Multifrequency ATCA Observations of NGC 55

Arpad Miskolczi

aka. The Slide Show

Ruhr-Universität Bochum

10.07.2012

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NGC 55 Image by ESO

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Outline:

- Motivation
- Observations
- Data Reduction
- Results

Basic Data:

- Magellanic type dwarf galaxy in the Sculptor Group
- Distance of 2.1 Mpc (1“ = 10 pc)
- Angular size of 32' x 5.6'
- Total mass of 1.8 x 10^{10} M_solar
- SFR of 0.22 M_solar yr^{-1}
- Almost edge–on, inclination of 81°

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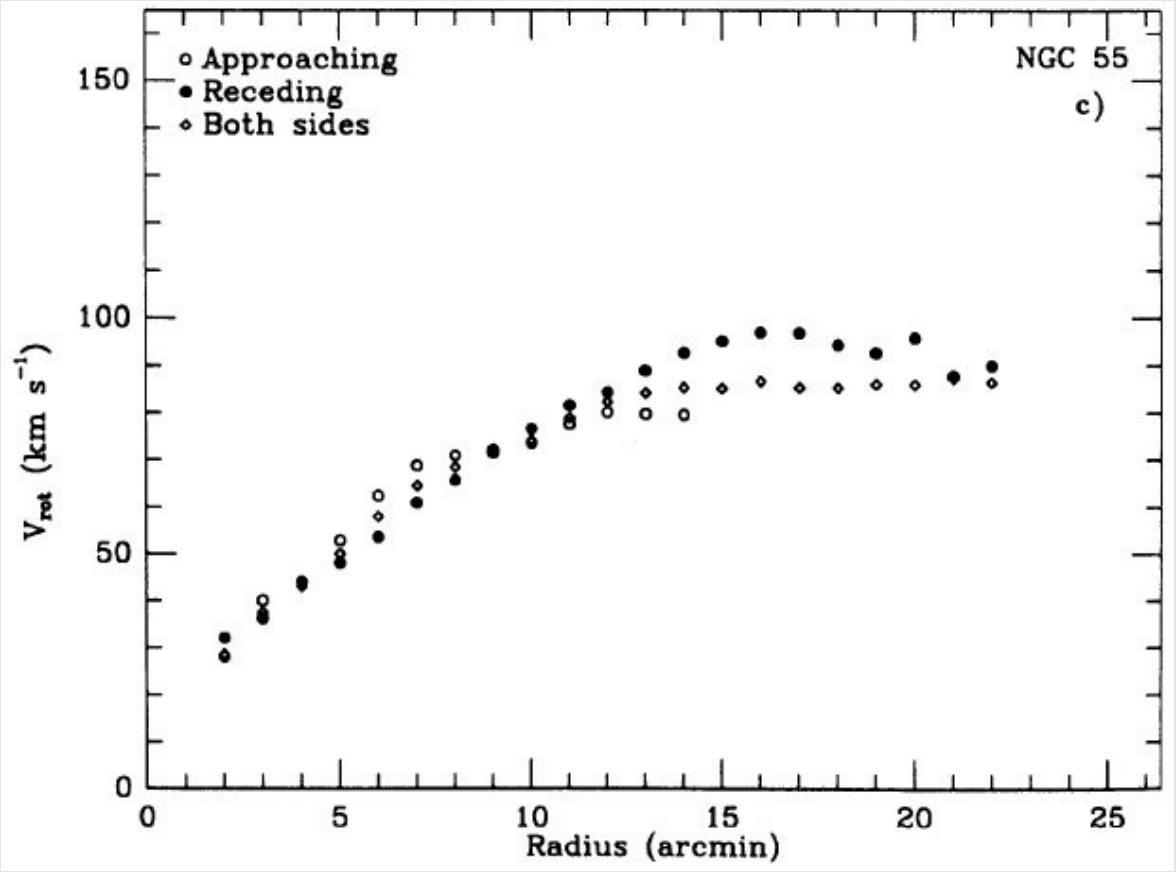
- Almost rigid inner rotation curve
  → weak shear!

