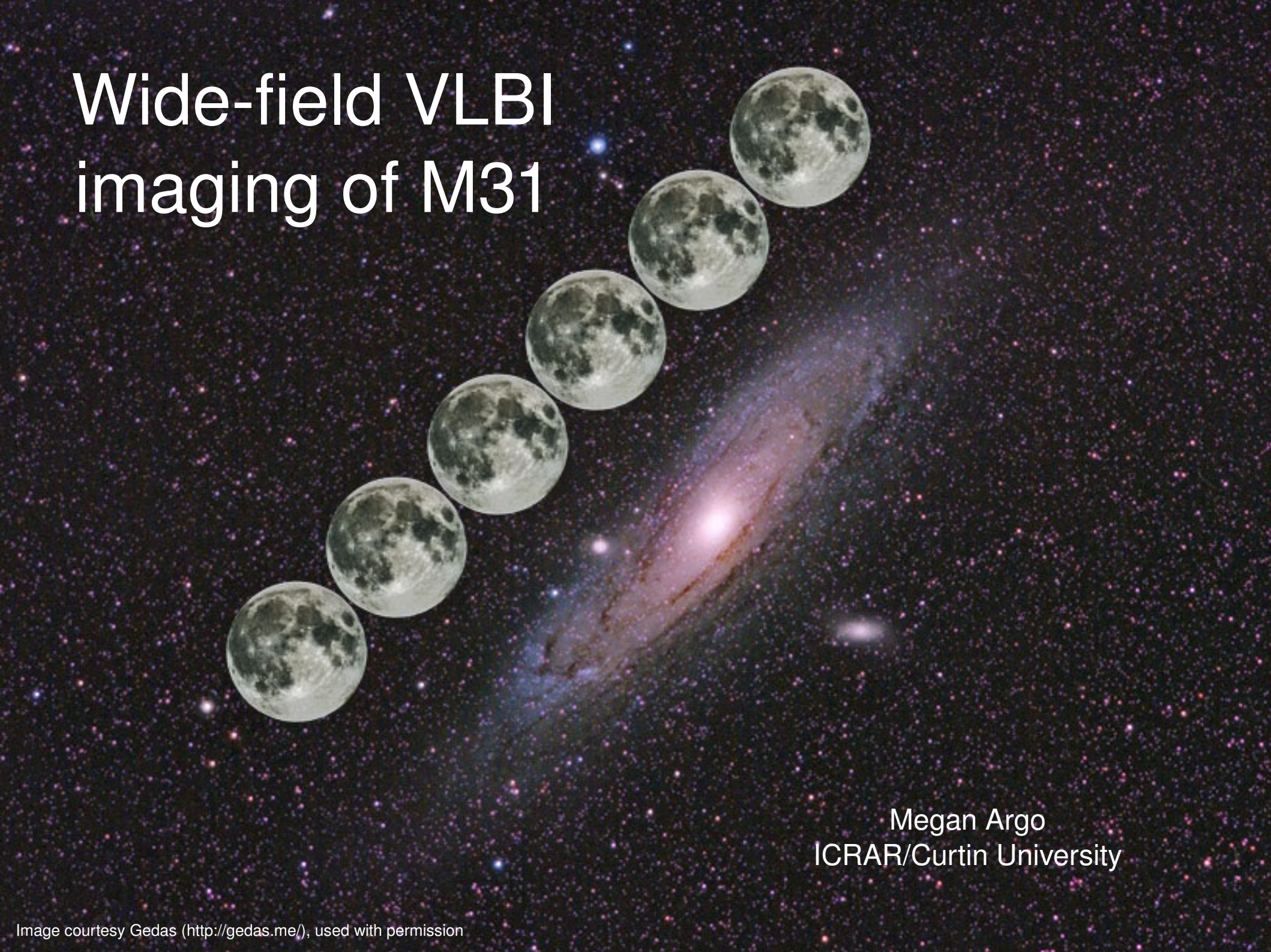
# Wide-field VLBI imaging of M31

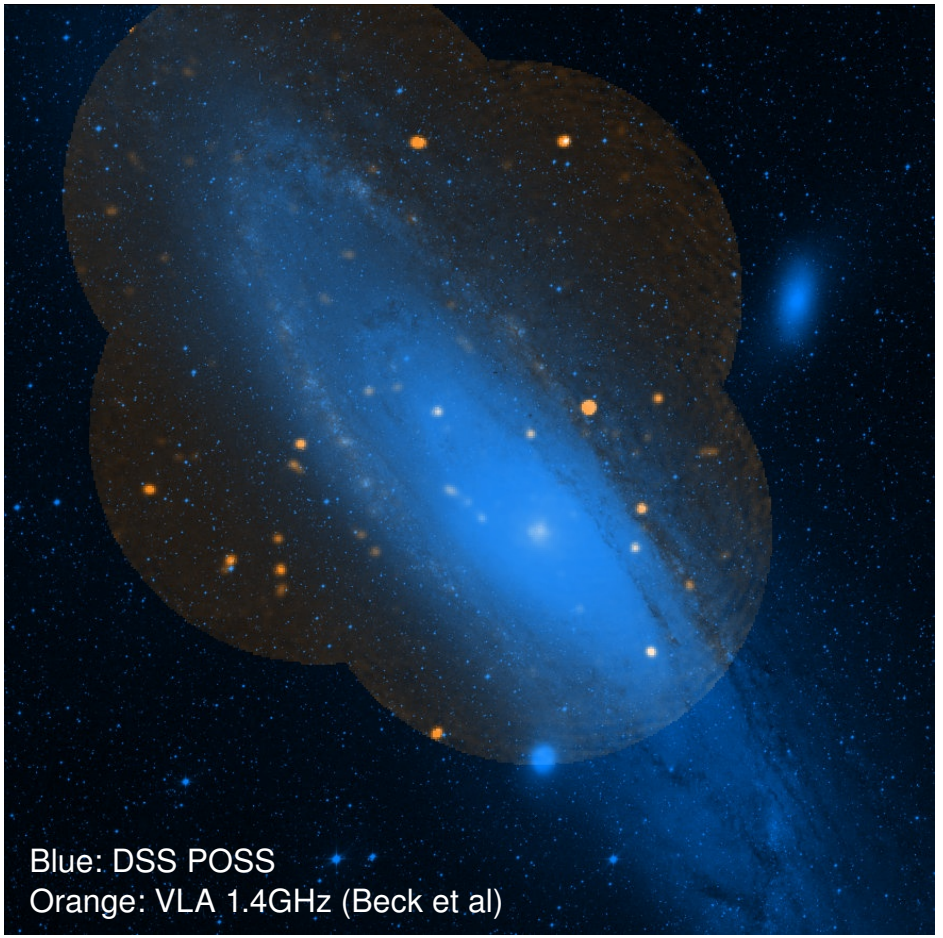


Megan Argo
ICRAR/Curtin University

Image courtesy Gedas (http://gedas.me/), used with permission

# Overview

- Why M31?
- What we know: existing surveys
- Observations
- BA097: the story so far
