

Parkes Fast Radio Bursts

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CSIRO ASTRONOMY & SPACE SCIENCE
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The Parkes FRB detections:

ANALOGUE

- 1 - Lorimer burst search of LMC/SMC surveys (FRB 010724)
- 1 - SBS/KB search of high-lat Swinburne surveys (FRB 010125)
- 1 - Keane burst from low-lat PMPS survey (FRB 010621)

DIGITAL

- 10 - High Time Resolution Universe (HTRU) survey
 - Thornton et al. 2013; FRBs 110220, 110627, 110703, 120127
 - Champion et al. 2016; FRBs 090625, 121002, 130626, 130628, 130729
- 1 - HTRU follow-up for FRBs (Petroff et al. 2015; FRB 140514)
- 1 - RRAT observing (Petroff et al. 2016; FRB 150215)
- 5 - SUPERB
 - Keane et al. 2016; FRB 150418
 - Bhandari et al. 2018; FRBs 150610, 151206, 151230, 160102
- 2 - Shannon/Ravi searches (FRBs 131104, 150807)
- 1 - Timing Array observing (FRB 171209)
- **23 TOTAL SCORE**
- **20 FRBs in 7357 hours = 1 per 15 days on sky with MB/BPSR**

NOT REAL TIME
TOTAL INTENSITY ONLY

REAL TIME PLUS
POLARIZATION INFO

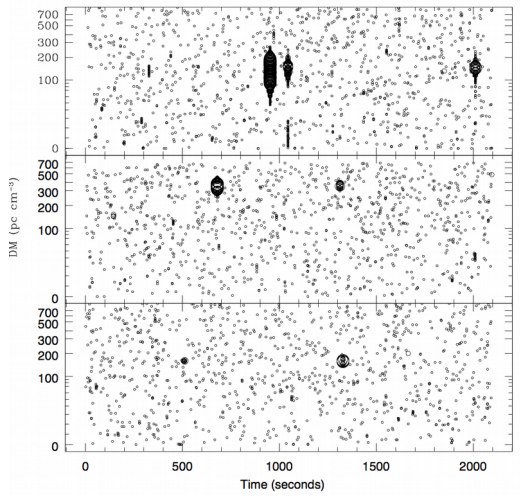
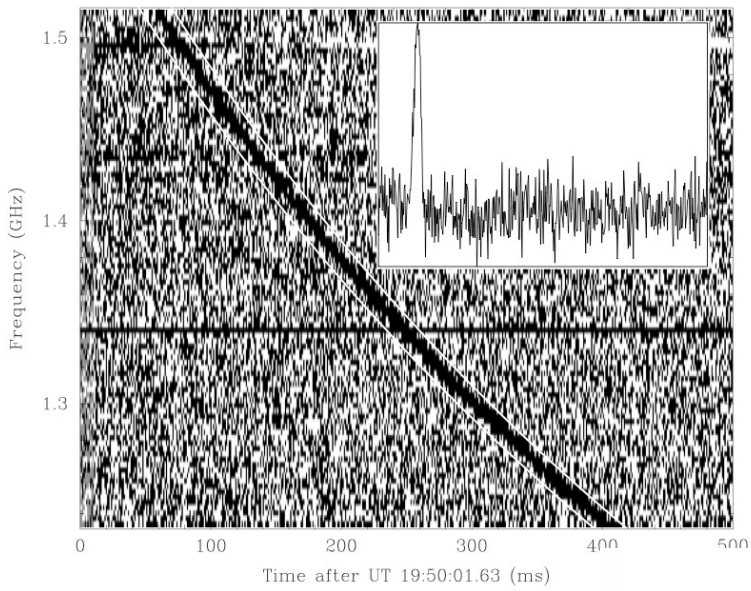
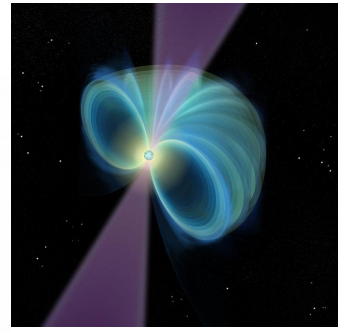
The Parkes FRB highlights:

- The Lorimer burst and its implications / confusions
- The HTRU discoveries
- The first SUPERB discovery and Nature paper
- Recent high DM/RM FRB

