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and the FAST team

HI ABSORPTION OBSERVATION USING FAST

HI absorption meeting @ ASTRON
Aug 29, 2018

An incomplete list of previous single dish studies

- Arecibo: 1 associated absorption in 8983 sources stronger than 7.7mJy in 517deg^2 (Darling+2011)
- HIPASS: 4 associated HI absorptions in 204 sources stronger than 250mJy (Allison+2014)
- GBT: 4 intervening absorbers out of 17 systems (Zwaan+2015)

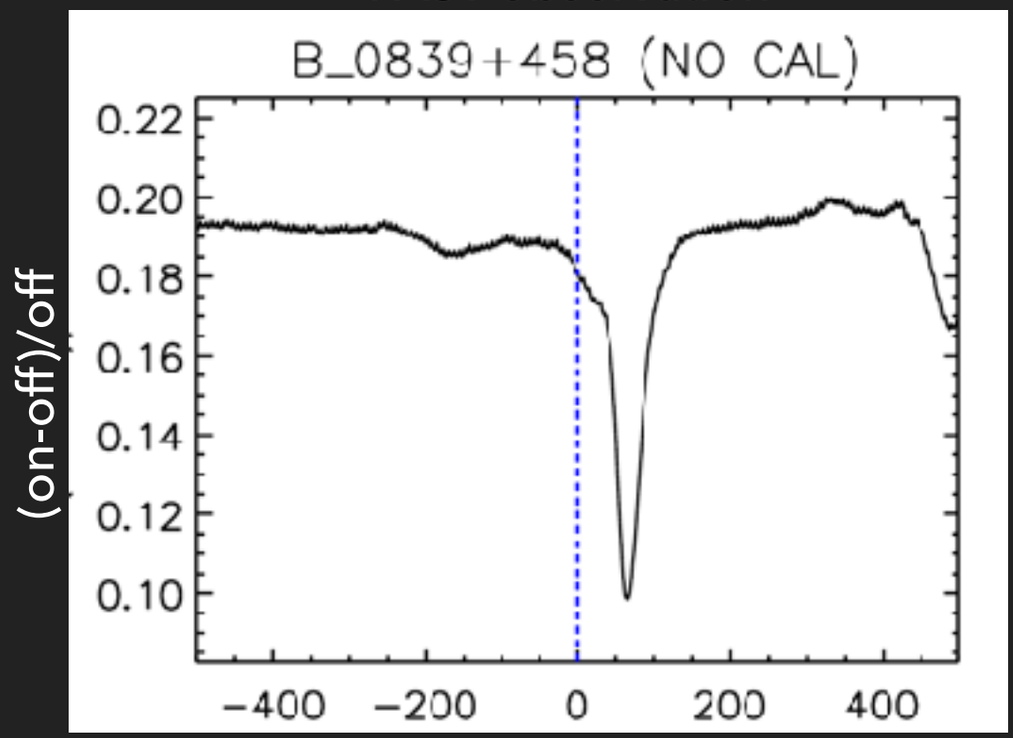
Brief summary of FAST status

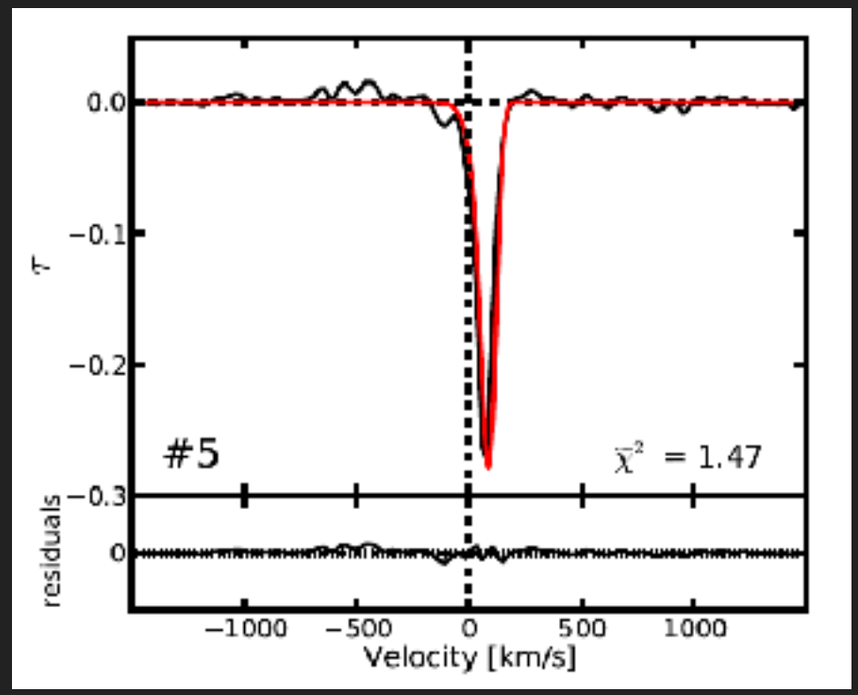
- Can track ~> 2hr
- Dec range:
  - 0 to 52 deg (full sensitivity)
  - -14 to 66 deg (partial sensitivity)
- Beam size: 2.9′
- 19-beam receiver is on
  - Tsys ~ 18 K
  - 1.05-1.45 GHz
- Ultra wide-band receiver
  - 0.27 - 1.62 GHz

FAST test observation

- B 0839+458
  - 331 mJy @ 1.4 GHz
  - z = 0.192
- FAST observed for 18min (on-source)
- WSRT observed for 4 hrs