- Detections?
- What next?



# Why M31?

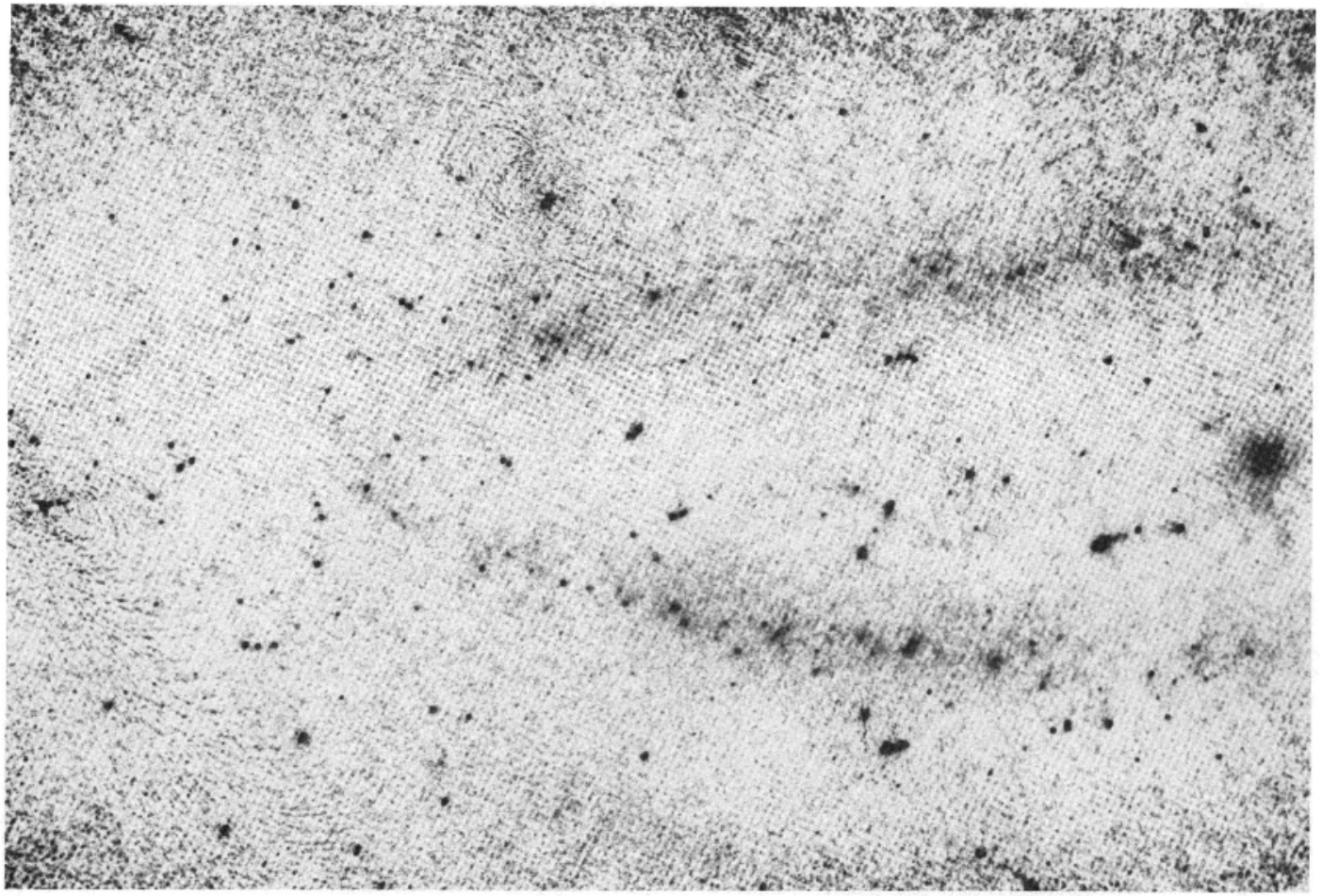
- There are several bright sources on the sky
    - ➔ so more than one will fall within the primary beam
- Well studied object, many known compact components
    - 10kpc SF ring
    - core
    - numerous background AGN