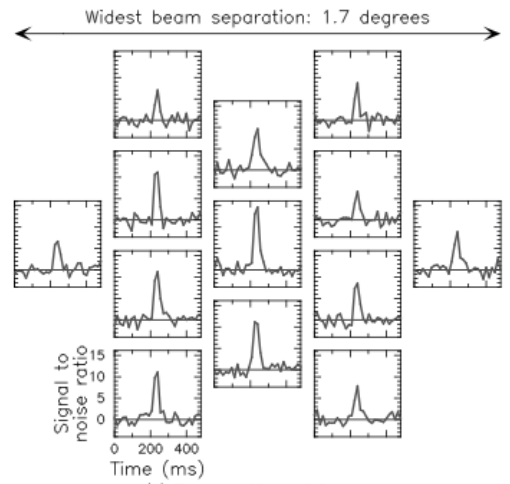
WHAT IS THE LORIMER BURST?

2010 STATUS

RRAT = PULSAR



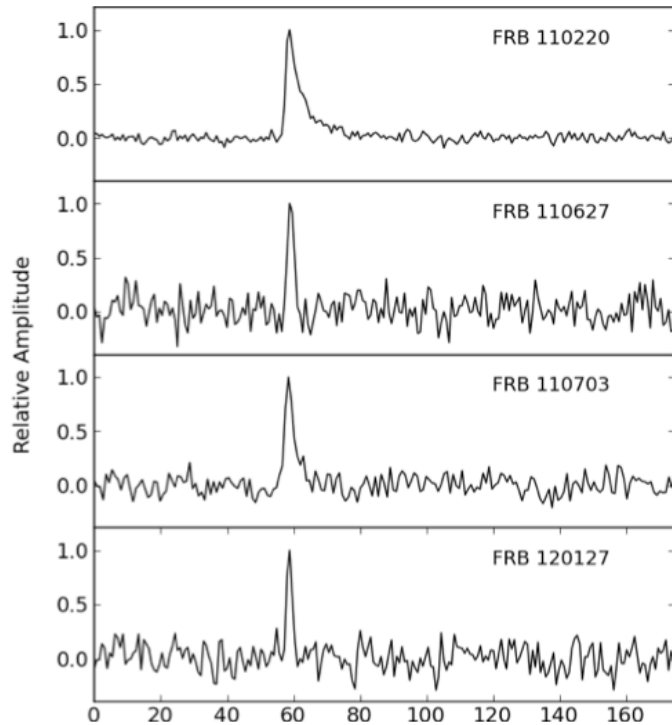
PERYTON = ATMOSPHERIC?



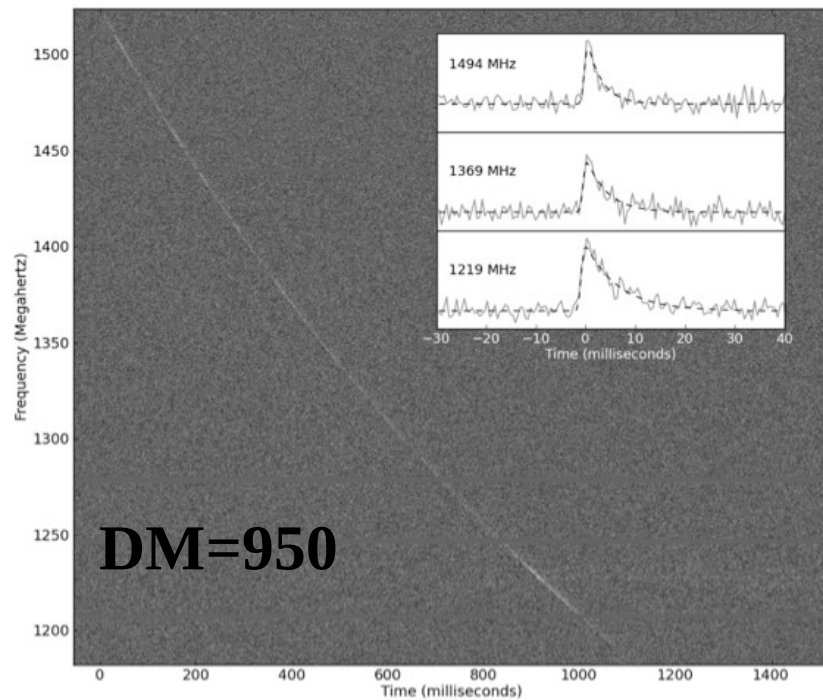
(a) Peryton 08 in 13 beams

LB = COSMOLOGICAL?

