

# LOFAR LBA observations of Abell 2256



Reinout van Weeren

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Surveys - Galaxy Clusters: M. Brüggen, G. Brunetti, H. Röttgering, G. Miley, et al.

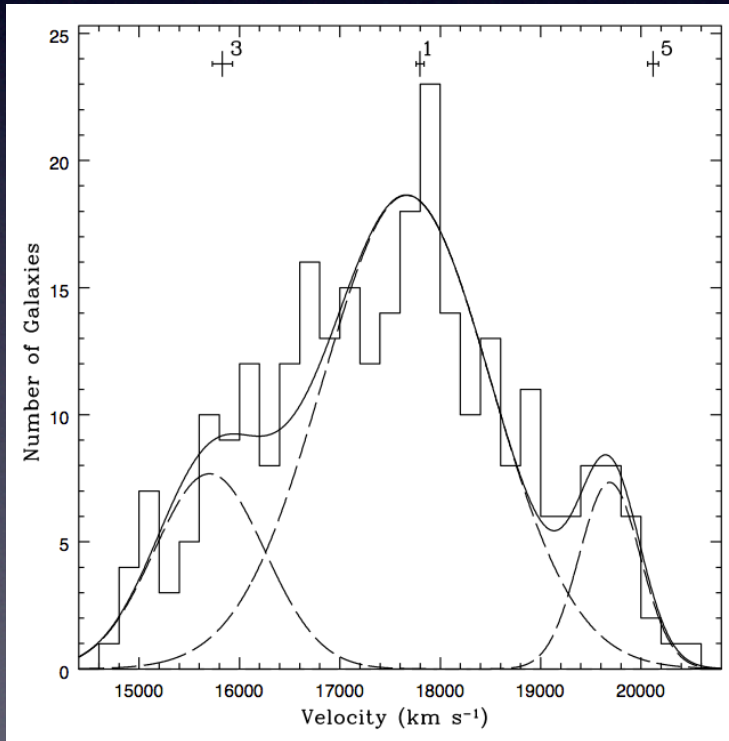
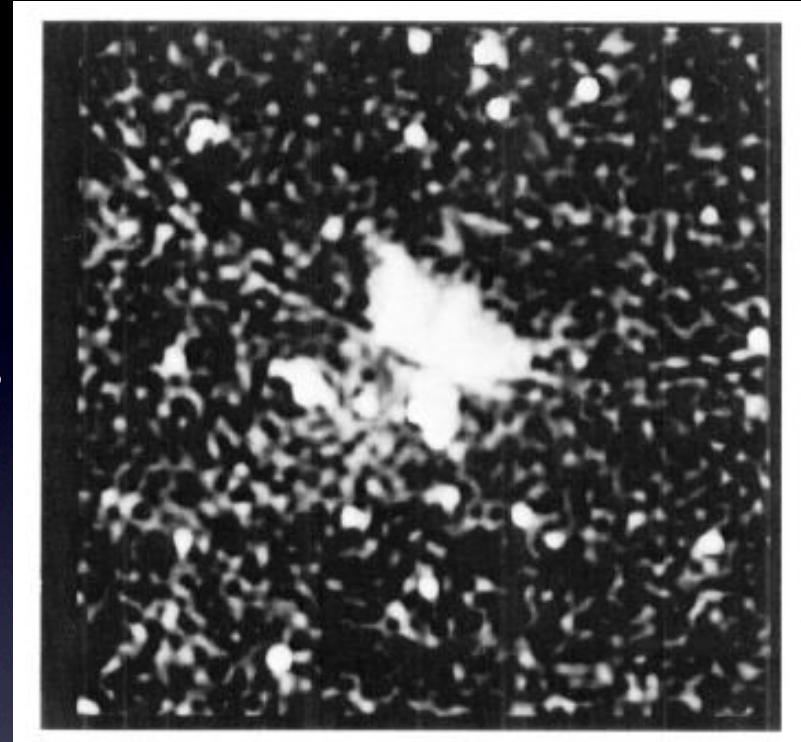
# Outline

- Introduction
- LOFAR Abell 2256 observations
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- Summary

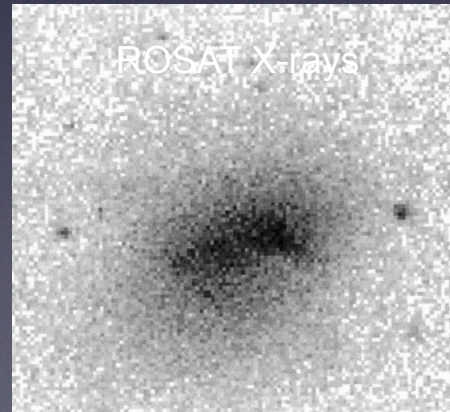
# Abell 2256

Bridle & Formalont 1976

- $z = 0.0594$
- $L_X = 4 \times 10^{44}$  erg/s
- velocity dispersion: 1350 km/s