18 hours, 11,000 exposures
Credit: K. Gordon (U. Arizona),
JPL-Caltech, NASA
Spitzer 24 microns


330 individual images
100' by 50' (200,000 by 100,000 ly)
Credit: NASA/Swift/Stefan Immler (GSFC) and Erin Grand (UMCP)
Swift UVOT

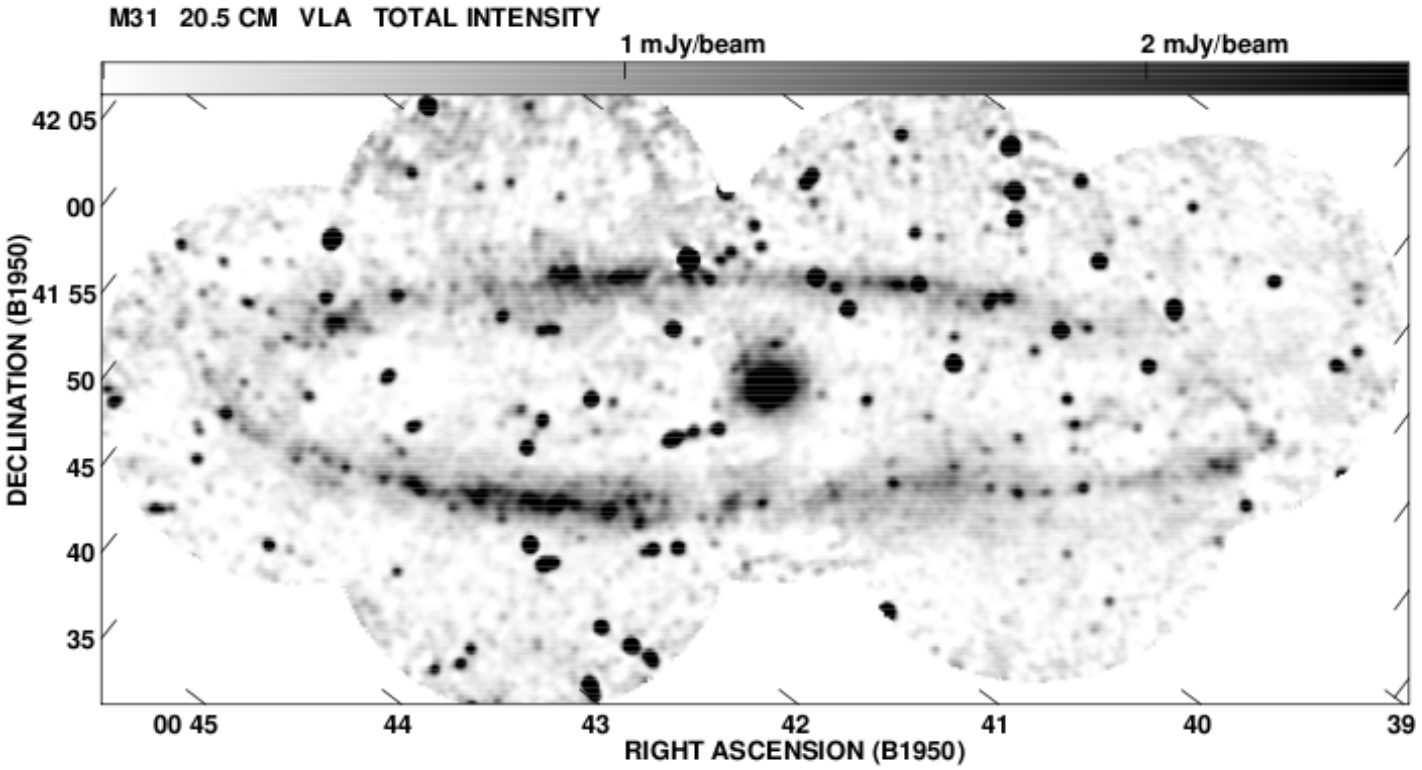