FAST observation

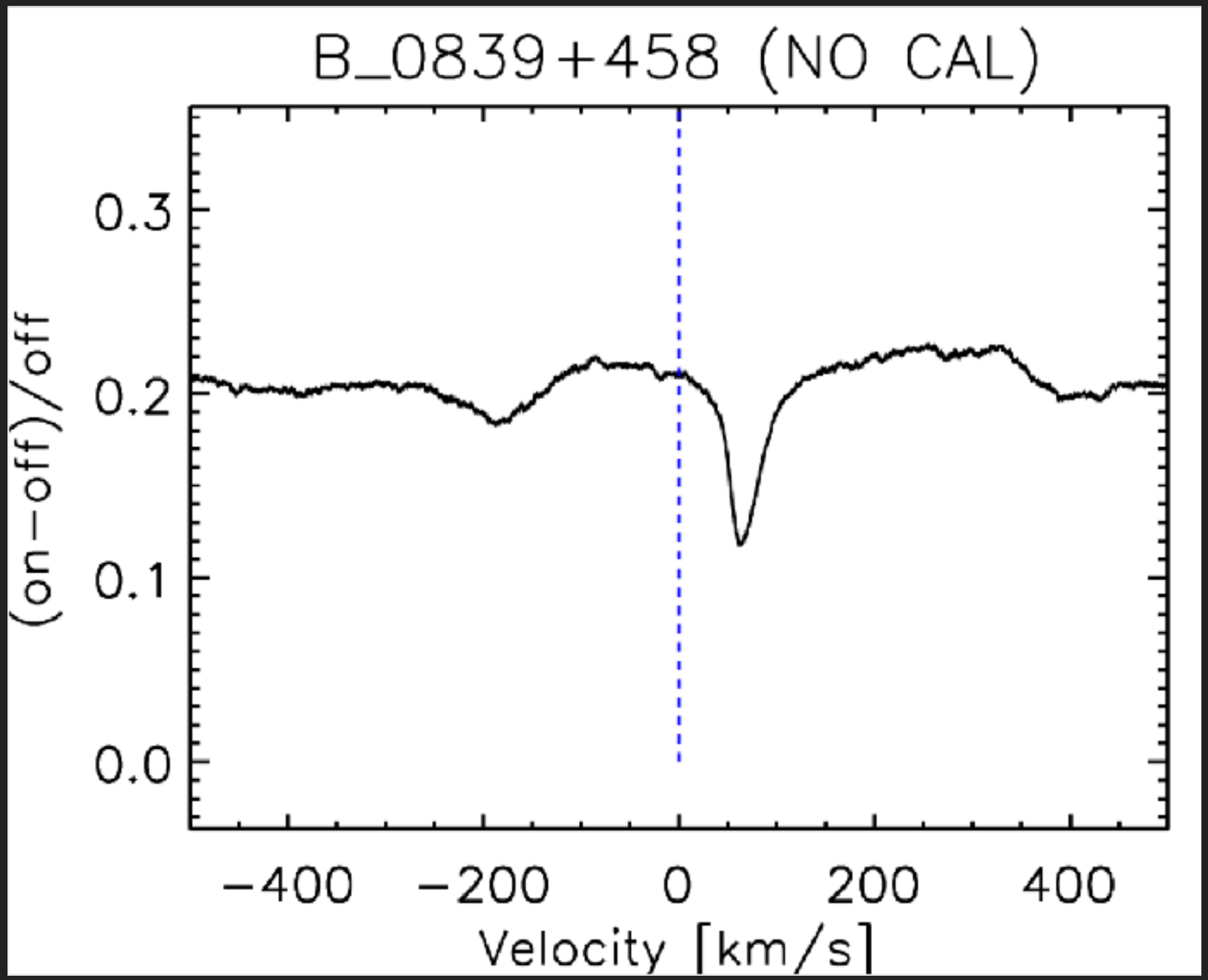




WSRT observation (Gereb+2014)