Thornton et al. 2013. Science



HTRU explicitly was all-sky and explicitly looking for fast transients. Success came from multibeam frontend, Swinburne backends, people, large time allocation.



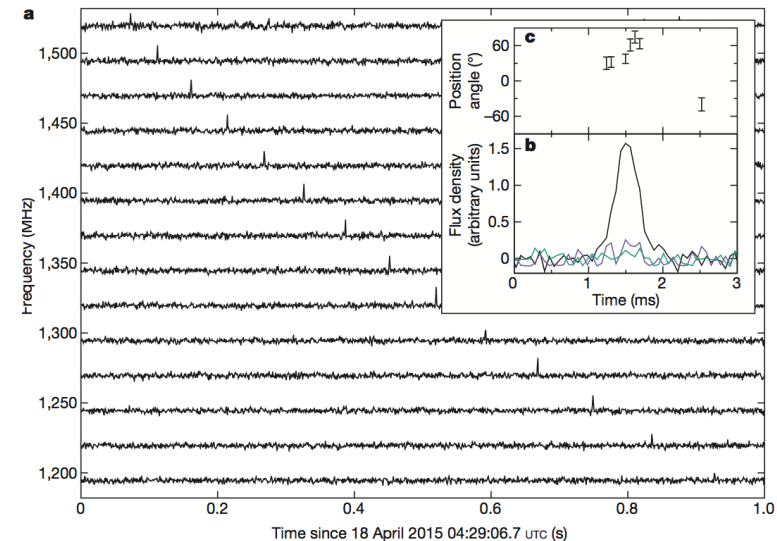
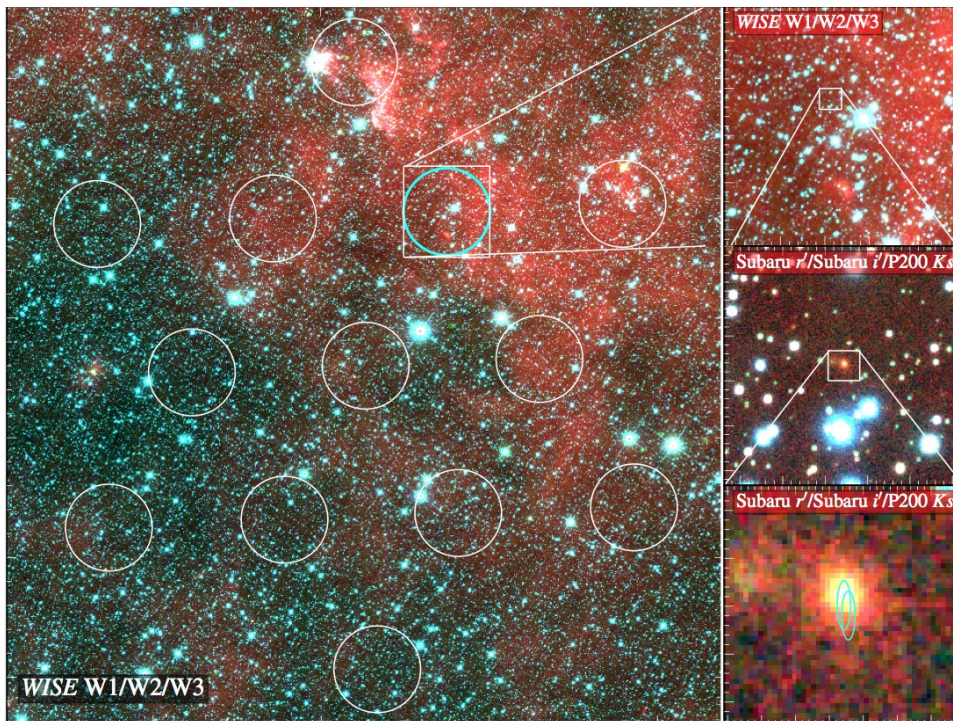
Dispersed + Scattered exactly as ISM says it should be !!

Strong indication for cosmological origin of FRBs !!

Associating DM with distance and knowledge of the IGM then DM=1200 corresponds to $z=1$.