# Existing radio surveys

Braun ApJS 72 761 1990
VLA B-, C- and D-configs, 10 pointings, 5”, 30$\mu$Jy/bm



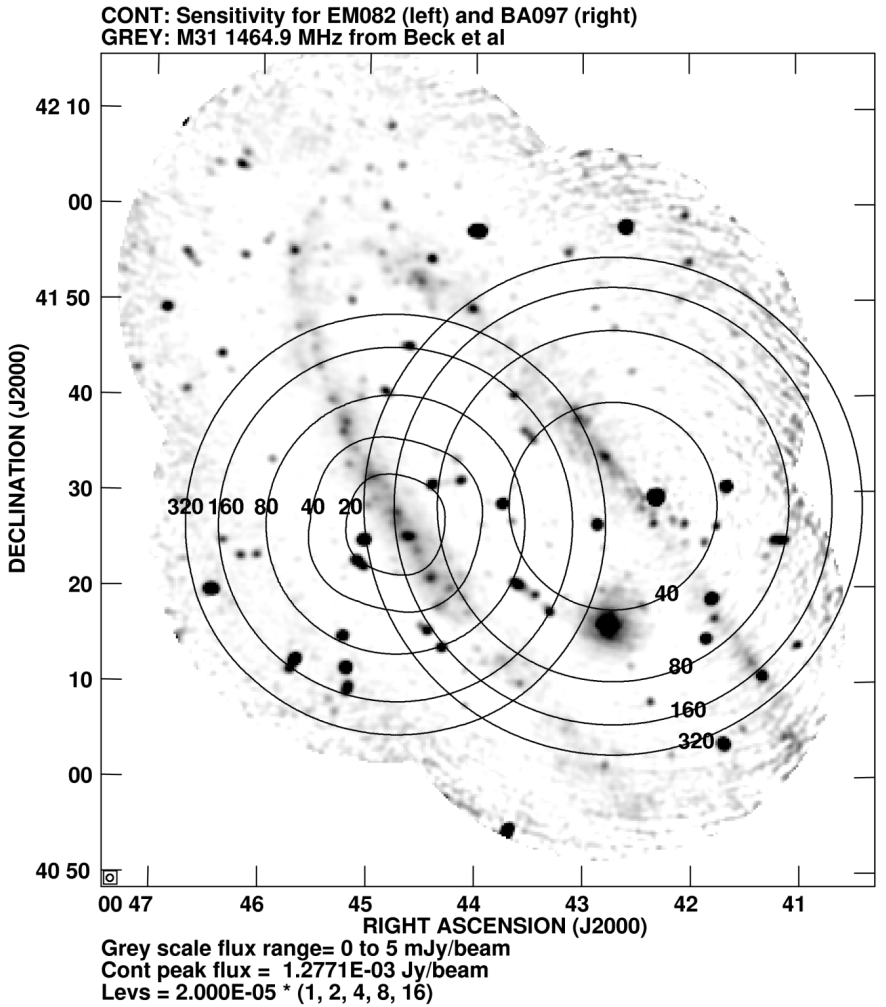
# Existing radio surveys

Beck, Berkhuijsen & Hoernes 1998
VLA D-config, 7 pointings, 20cm, 45”, 75$\mu$Jy/bm