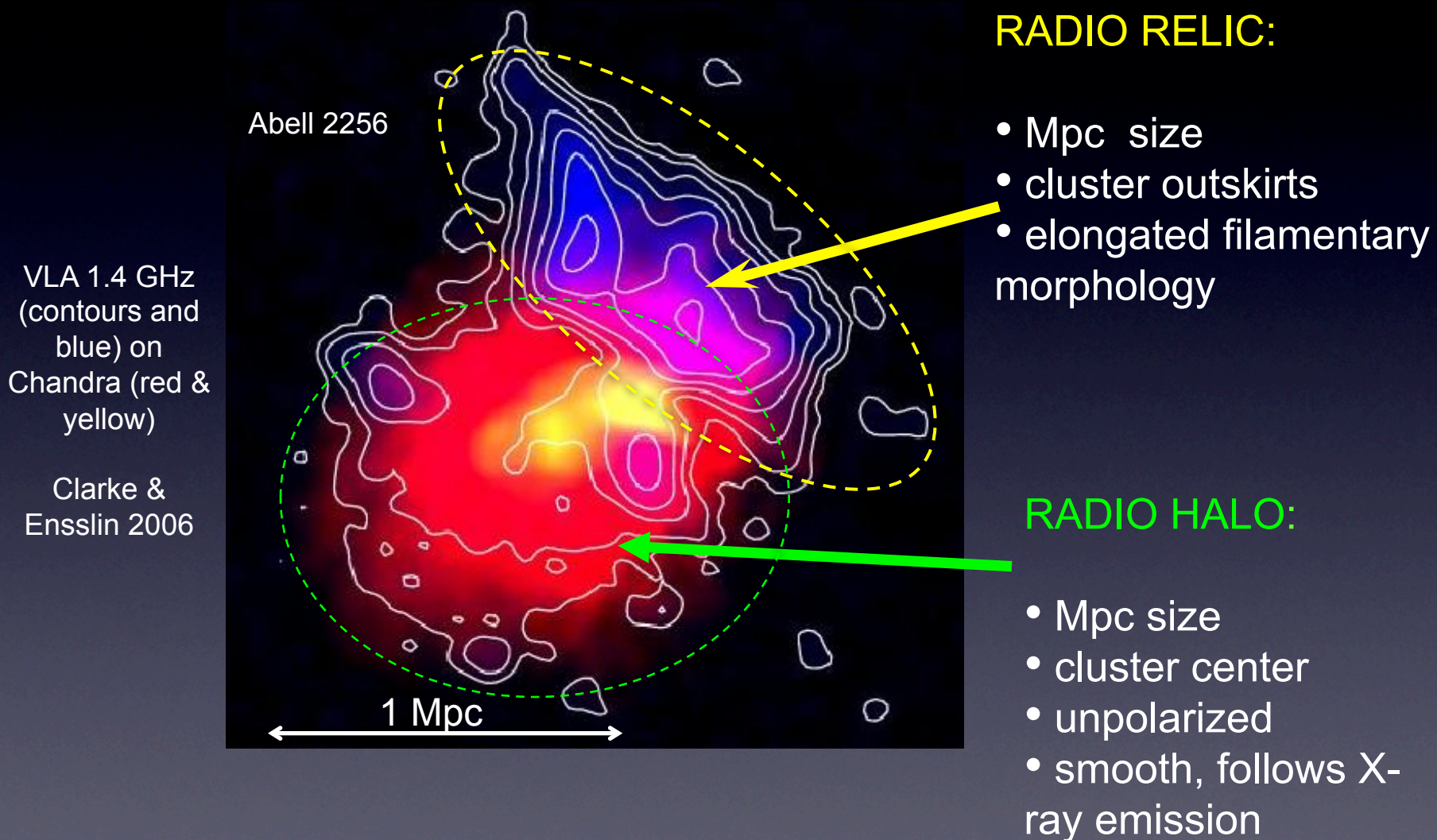


Berrington et al. (2003)



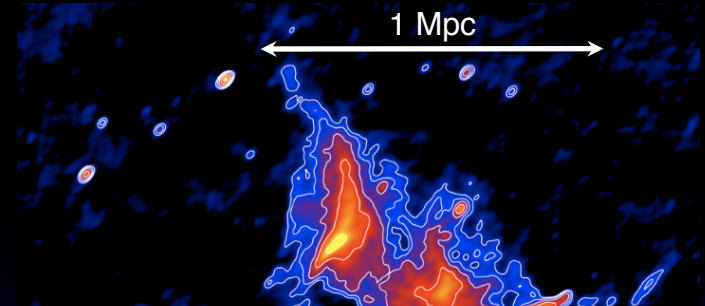
Slezak et al. (1994)

# A2256: Chandra & VLA

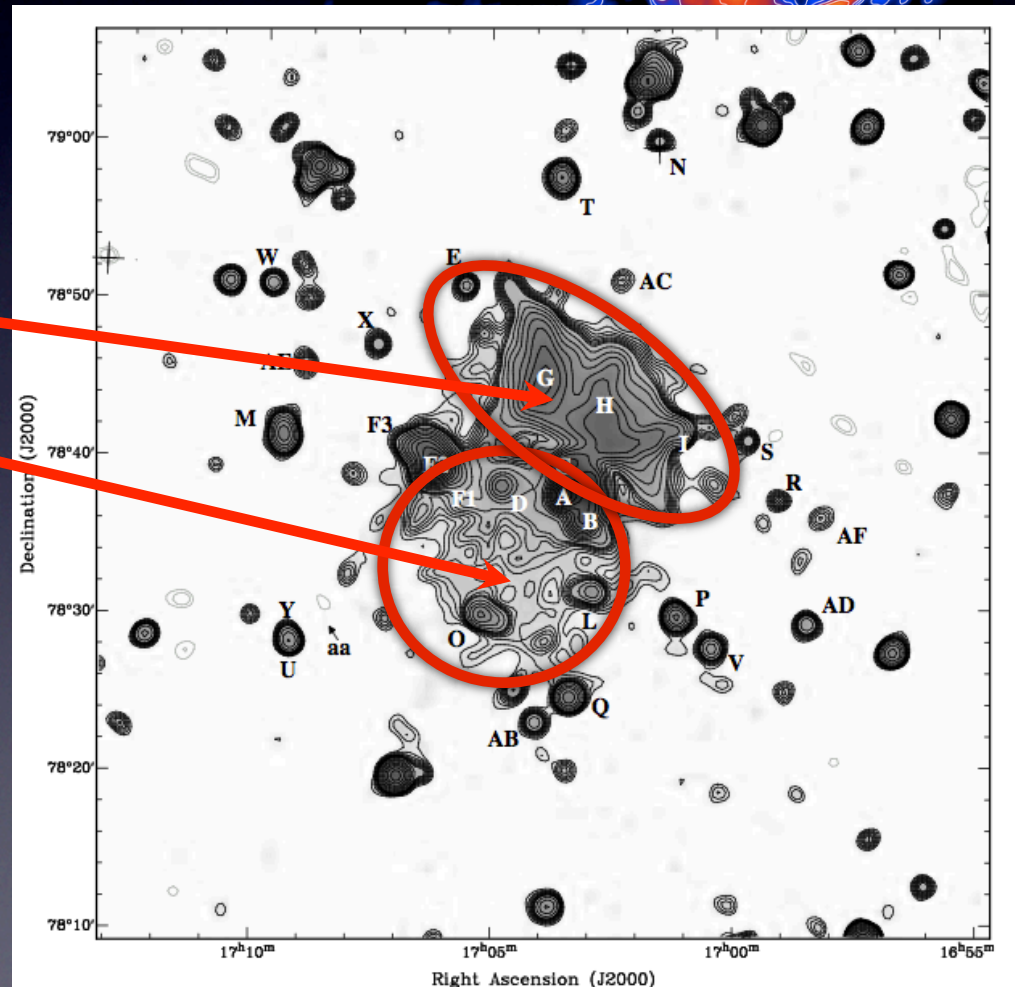


# A2256

GMRT 325 MHz, van Weeren et al. (2009)