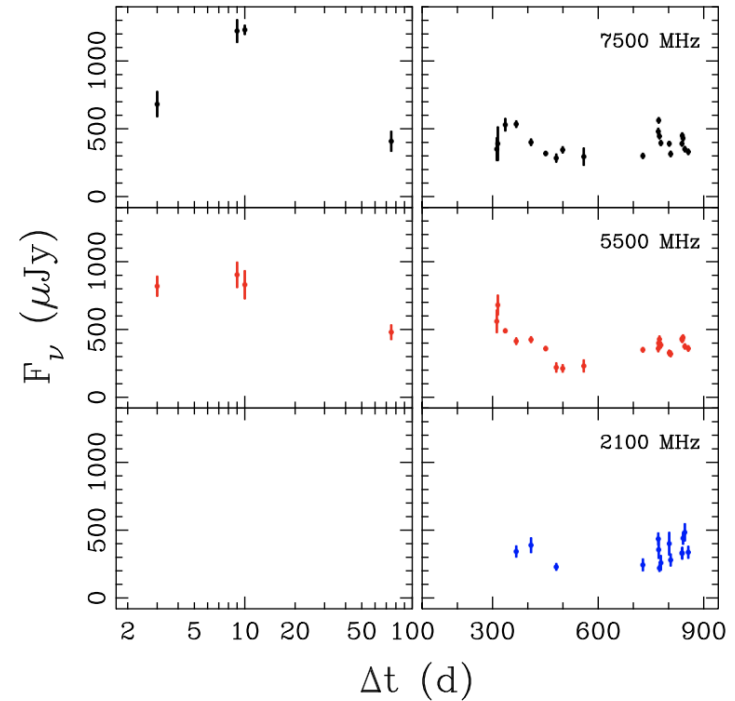
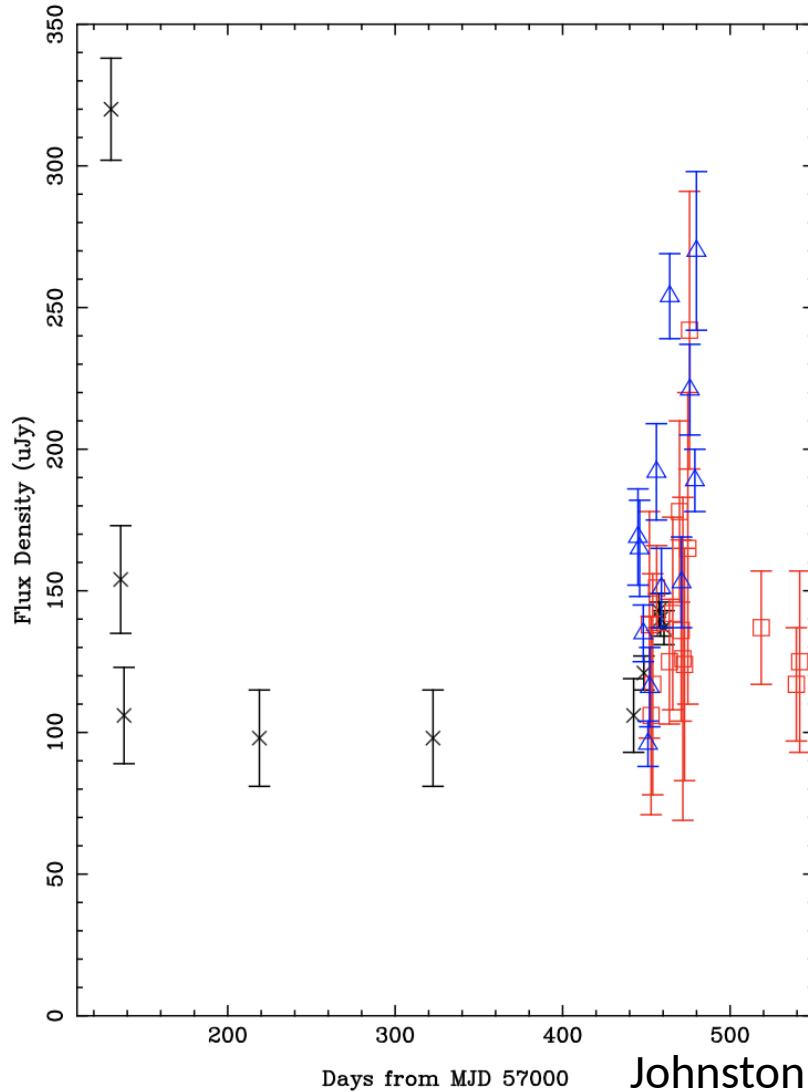
The host galaxy of a fast radio burst