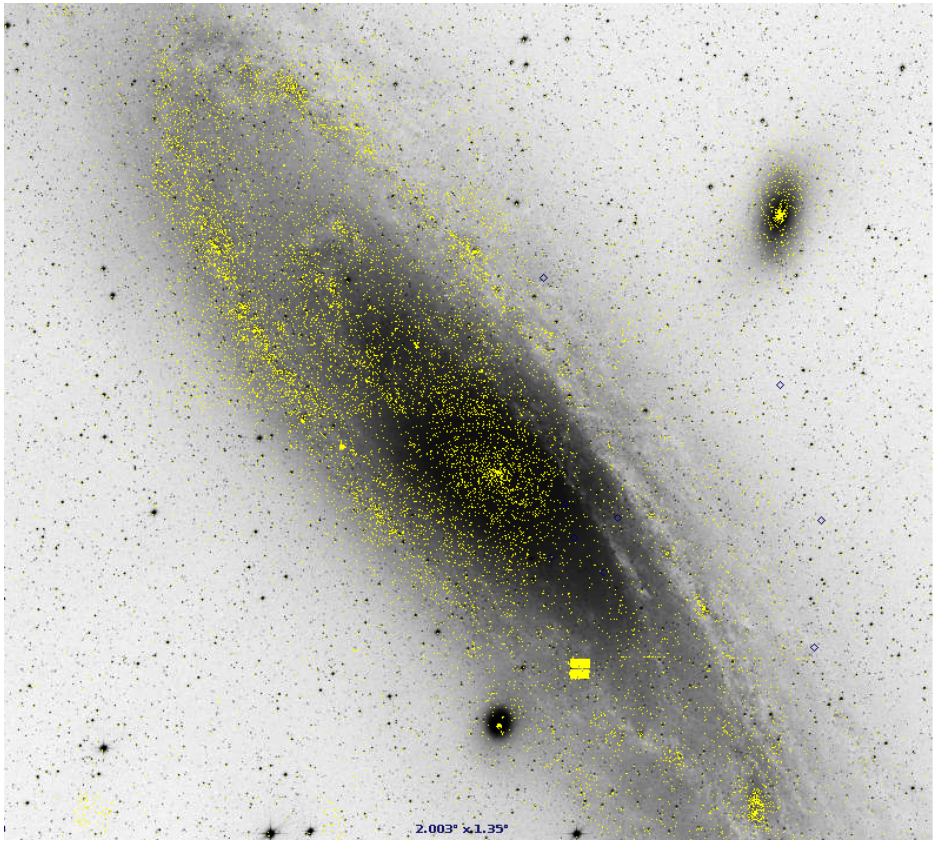
# Observations

- VLBA single pointing, 8 hours, 4 IFs, 16 MHz, nodding to J0038+4137 (~1°), observed July 4th
- EVN four pointings spaced 7.5', 8 hours, same phase cal, observed June 7th
- Sensitivities: see right (for details see John's poster)
- First-look at the VLBA data



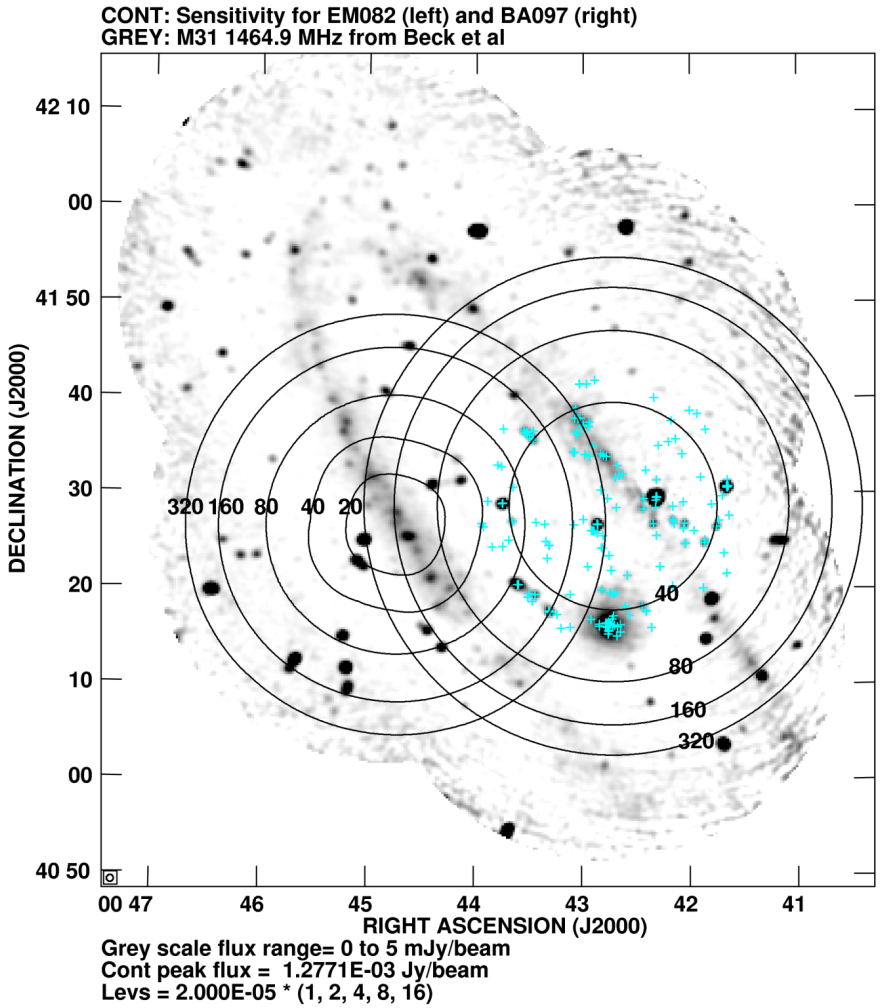
# Where to correlate?