  → Inefficient magnetic field amplification

- Gives constraints if no magnetic fields found



Puche et al. 1991

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Many observations have been carried out

Used archival Data from 1995:

- 3cm
- 6cm

(mulitple pointings)

- 13cm → bad data!
- 20cm (Most compact config. and 1.5km config., three pointings each)
- Each consisting of 13 x 8 Mhz

New observations from 2010:

- 3cm + 6cm, 18 pointings each
- Both with new CABB backend
- 2 GHz bandwidth divided into 2048 x 1 MHz
- Gives excellent spectral resolution and high sensitivity
- In addition observations at 6 cm and 20 cm have been carried out with Parkes to fill the missing spacings of interferometers

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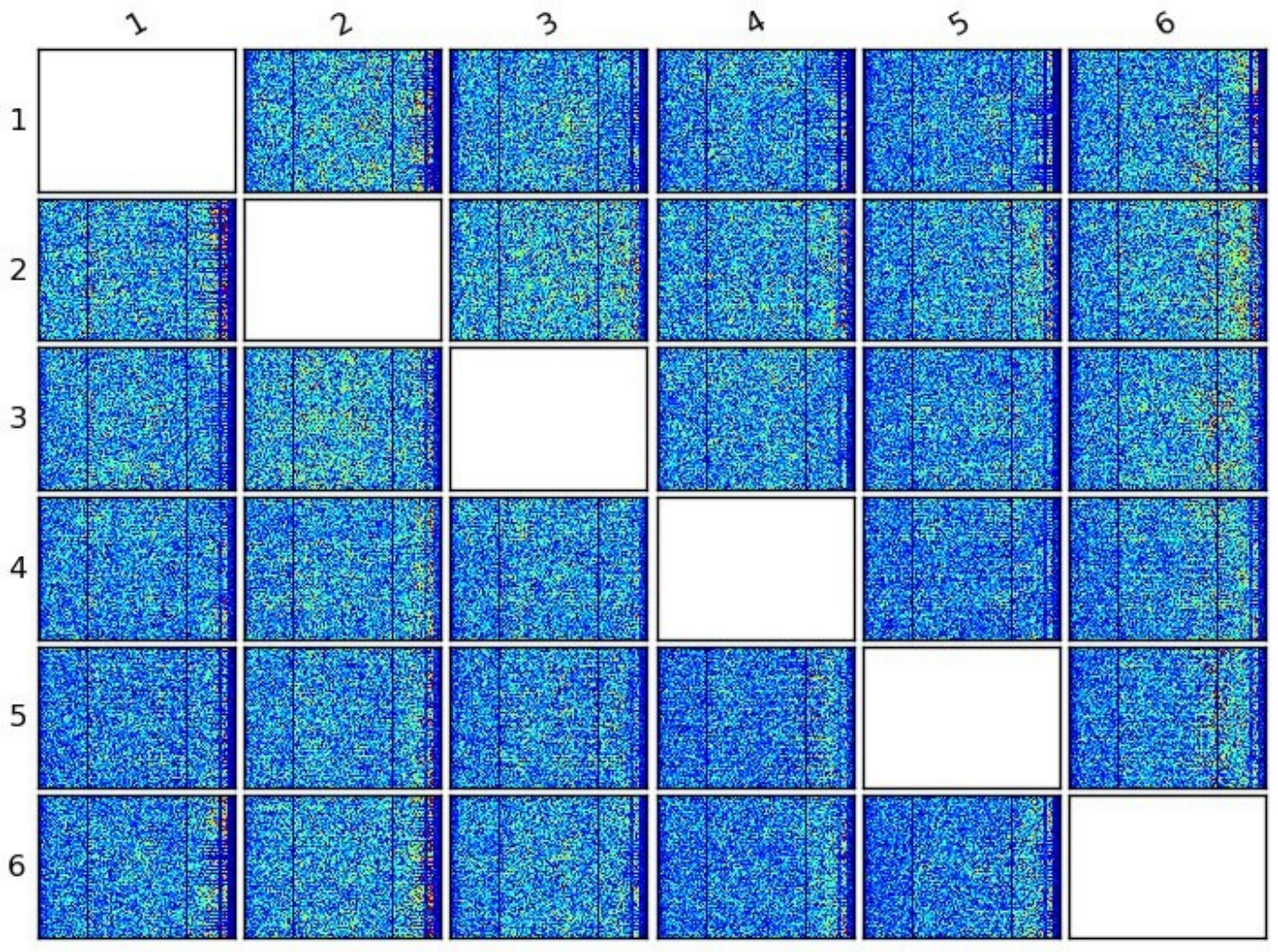
Flagging ATCA data is pure joy (compared to others).