E. F. Keane^{1,2,3}, S. Johnston⁴, S. Bhandari^{2,3}, E. Barr², N. D. R. Bhat^{3,5}, M. Burgay⁶, M. Caleb^{2,3,7}, C. Flynn^{2,3}, A. Jameson^{2,3}, M. Kramer^{8,9}, E. Petroff^{2,3,4}, A. Possenti⁶, W. van Straten², M. Bailes^{2,3}, S. Burke-Spolaor¹⁰, R. P. Eatough⁸, B. W. Stappers⁹, T. Totani¹¹, M. Honma^{12,13}, H. Furusawa¹², T. Hattori¹⁴, T. Morokuma^{15,16}, Y. Niino¹², H. Sugai¹⁶, T. Terai¹⁴, N. Tominaga^{16,17}, S. Yamasaki¹¹, N. Yasuda¹⁶, R. Allen², J. Cooke^{2,3}, J. Jencson¹⁸, M. M. Kasliwal¹⁸, D. L. Kaplan¹⁹, S. J. Tingay^{3,5}, A. Williams⁵, R. Wayth^{3,5}, P. Chandra²⁰, D. Perrodin⁶, M. Berezina⁸, M. Mickaliger⁹ & C. Bassa²¹



FRB150418 and 131104 - radio light curves

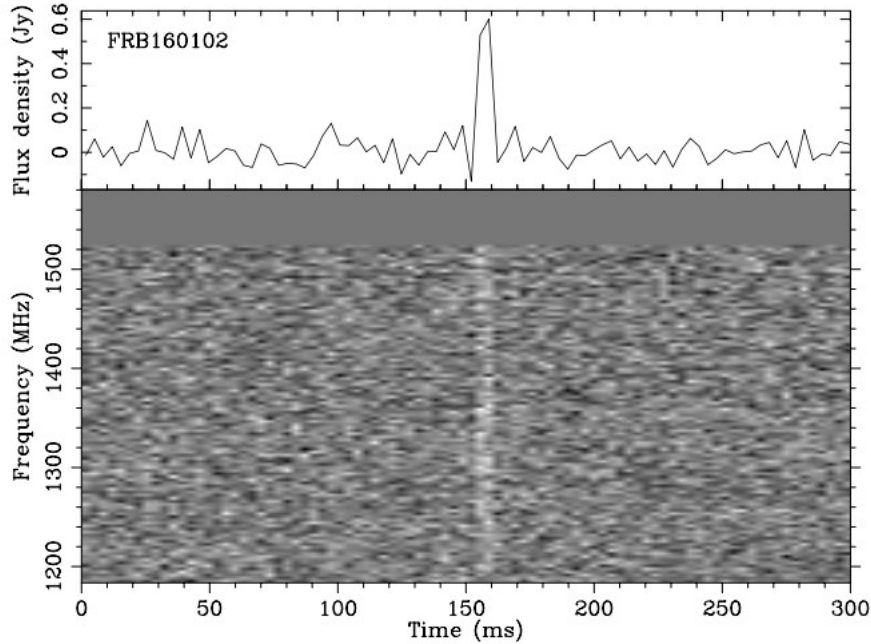
Shannon & Ravi 2017



Weak AGN activity, relationship with FRB? Relationship with the repeater?