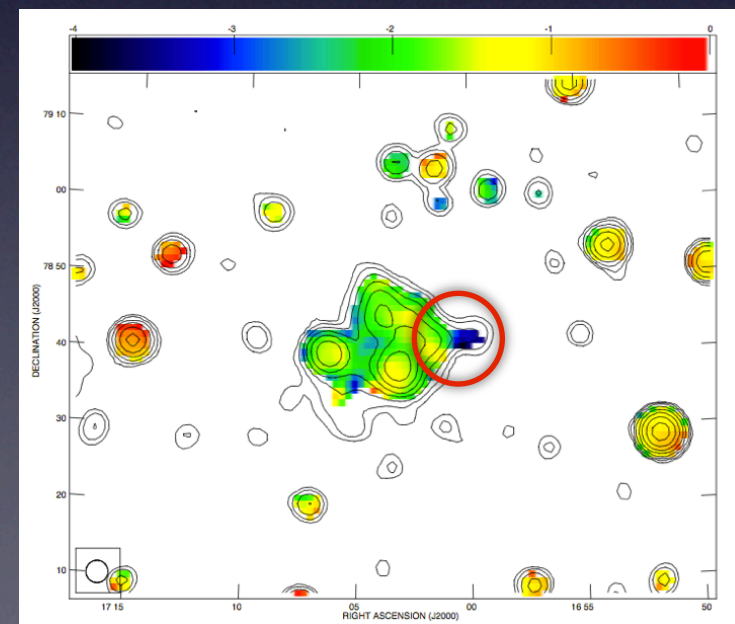
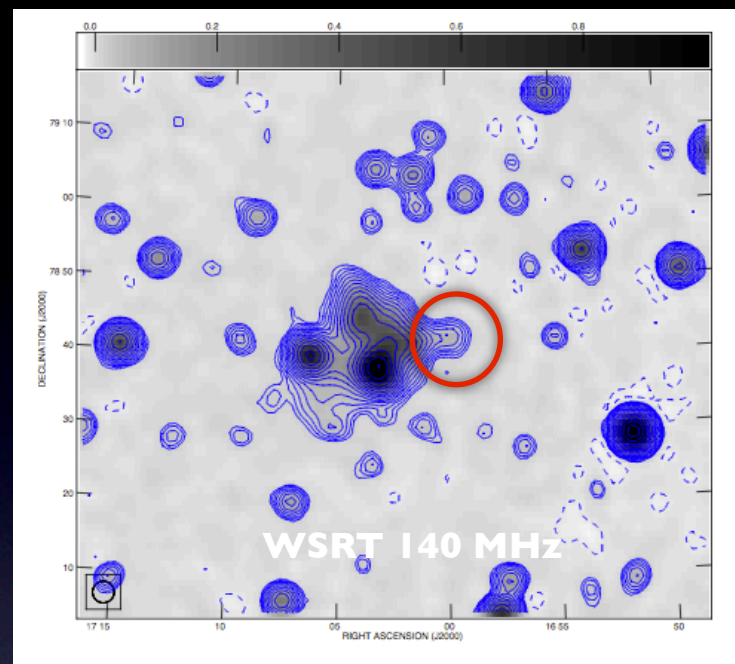
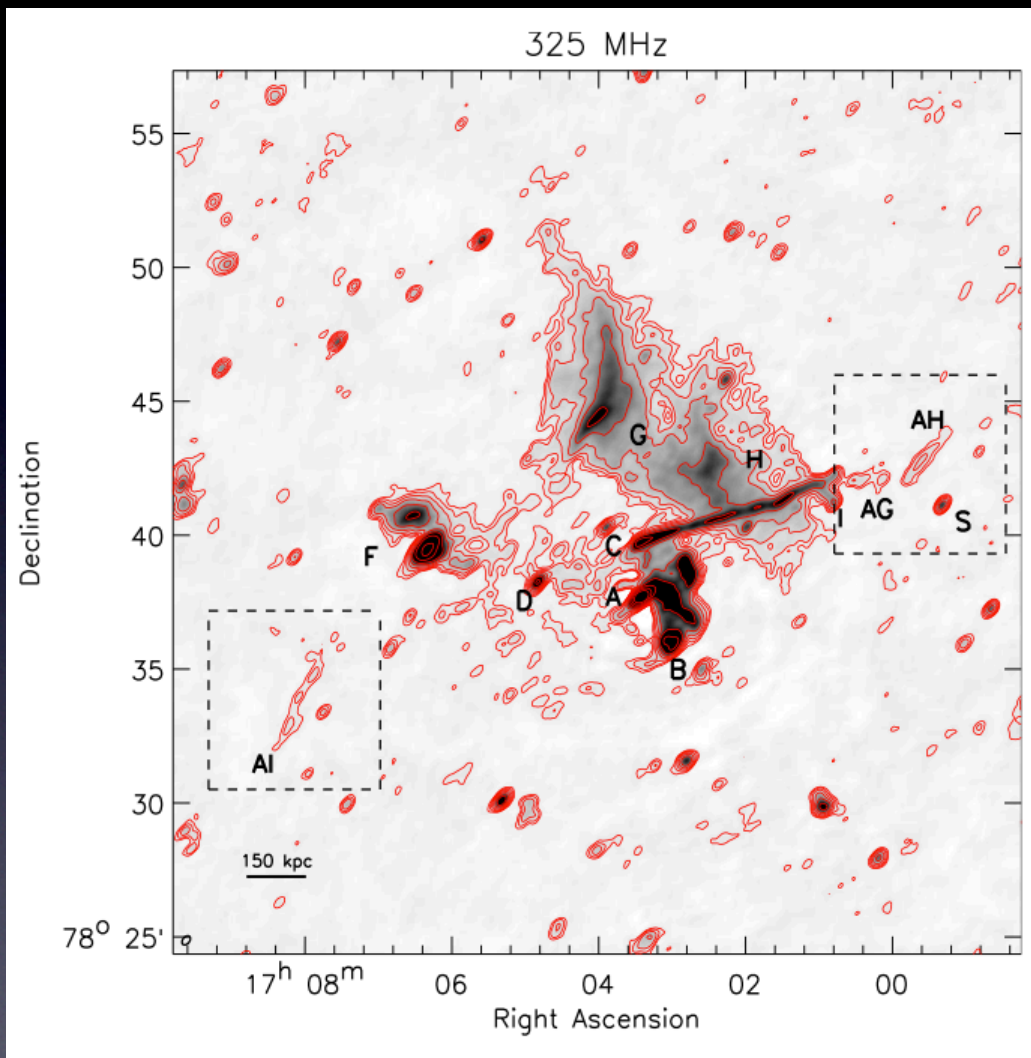


- range of spectral indices
  - relic  $\alpha = -0.7$
  - halo  $\alpha = -1.6$
  - smaller relics/head-tails  $\alpha \sim -1$  to  $-2$



WSRT 350 MHz, Brentjens (2008)