Almost nothing to do



MSinspector output of 6cm Cabb data

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Measurement Set Inspection Utility written in python

Heavily relies on pyrap and matplotlib

Shows XX and YY (RR and LL) of every baseline on one single Plot. Also works for polarization products

In interactive mode, it also shows one baseline with full details
In non interactive mode, it just saves plots of all baselines.

Globally bad data is immediatly seen

Can also show model, corrected, residual data

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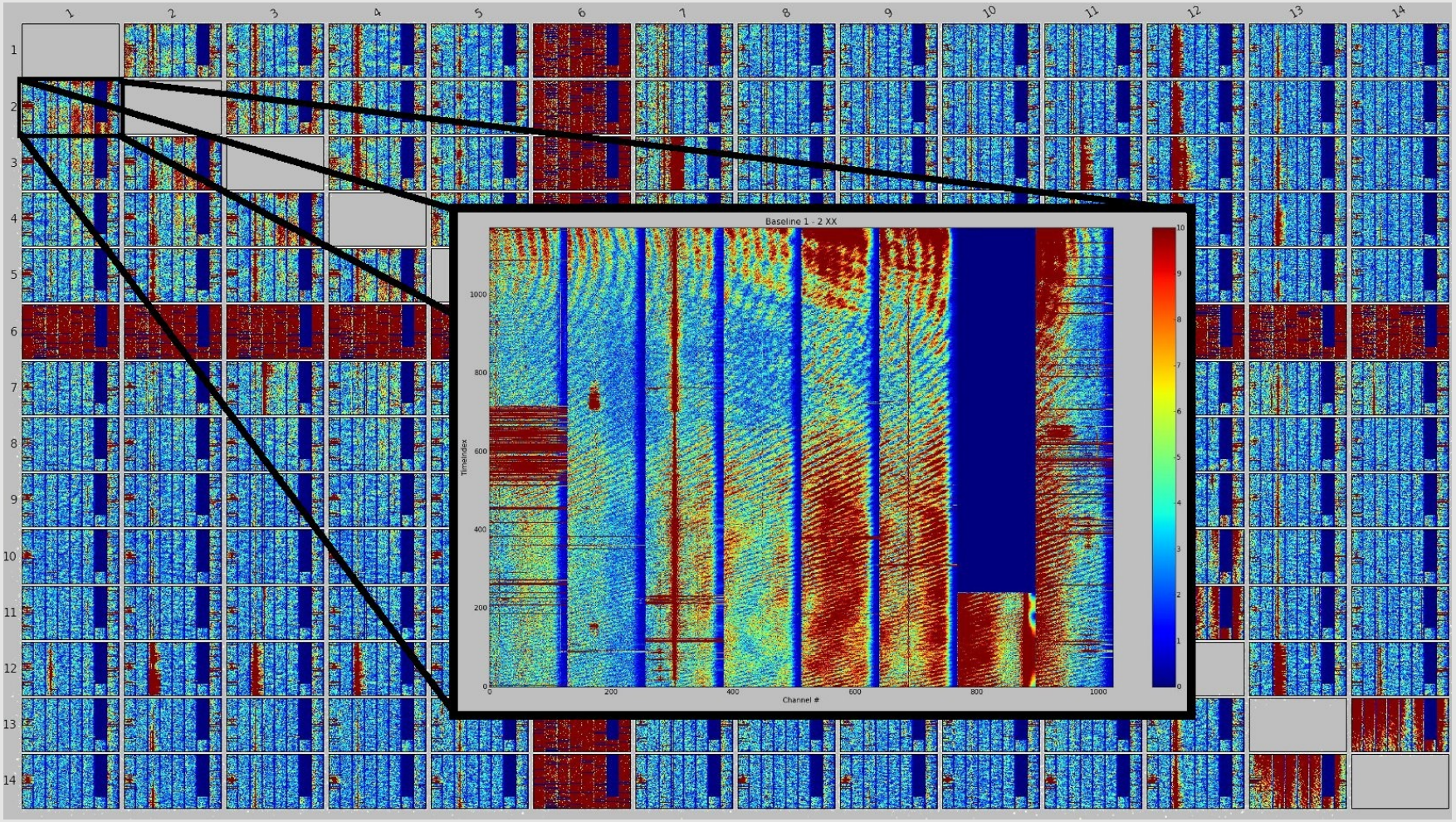