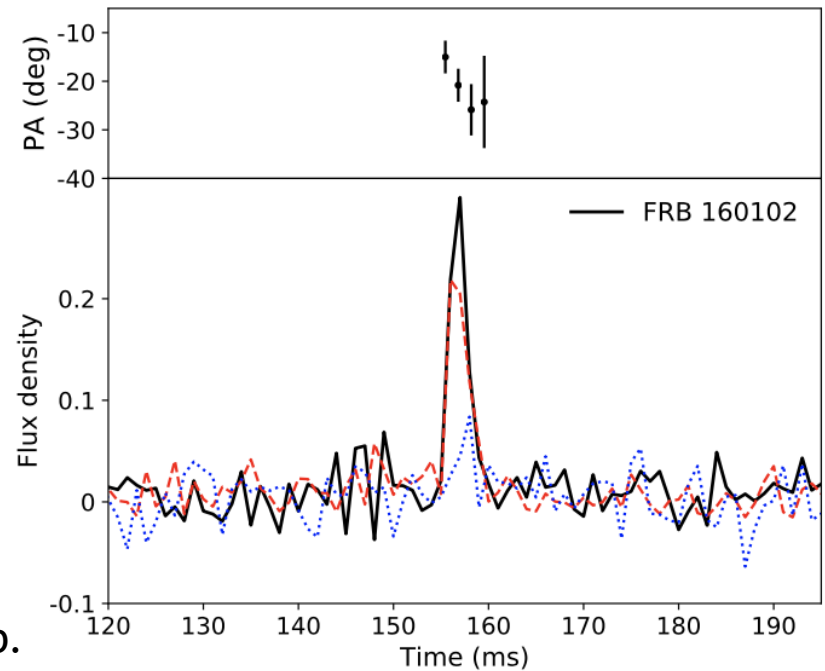
Johnston et al. 2017

FRB160102 - DM=2596, RM = -221



Bhandari et al 2018

- 140514 - V but no L
- 150215 - moderate L, low RM
- 150418 - low L, low RM
- 150807 - high L, RM = 12
- 151230 - some L? high RM?
- 171209 - high L, low RM