# GMRT & WSRT



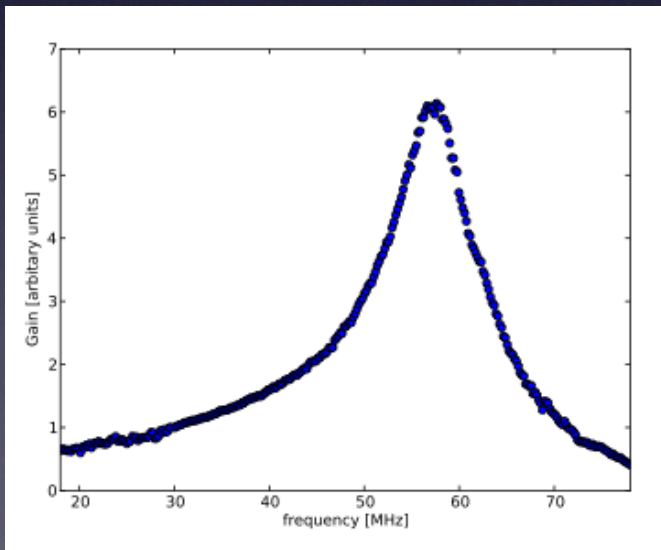
# A2256 LOFAR LBA

## observations

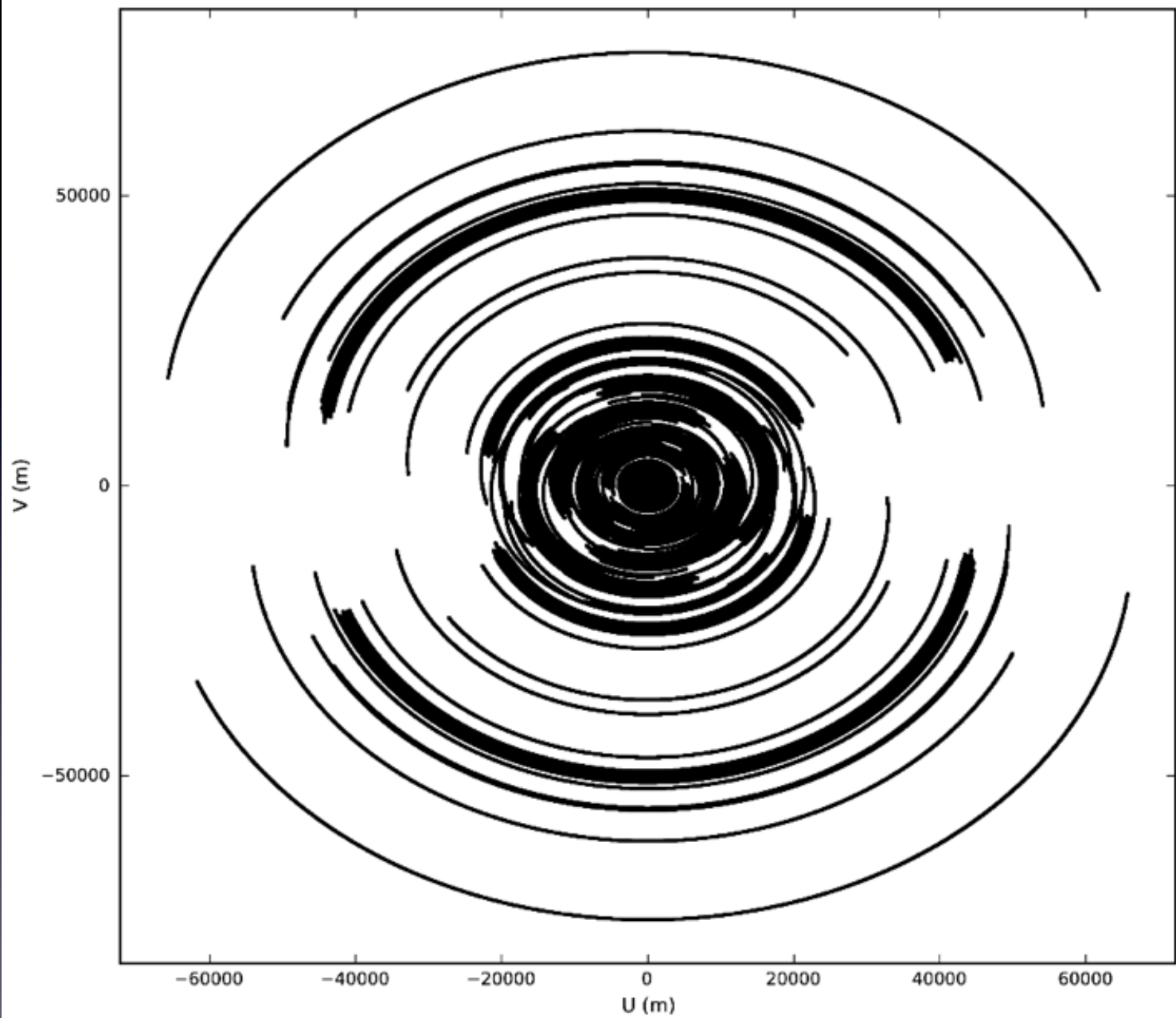
- Jan & Aug 2011
- 6, 10 hrs
- 25 stations (7, 8 remote)
- 15- 67 MHz 244 bands (0.2 MHz, 64 channels)
- 30, 75 km baselines

## calibration

- (1) remove Cas A, Cyg A, VirA (at full frequency resolution)
- (2) take out global bandpass
- (3) global calibration against VLSS 74 MHz model
- (4) image with casapy (20 x 0.2 MHz)
- (5) station beam correction in the image plane (fluxes are correct, only uncertainty is the knowledge of the station beam)
- issue: varying station beam in CLEAN, new awimager still too slow to handle this dataset



