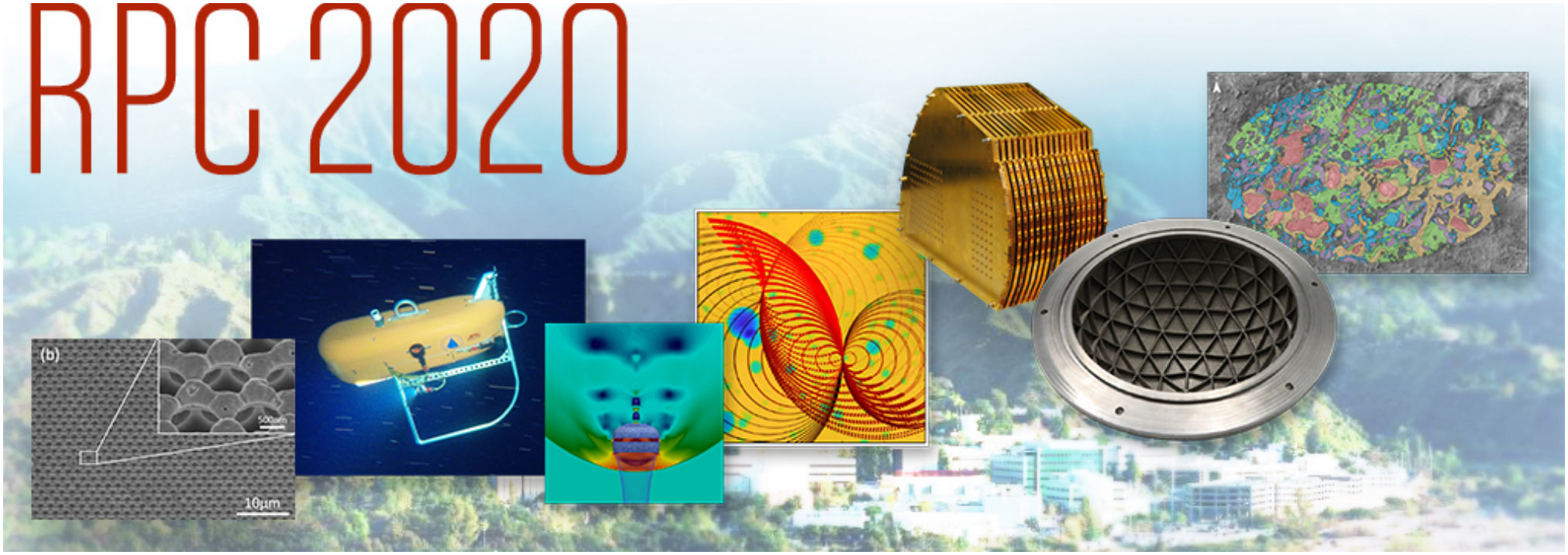


Virtual Research Presentation Conference

Ultra-High Time Resolution Observations of Fast Radio Bursts

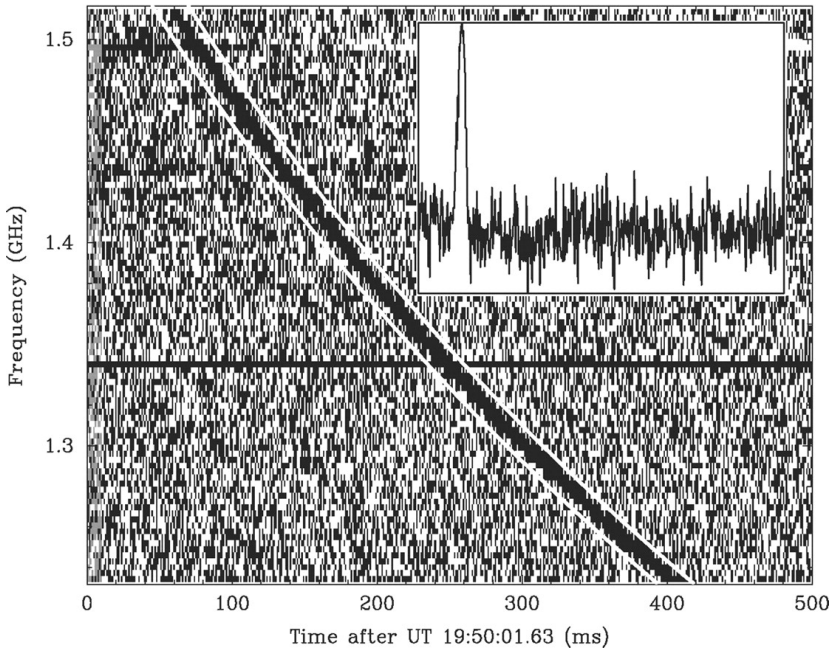
Principal Investigator: Thomas Prince (120, Caltech, PMA)
Co-Is: Walid Majid (335D)
Program: Spontaneous