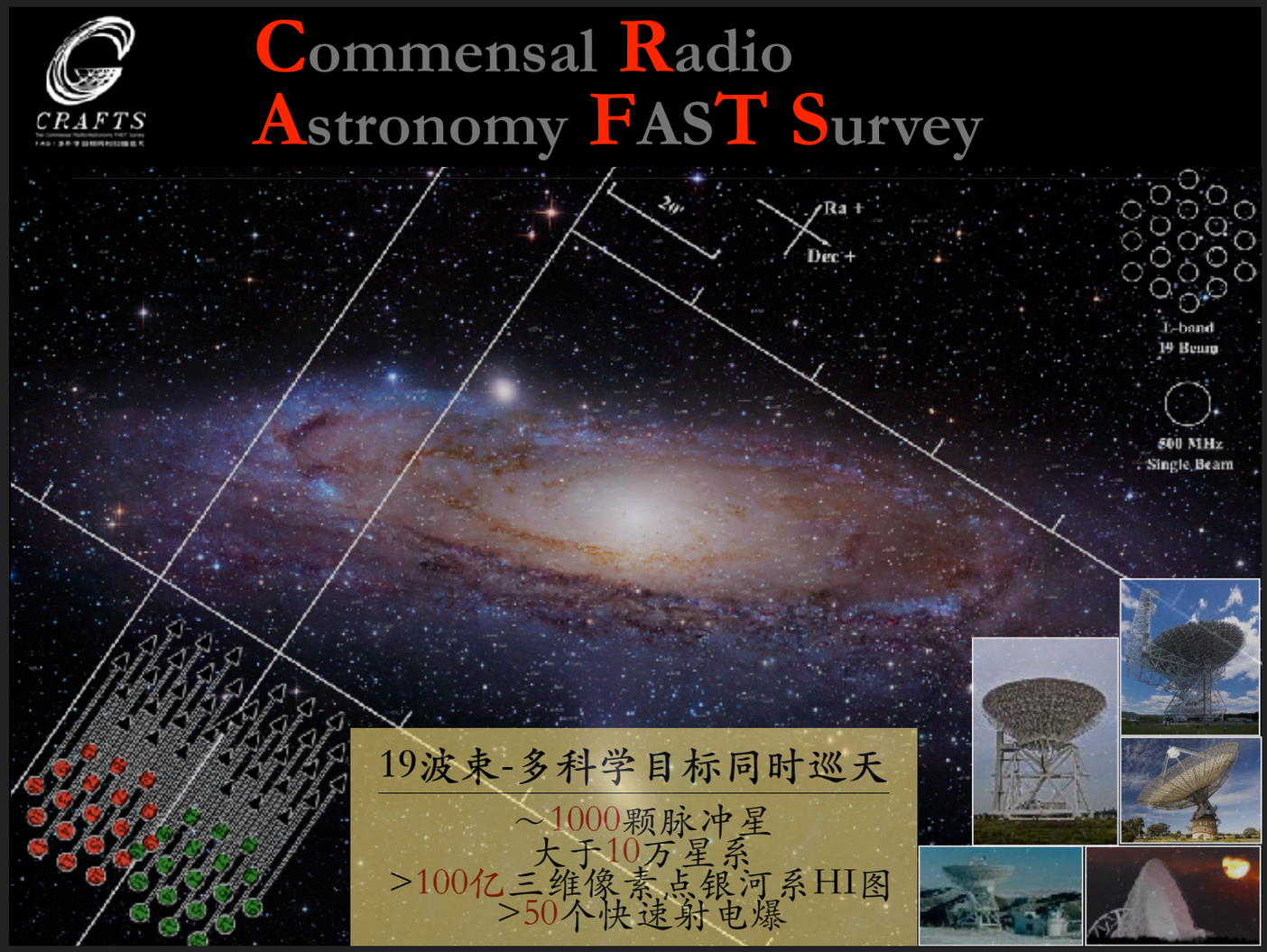
FAST drift scan capability

10s integration ~ <drift scan integration time



Commensal Radio Astronomy FAST survey (CRAFTS)

- Drift scan using the 19-beam receiver
- 220 full days to cover the FAST sky between -14° and +66° of DEC