D. Rafferty





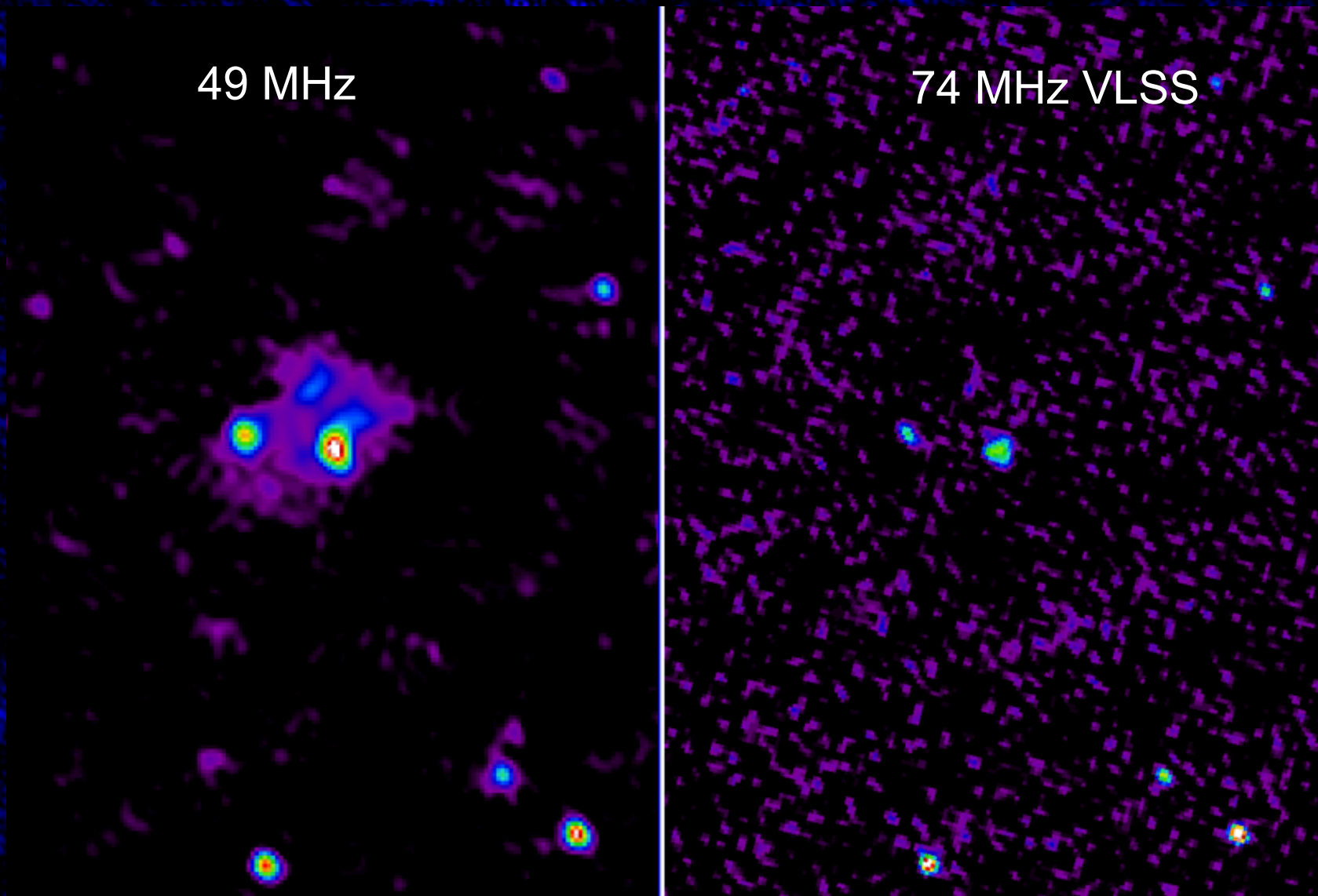
3°

49 MHz (longest baseline 25 km)



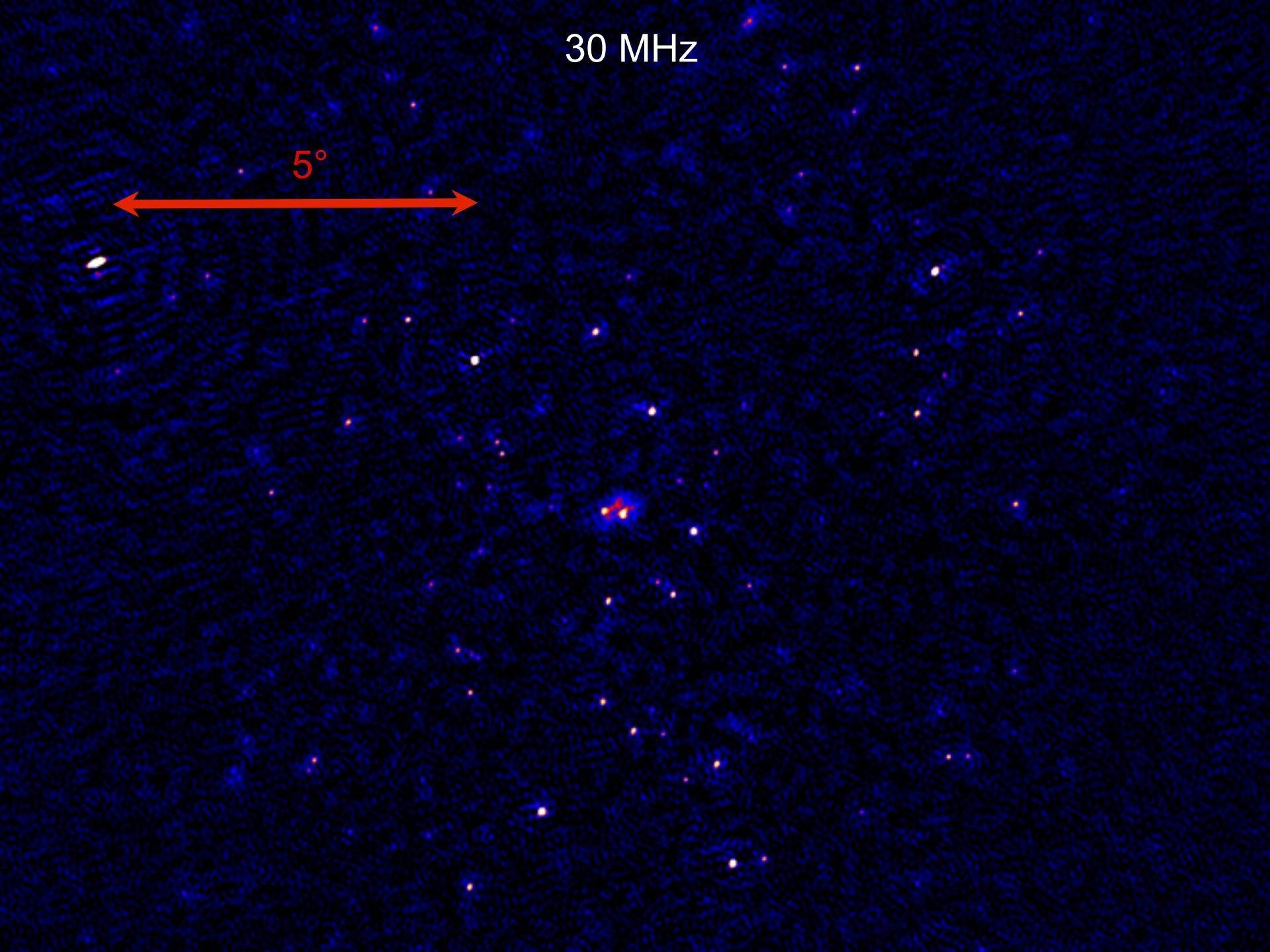
49 MHz

74 MHz VLSS

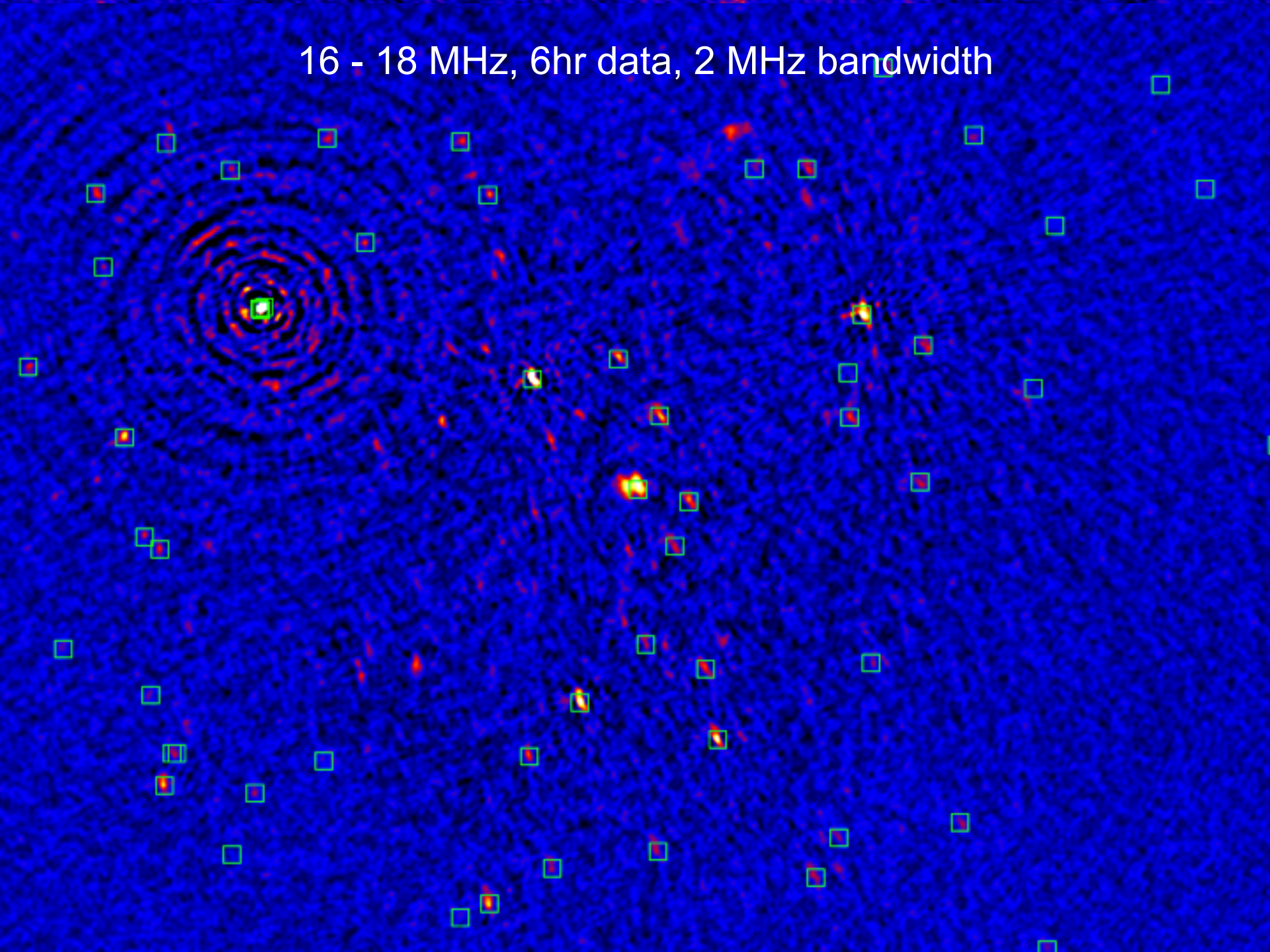