Assigned Presentation # RPC-31

Jet Propulsion Laboratory
California Institute of Technology

Tutorial Introduction

- Bright millisecond duration radio bursts with flux densities in the range of few mJy – Mjy
- Large dispersion measures well in excess of expected values from the Milky Way
- ~10,000 events per sky per day
- Energy densities 10 Billion times larger than from Galactic pulsars



Lorimer+2008

Program Description

a) Observe a sample of repeating fast radio bursts simultaneously at multiple radio wavelengths

b) Make use of the sensitive Deep Space Network dishes with multiple receivers

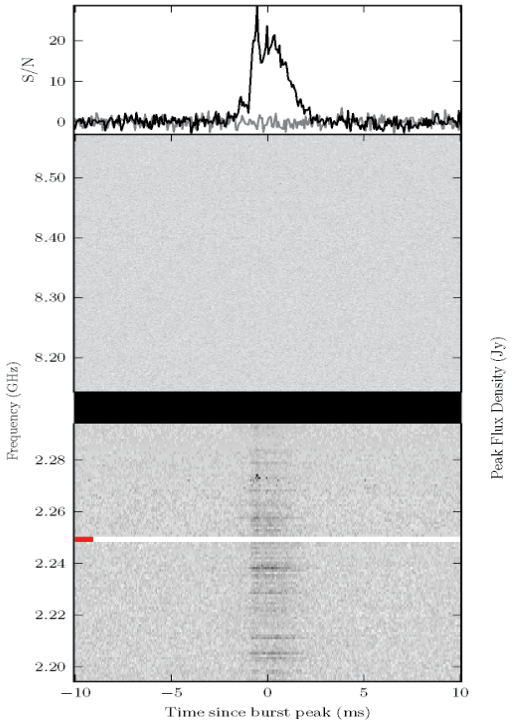
c) Carry out observations with high time and high frequency resolution

d) Constrain the emission mechanism of FRBs through detailed studies of burst spectra

e) Study propagation effects due to interstellar medium

Results

- Multi-frequency observation of FRB121102, first repeating FRB
  - Simultaneous observations at S and X-bands
  - Narrow emission bandwidth: Detection of six busts at S-band and absence of emission at X-band
  - Propagation effects not responsible for narrow-banded emission
  - Paper has been published in ApJL (Majid+2020)
- Coordinated observation of FRB 180916.J0158+65 with Chandra X-ray telescope
  - Constrain energetics of FRBs at high energies
  - Paper submitted to ApJ (Scholz+2020)
- Long term monitoring of FRB 180916.J0158+65 at S and X-bands
  - FRB has been localized using the EVN
  - DSN observations using DSS-14 & DSS-63 at S, X, and L-bands
  - Paper in prep (Pearlman+2020)



Majid et al. 2020

Significance and Next Steps

Significance

- Broadband observation of FRBs provide an excellent means to study the emission processes responsible for this puzzling phenomenon.
- Our work has led to several publications, highlighting the unique capabilities of the DSN large dishes for FRB studies. The unique capabilities at the DSN has allowed us to for the first time constrain the broadband nature of FRBs.
- Our early results from FRB121102 was also recently highlighted by the AAS NOVA team as a significant contribution to the study of FRBs.

Next steps

- Research effort in collaboration with the DSA instrument on Campus is continued through support from a PRPDF program

Publications and References

[A] Majid, W. A., Pearlman, A. B., Prince, T. A., et al., "A Dual-band Radio Observation of FRB 121102 with the Deep Space Network and the Detection of Multiple Bursts", The Astrophysical Journal Letters, 897, L4 (2020).

[B] Scholz, P., Cook, A, Cruces, M., et al., "Simultaneous X-ray and Radio Observations of the Repeating Fast Radio Burst FRB 180916.J0158+65", Submitted to the Astrophysical Journal, arXiv:2004.06082 (2020).

[C] Pearlman, A. B., Majid, W. A, Prince, T. A., et al., "MULTIWAVELENGTH RADIO OBSERVATIONS OF TWO REPEATING FAST RADIO BURST SOURCES: FRB 121102 AND FRB 180916.J0158+65", To be submitted to The Astrophysical Journal (2020).