Li+2018

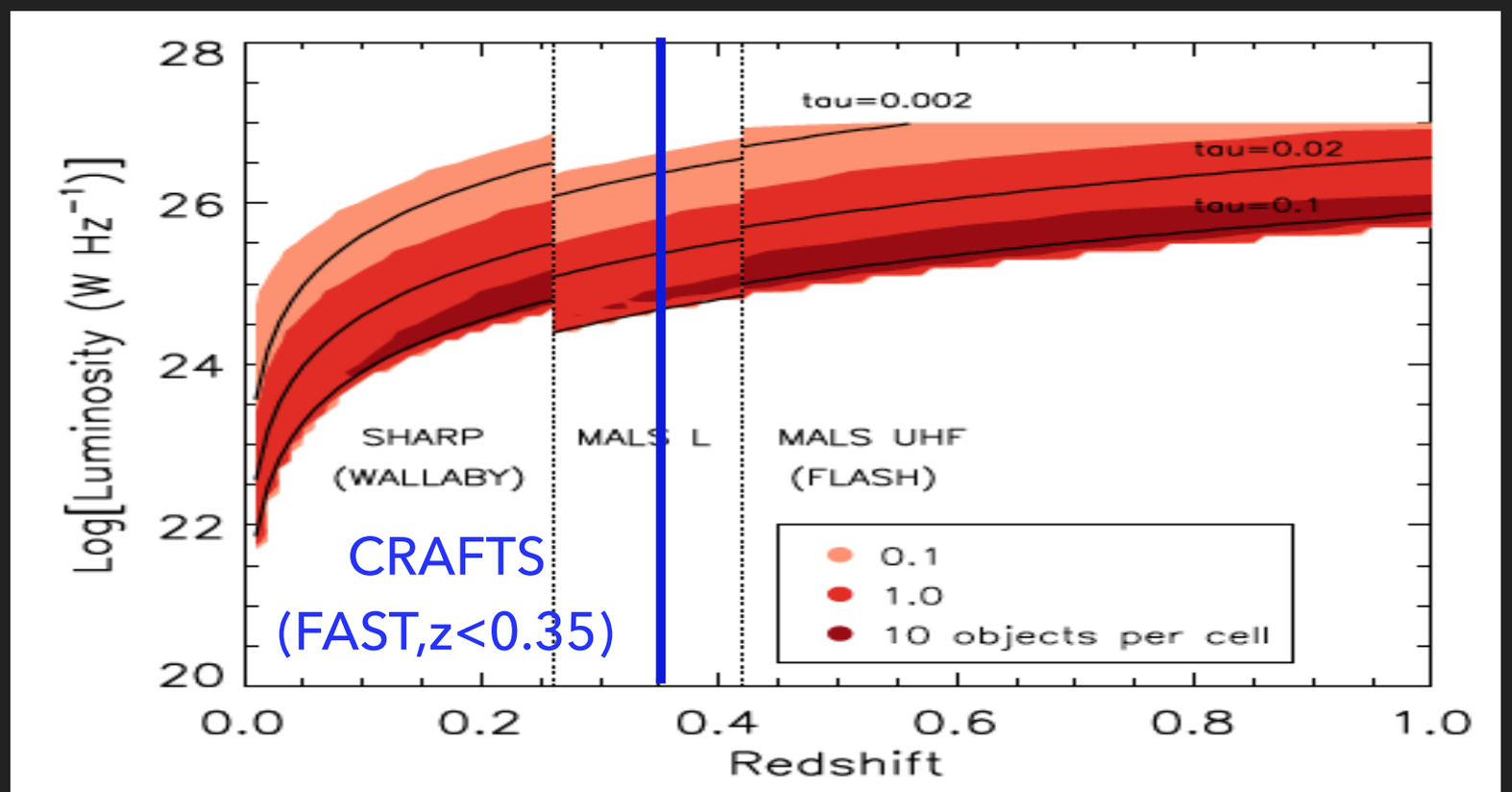
http://crafts.bao.ac.cn/pulsar/

UPCOMING HI ABSORPTION SURVEYS & FAST-CRAFTS

Table 3: Summary of various upcoming H I 21 cm absorption line surveys

Survey	Redshift [H I 21 cm]	Time per pointing [hrs]	Spectral r.m.s. [mJy]	Sky coverage [deg^2]	Total time [hours]	Number of lines of sight
Apertif – SHARP	0–0.26	12	1.3	4000	6000	25000 (> 30 mJy)
ASKAP – FLASH	0.4–1.0	2	3.8	25000	1600	65000 (> 90 mJy)
ASKAP – Wallaby	0–0.26	8	1.6	30000	8000	132000 (> 40 mJy)
MeerKAT – MALS (L -band)	0–0.57	1.4	0.5	1300	1333	16000 (> 15 mJy)
MeerKAT – MALS (UHF-band)	0.40–1.44	1.7–2.8	0.5–0.7	2000	2125	33000 (> 15 mJy)

- FAST-CRAFTS
  - z: 0-0.35
  - integration time: ~15s
  - rms: 5mJy?
  - sky coverage: whole sky from -14 to 66 Deg



Maccagni+2017

FAST observation plan I: drift scan

- Yu+2017: very preliminary CRAFTS drift scan estimation
  - rms ~ 2.3 mJy
  - for 10sigma detection, only F > 0.11 Jy background sources can be detected
  - ~ 10,000 luminous (F>0.11Jy) radio sources/month
  - detect ~ 200 sources/month

FAST observation plan II: tracking

- search for HI in promising sources such as MgII absorbers and DLAs
- search for OH absorption lines in detected ‘high redshift’ HI absorption systems

FAST observation problems

- RFI
- Baseline ripples, instabilities
- large overhead for switching RA&Dec

SUMMARY

- HI absorption survey is one of the FAST key projects
- FAST will be mostly in drift scan survey mode (CRAFTS) in the next couple of years but now we are mostly doing tests in tracking mode.
- We have done a few HI absorption observation tests and found that FAST is promising in detecting extragalactic HI absorption systems given the absorption redshift.
- RFI and baseline could be big problems.