- Catalogues from NED (inc. NVSS + Beck and Braun sources)
- 1533(!) objects within ~0.5° of pointing centre
- Reject anything unlikely to be radio bright
- Reject duplicates
- ➔ List of 175 sources for a first pass
- Correlate at each position



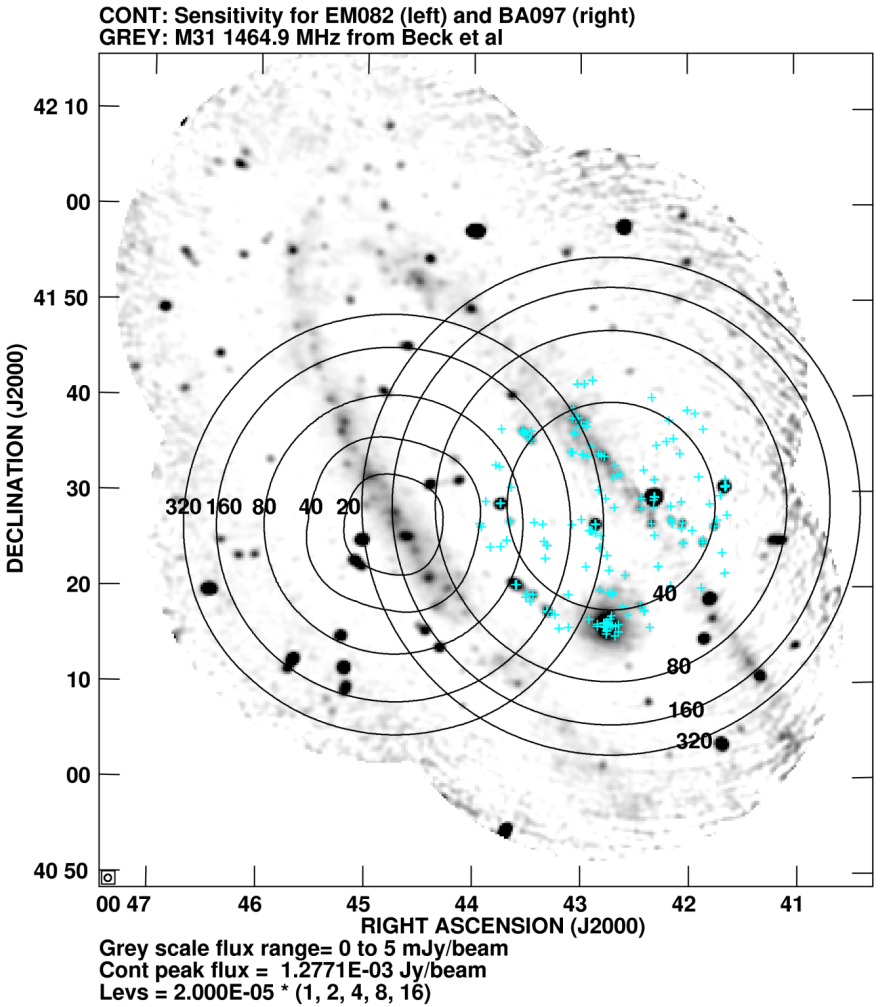
# The story so far

- Baseband data (~15TB) shipped to Curtin, loaded onto cluster
- Correlated at 175 phase centres with DiFX (128 ch/IF)
- Flagging and calibration (mostly) on dataset correlated in Socorro
- Pipelined calibration and imaging of each new dataset
- Image out to several arcseconds