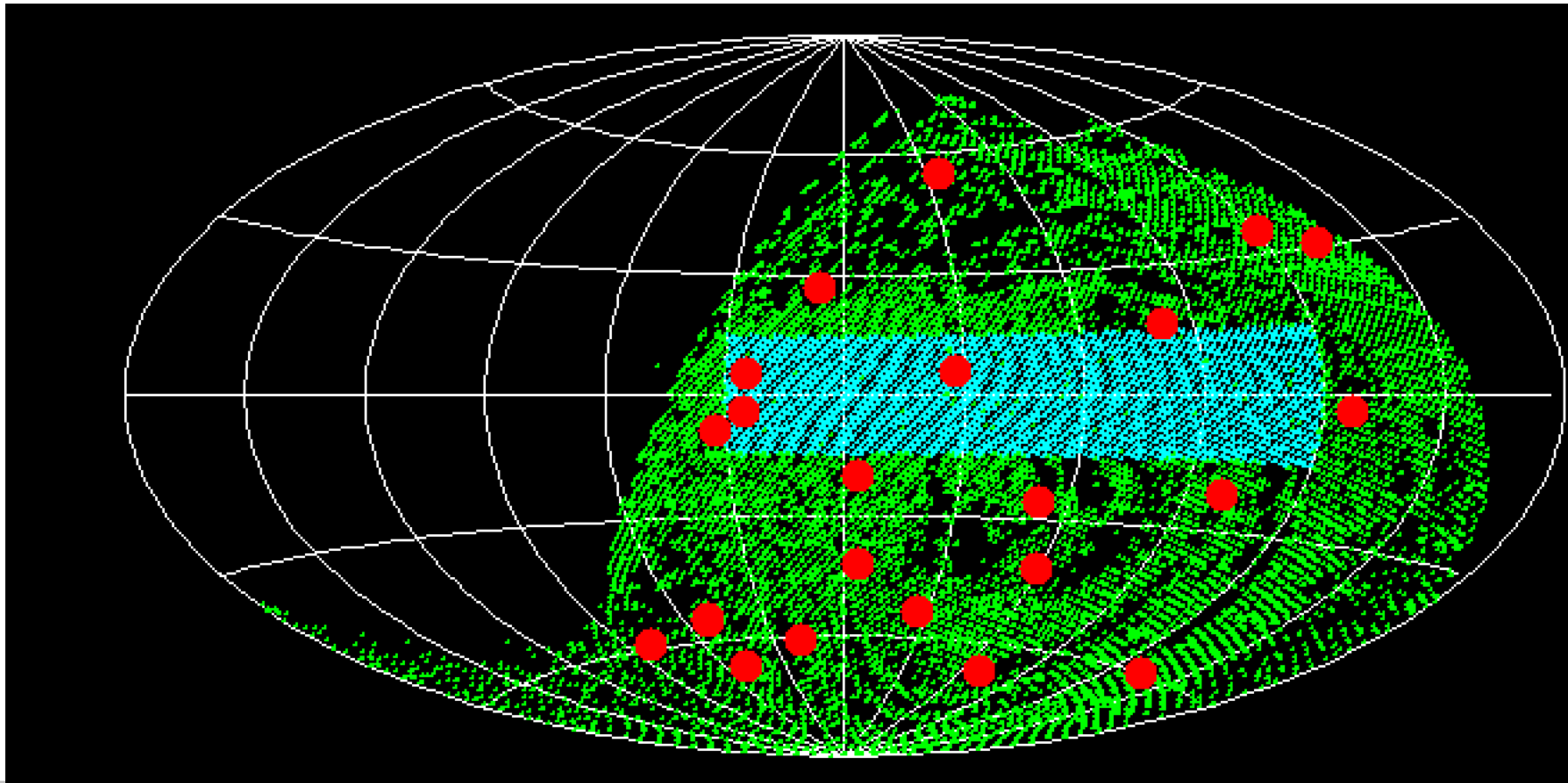


Caleb et al. In Prep.

Bhandari et al. 2018

PKS rate 4700 FRBs/sky/day.