30 MHz

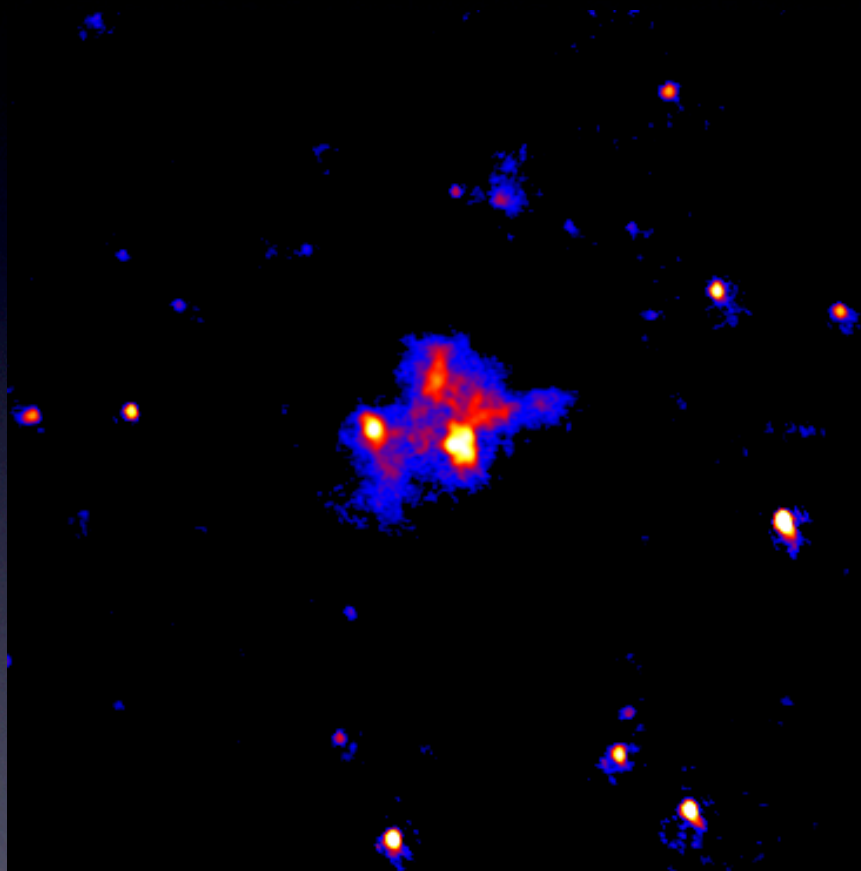
5°



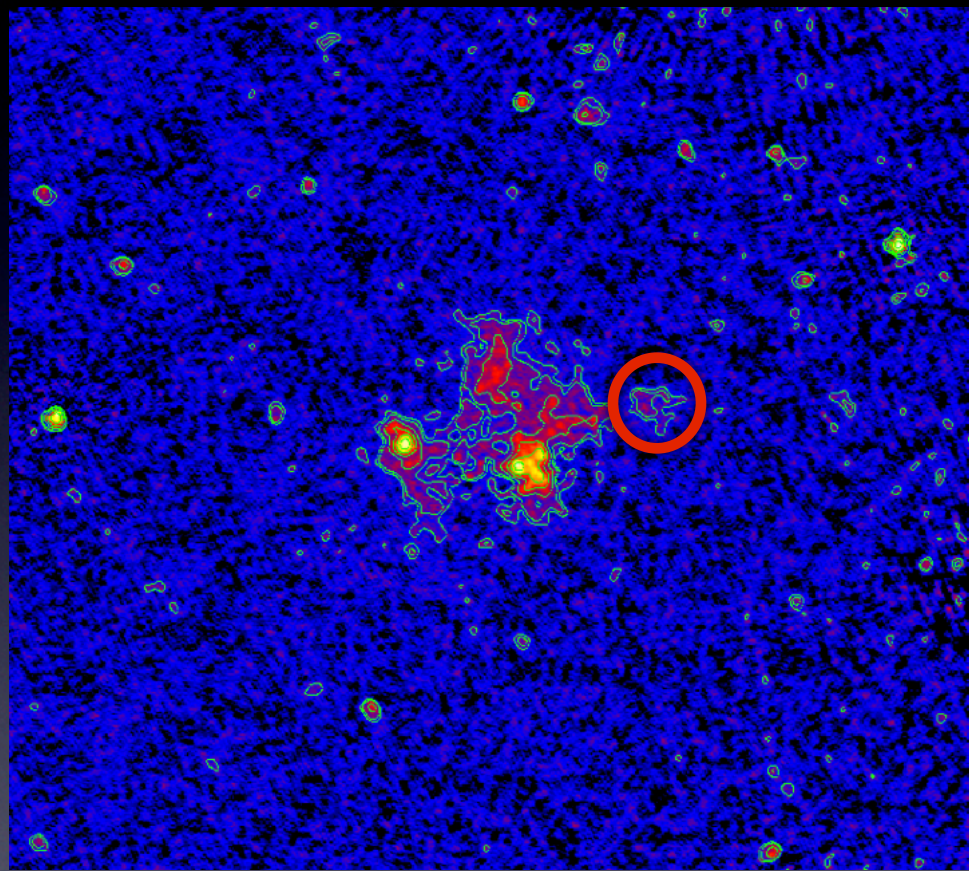
16 - 18 MHz, 6hr data, 2 MHz bandwidth



60-64 MHz, August 2011 (longest baseline 80 km)