MSInspector output of a WSRT 92cm „Legacy“ dataset

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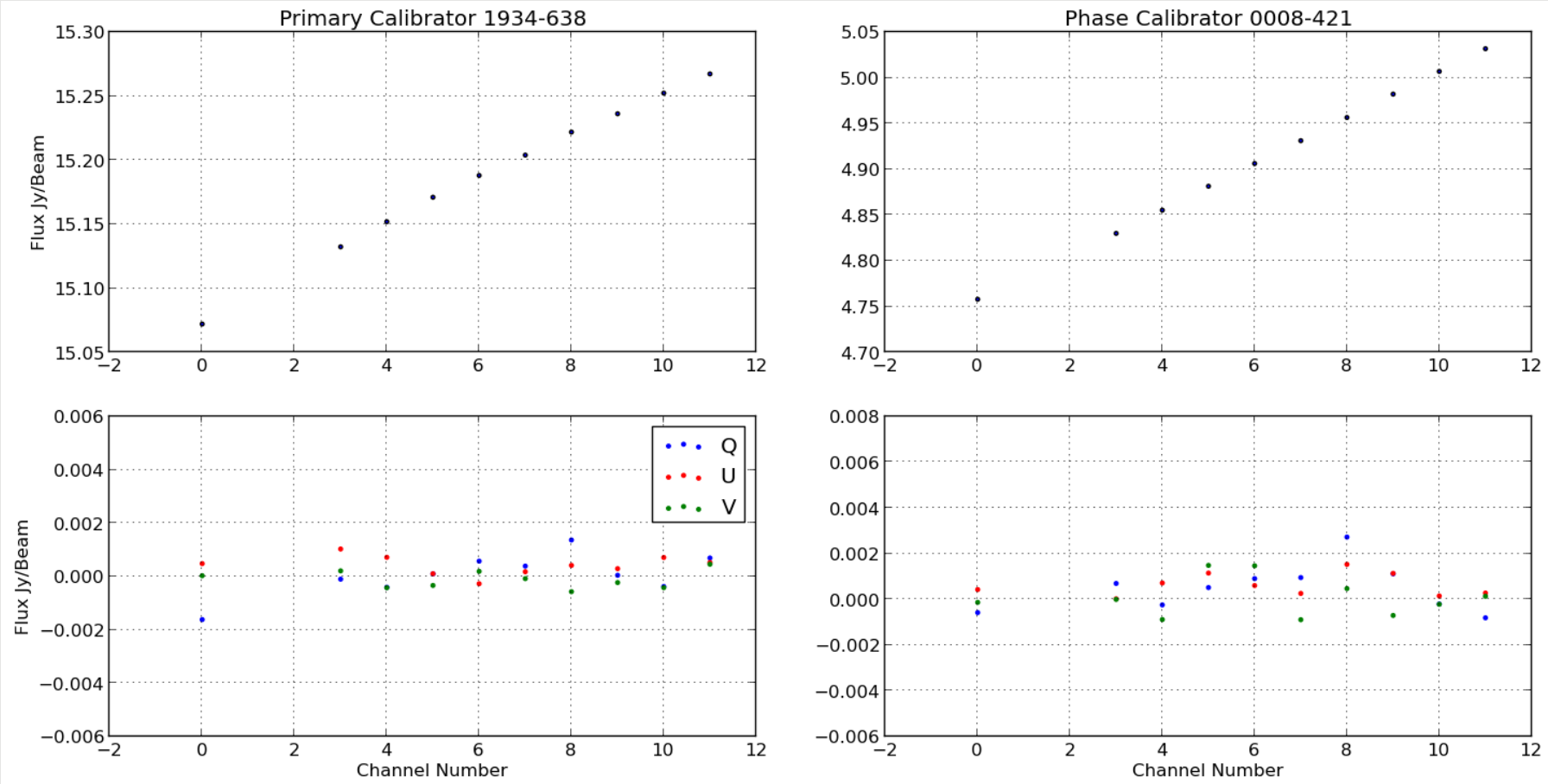
All datasets were calibrated on a per channel basis



Fluxes fit with known fluxes from literature.