1700 FRBs/sky/day above 2 Jyms.



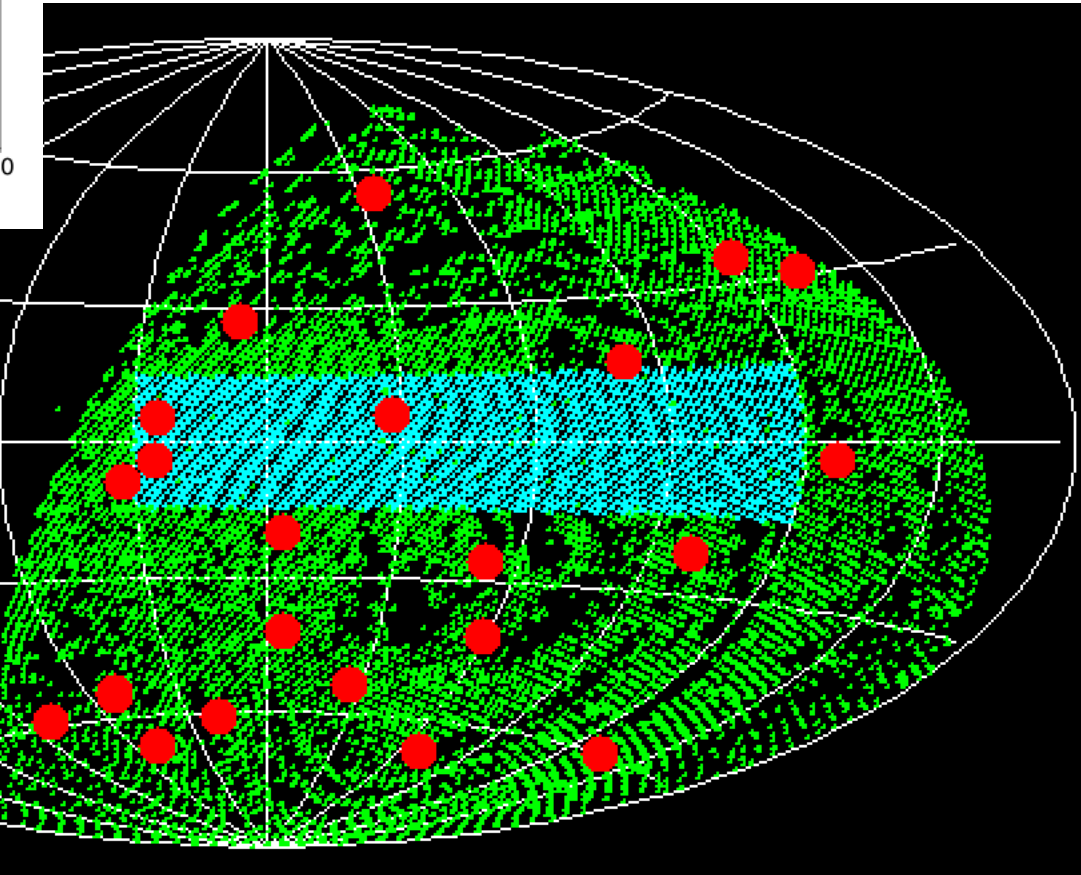
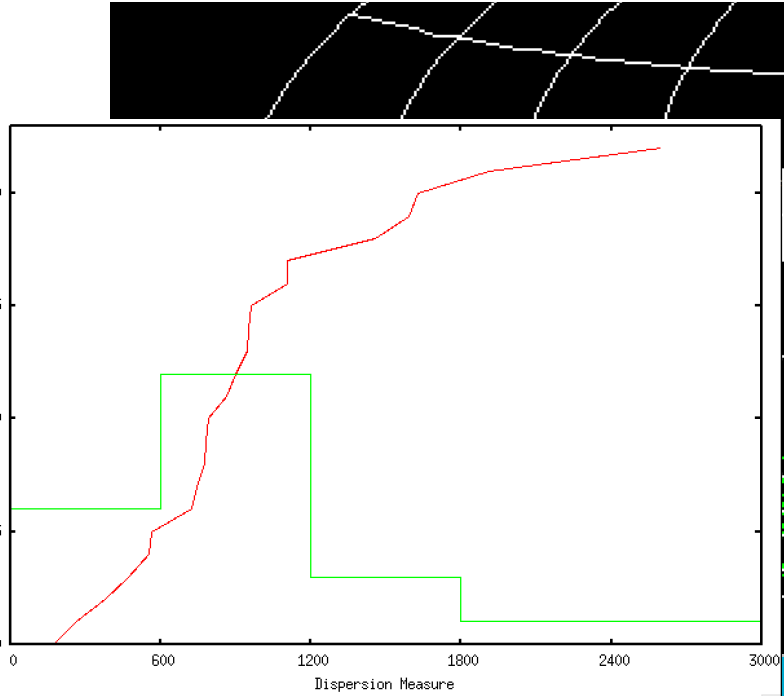
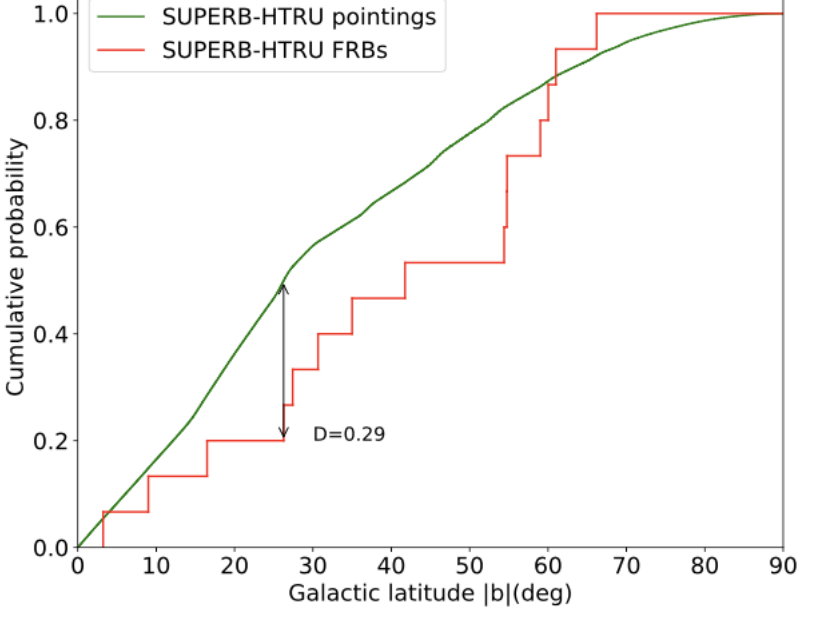
Bhandari et al. 2018

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1700 FRBs/sky/day above 2 Jyms.

Latitude distribution consistent with isotropy (?) but scintillation important.

DM peaks between $z \sim 0.5$ and $z \sim 1$?



Pros and Cons of Parkes FRB surveys

Parkes current record holder !!

PROS

- High sensitivity, 13 beams, large bandwidth
- Digital backend / Heimdall software
- People power
- Lots of observing time
- RFI environment not too bad

CONS

- Limited position information
- Limited energy information
- Very incomplete at S/N near threshold
- Very incomplete at largish widths

FUTURE

- SUPERB through 2018
- Cryo PAF > 2 years away
- ASKAP + positions will dominate soon
- CHIME may dominate numbers



Thank you

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