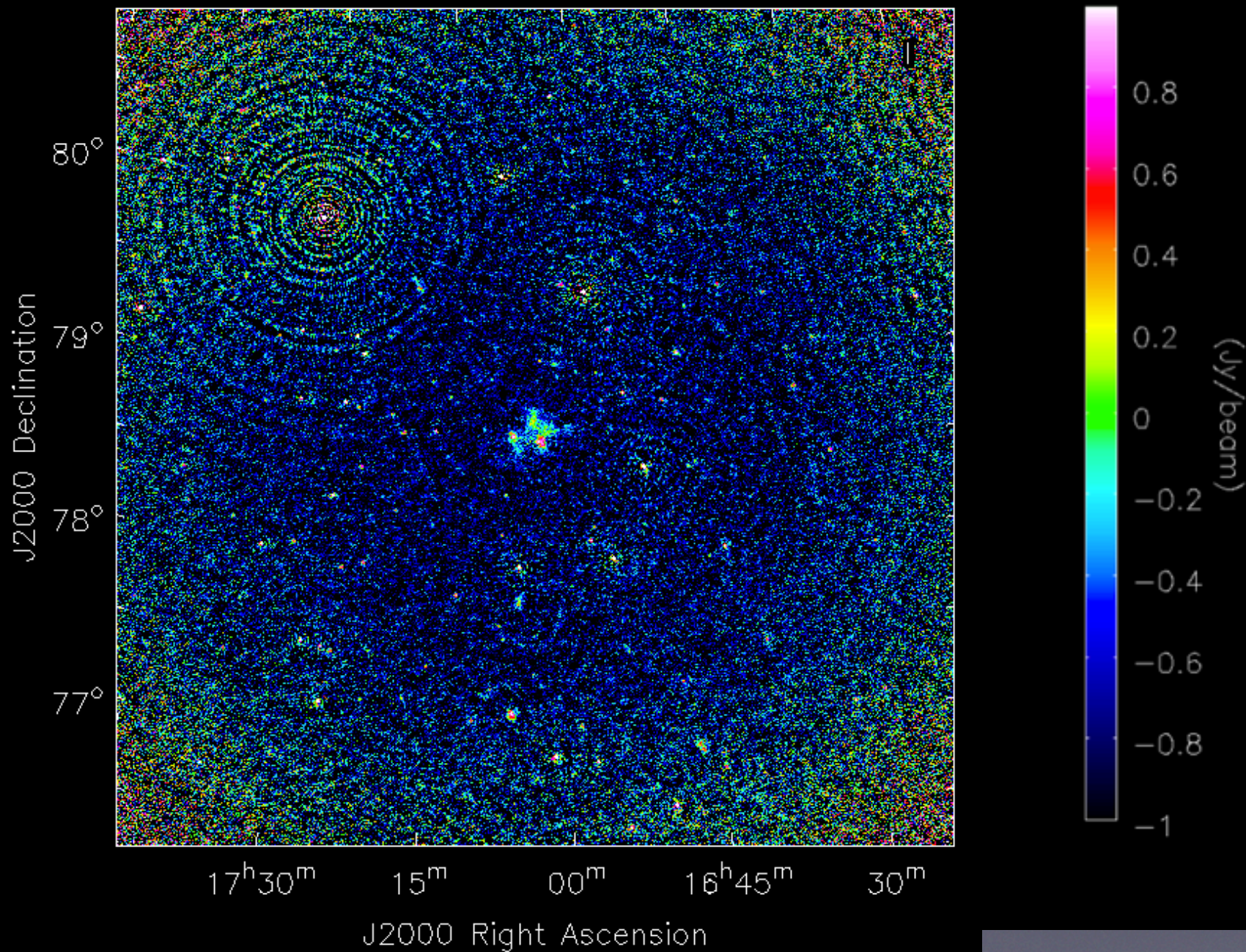


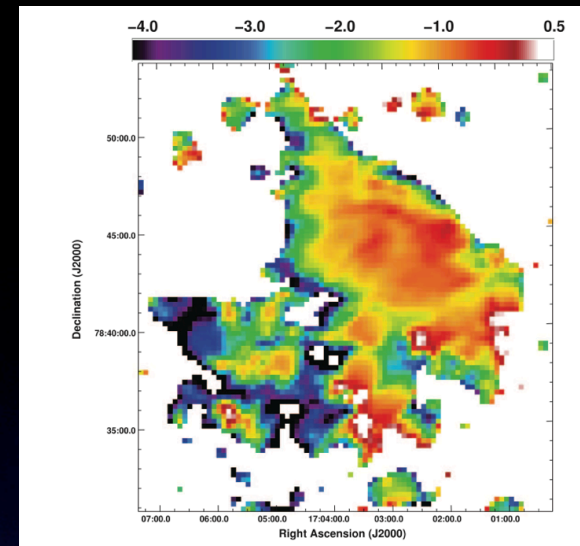
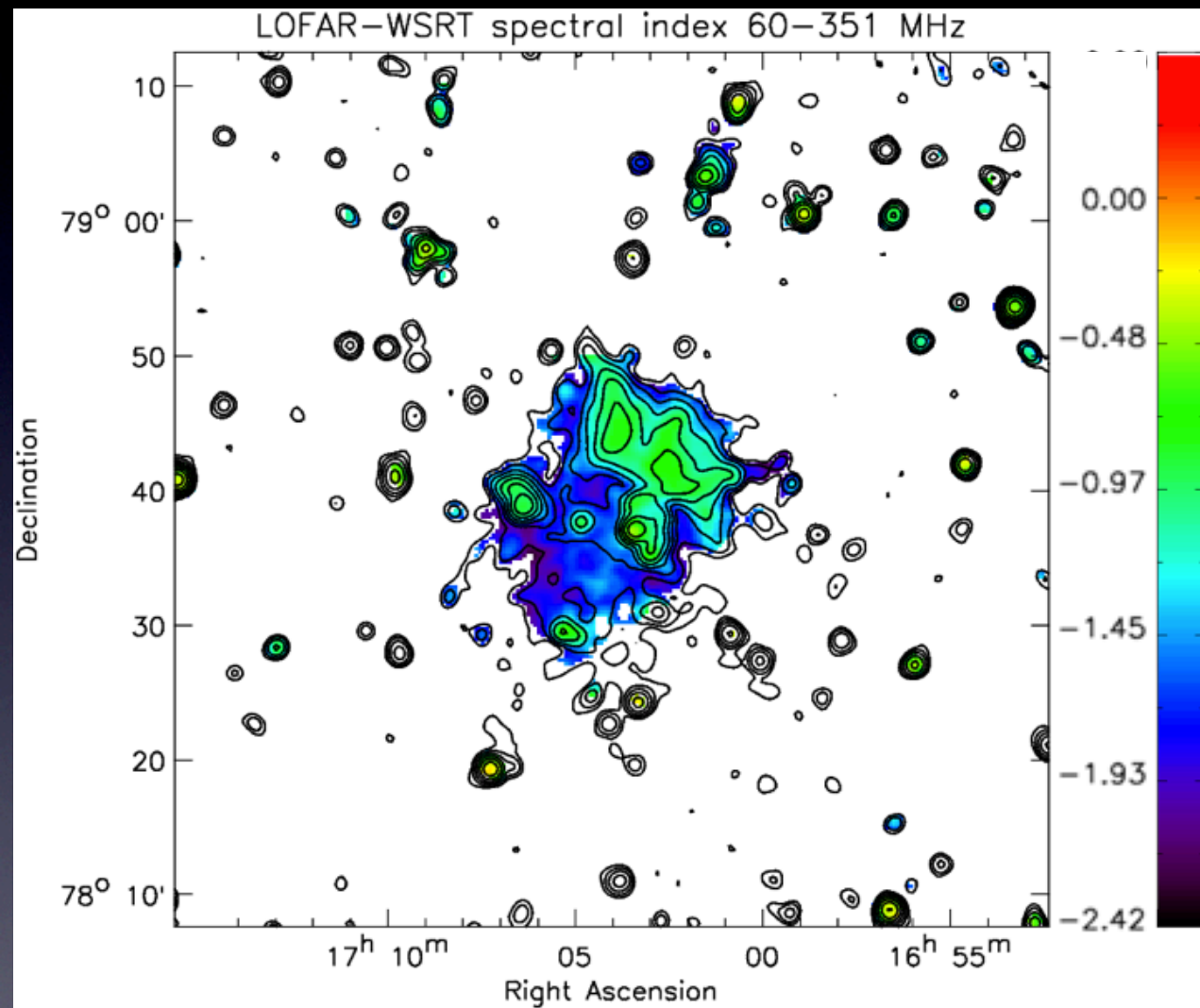
30" x 30", noise 15 mJy/beam



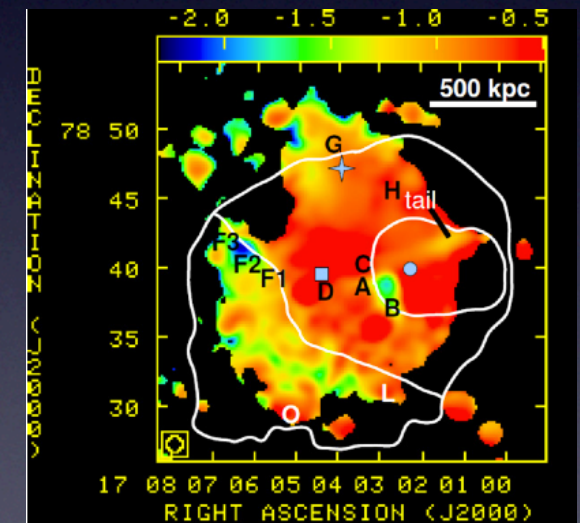
20" x 20", noise 8 mJy/beam

note: deepest VLA 74 MHz image (25" x 25") has a noise of 20 mJy/beam





Clarke & Ensslin 2006



Kale & Dwarakanath 2010

# Future work

- selfcal
- ionospheric calibration
- clock errors (determine via A-team sources?)
  
- note: SNR per SB is too low for calibration, global solver is critical (more work needed to improve solver)
- note: current low-freq. A-team models have only 25 arcsec resolution (need  $\sim 10$ -5 arcsec for 75 km baselines in LBA)

# Summary

- A2256: halo and relic for the first time detected below 100 MHz
- halo has steeper spectrum than relic
- steep spectrum ( $\alpha \sim -2$ ) source present west of the cluster center (confirms recent GMRT and WSRT results)



Thank you