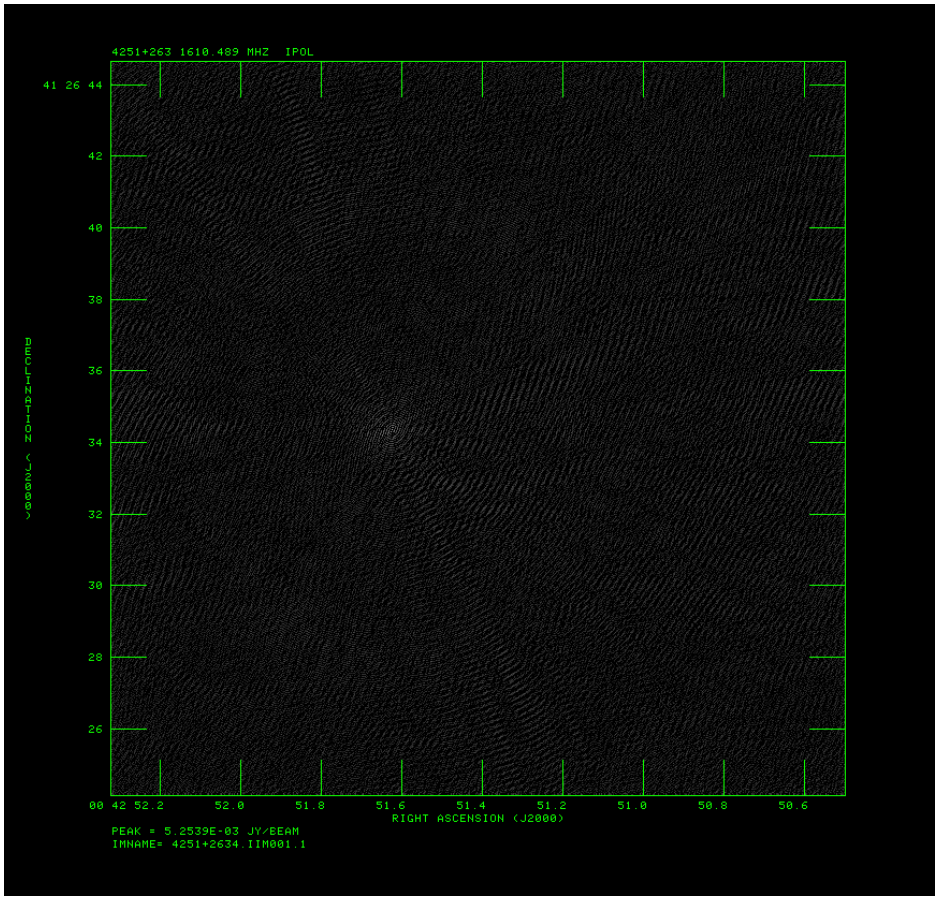
# Calibration and pipeline

- Pipeline applies flagging and calibration carried out using dataset correlated in Socorro
- Calibration follows standard recipe for VLBA datasets
- Mostly works
- Flagging is not perfect – some bad data may remain
- Bandpass on 3C84
- Pipeline (thank goodness for ParselTongue)



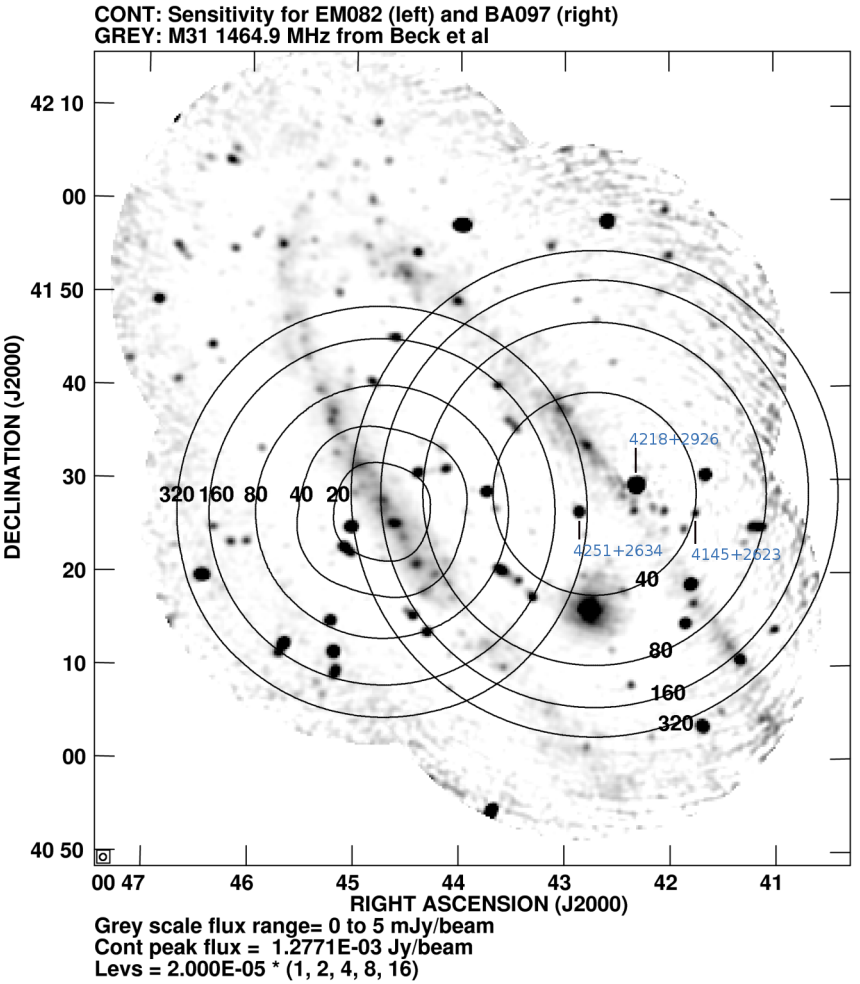
# Detections?

