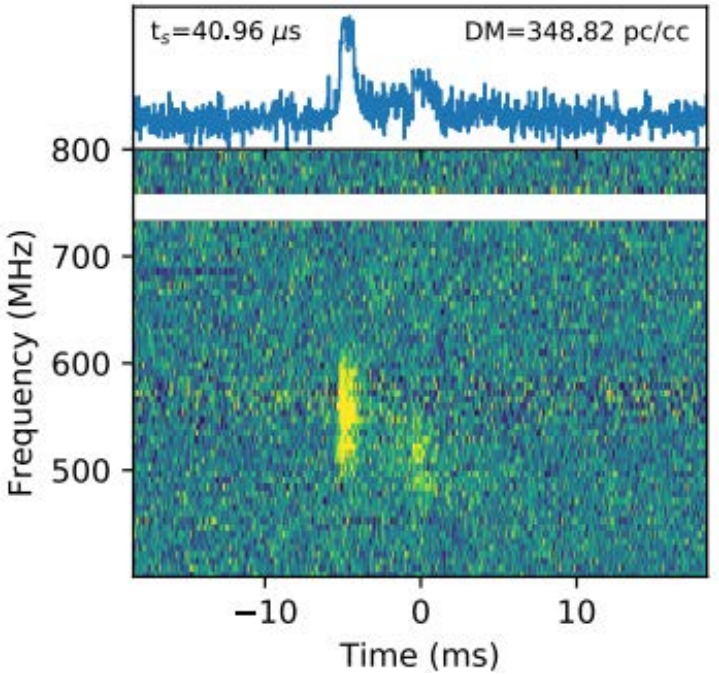
4-day phase window

DM $\approx$ 349 pc cm$^{-3}$

$S_\nu \sim$ a few Jy, $W \sim$ a few ms

Detected by others

- 100-m Effelsburg (1.4 GHz)
- Sardinia Radio Telescope (328 MHz, lowest to date)
  - $S_\nu \sim$ a few Jy, $W \sim$ 10 ms




For Kolmogorov interstellar scattering

$$W \sim \left(\frac{500\ \text{MHz}}{80\ \text{MHz}}\right)^{4.4} 2\ \text{ms} \sim 6\ \text{s}$$



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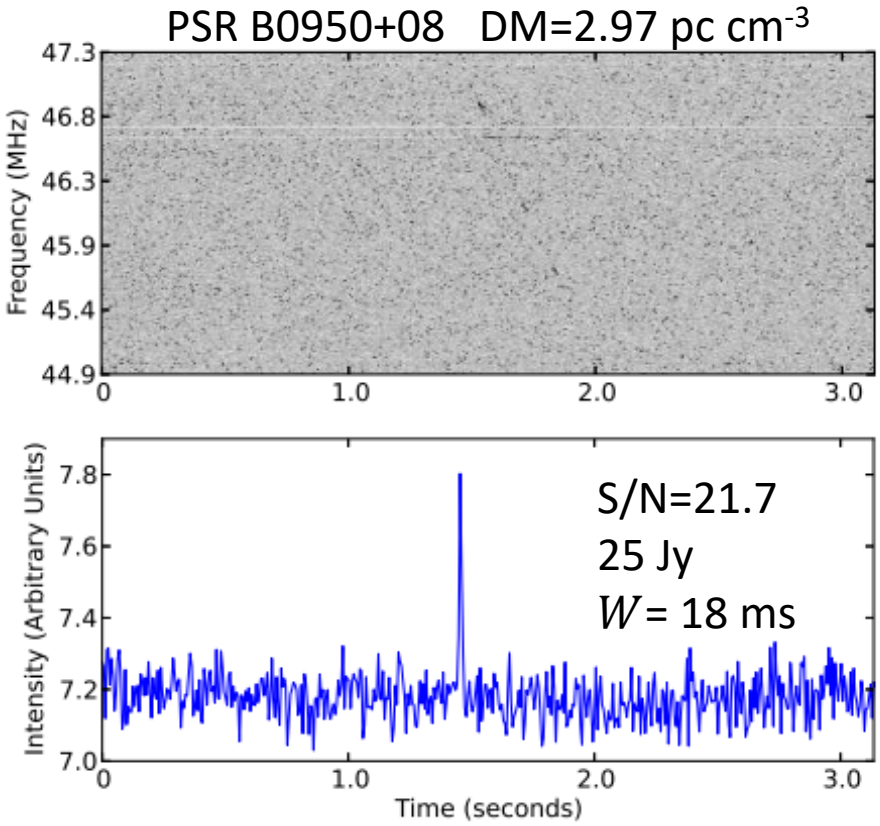
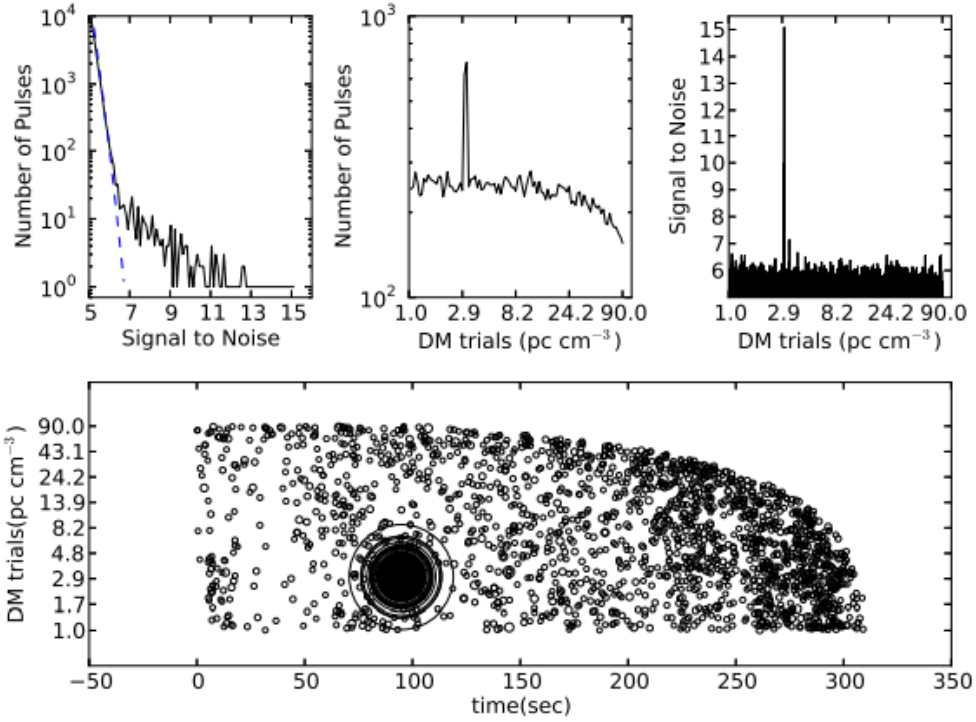
# Transient Pulse Detection




$$S_\nu \sim 2\ \text{Jy} \left(\frac{SNR}{10}\right) B_{20\text{MHz}}^{-\frac{1}{2}}\, \Delta t_{\text{seconds}}^{-\frac{1}{2}}$$

1) 0.209ms sampled raw data, 4 hours, 19.6 MHz BW → (LSL, FFT) → spectrogram
2) Bandpass removal
3) Removal of diurnal variation
4) RFI removal (impulsive, narrowband)
5) DM and pulse-width search



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# LWA1: FRB 180916.J0158+65

Our Observing Program

- Observed 180916 multiple times over the past few months
- Nighttime sessions
- CHIME detected a pulse (or more than one) during a few sessions

AND OUR RESULTS ARE…