- RMS and peak values from the pipeline → 2 sources?
- Inspection of all plots by eye
  - ➔ Confirmed 2 sources
  - ➔ Discovered another
- Hoping for something bright enough to use an in-beam calibrator



# Detections!

- 4145+2623
  - NVSS: 5.2mJy
  - BA097: 1mJy (~5$\sigma$)
- 4251+2633 (AGN candidate)
  - NVSS: 24mJy
  - Beck98: 22mJy
  - BA097: 2mJy (~10$\sigma$)
- 4218+2926 (see right)
  - NVSS: 372 mJy
  - Beck98: 307mJy
  - BA097: 1mJy + 2mJy



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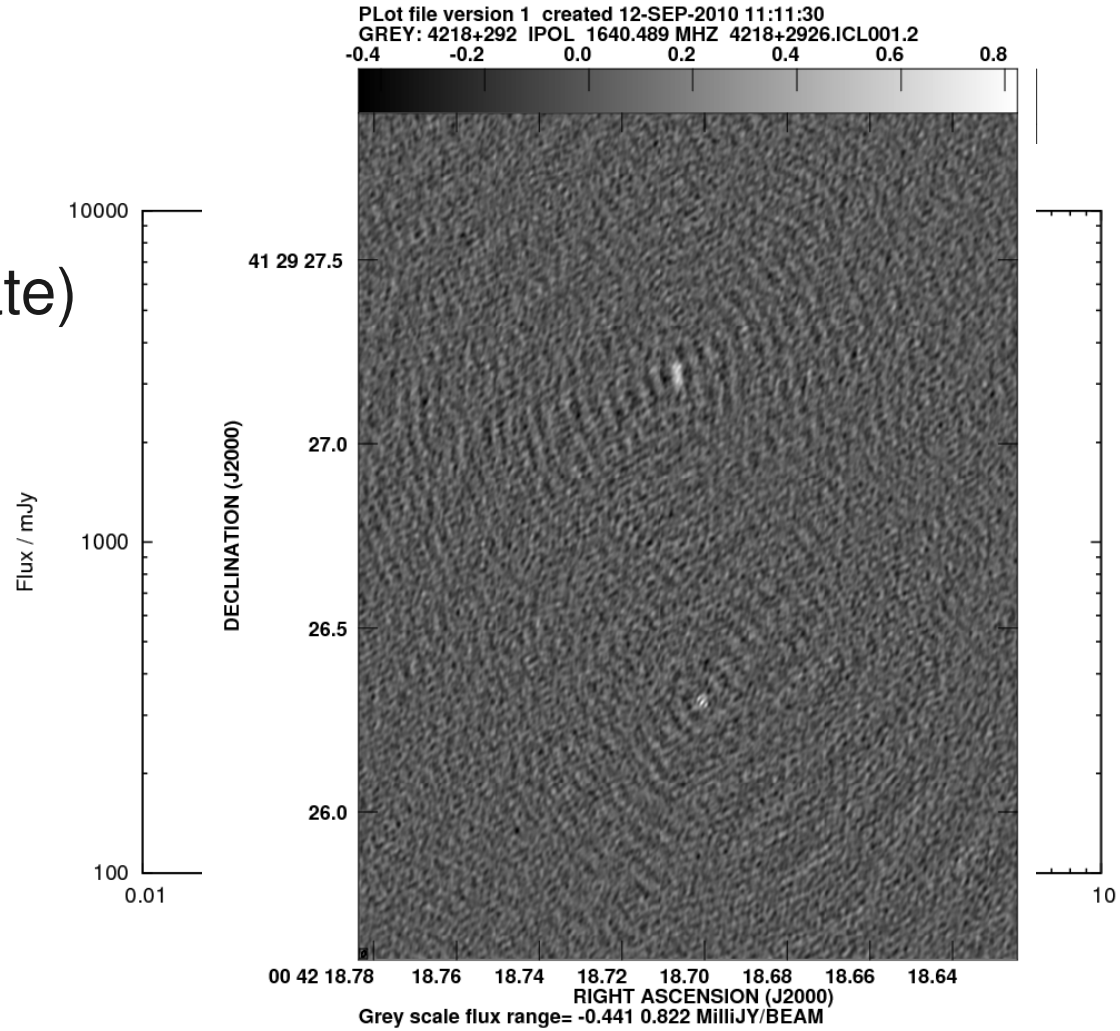

# What next?

- This is just a first look
- We plan to refine the calibration
    - More sources may pop out
- Ultimately image the entire field

- Then do it all again with the EVN data!