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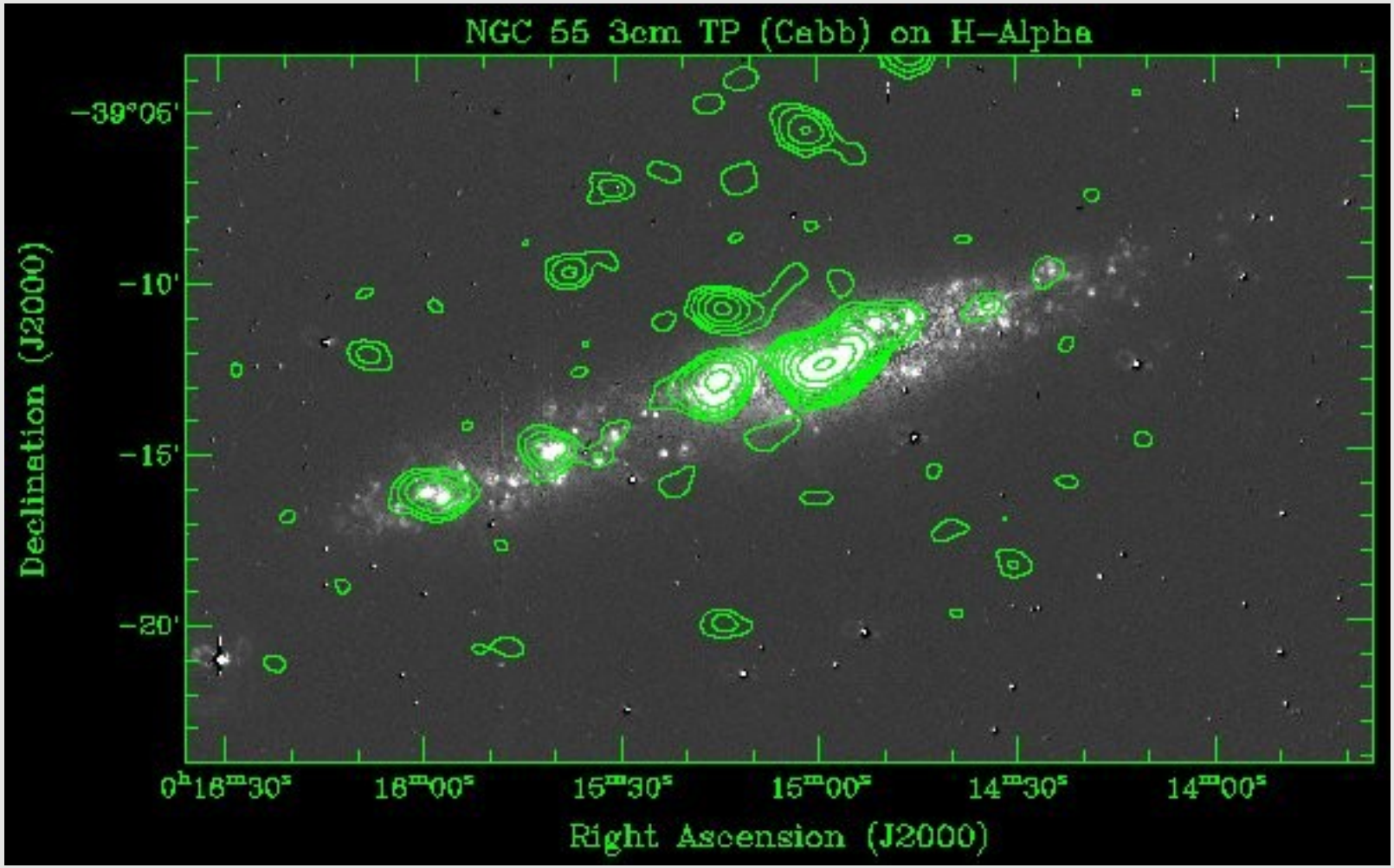
3cm (Cabb) total power on H-Alpha:



H-Alpha image by Dominik Bomans (priv. comm)

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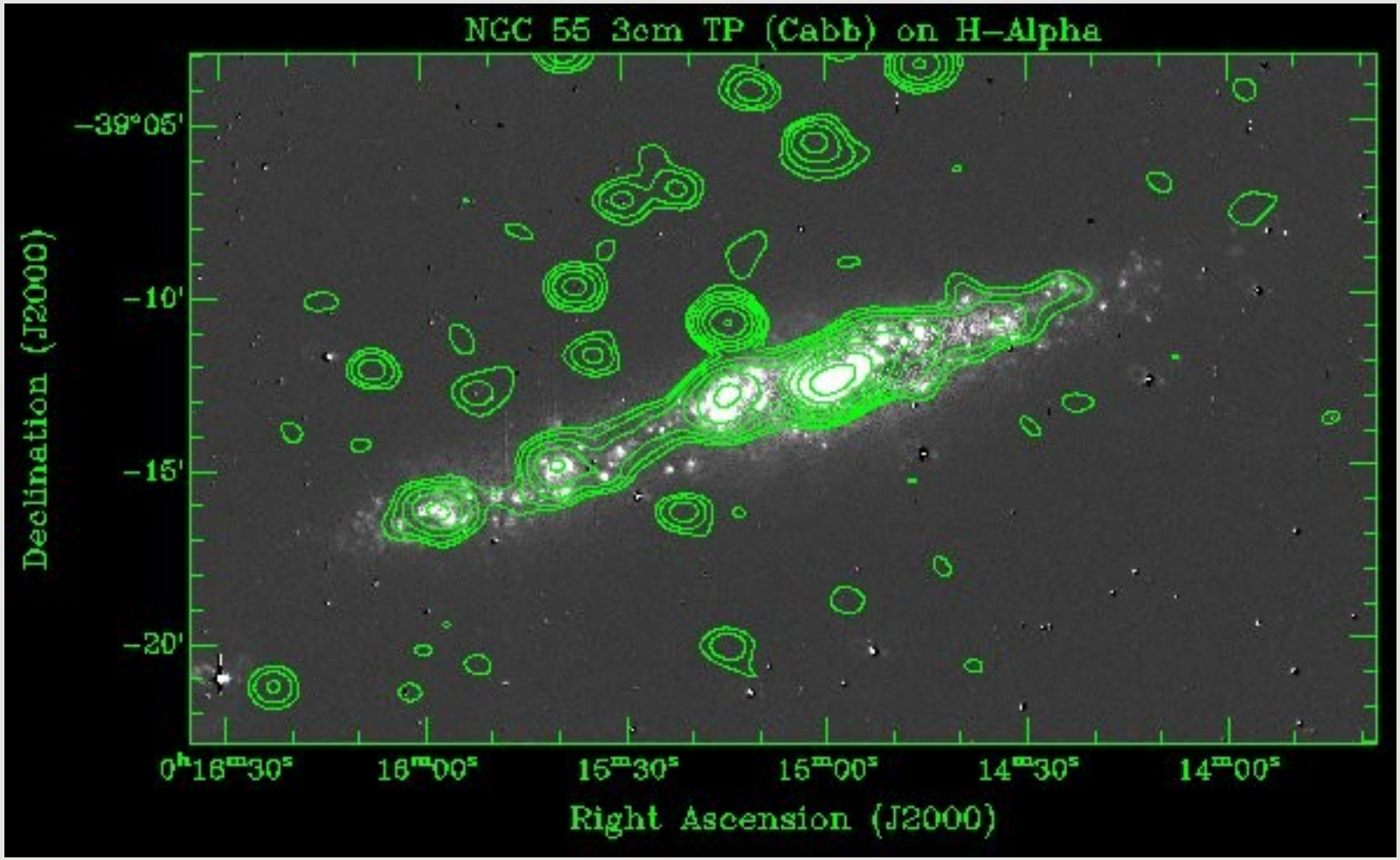
6cm (Cabb) total power on H-Alpha:



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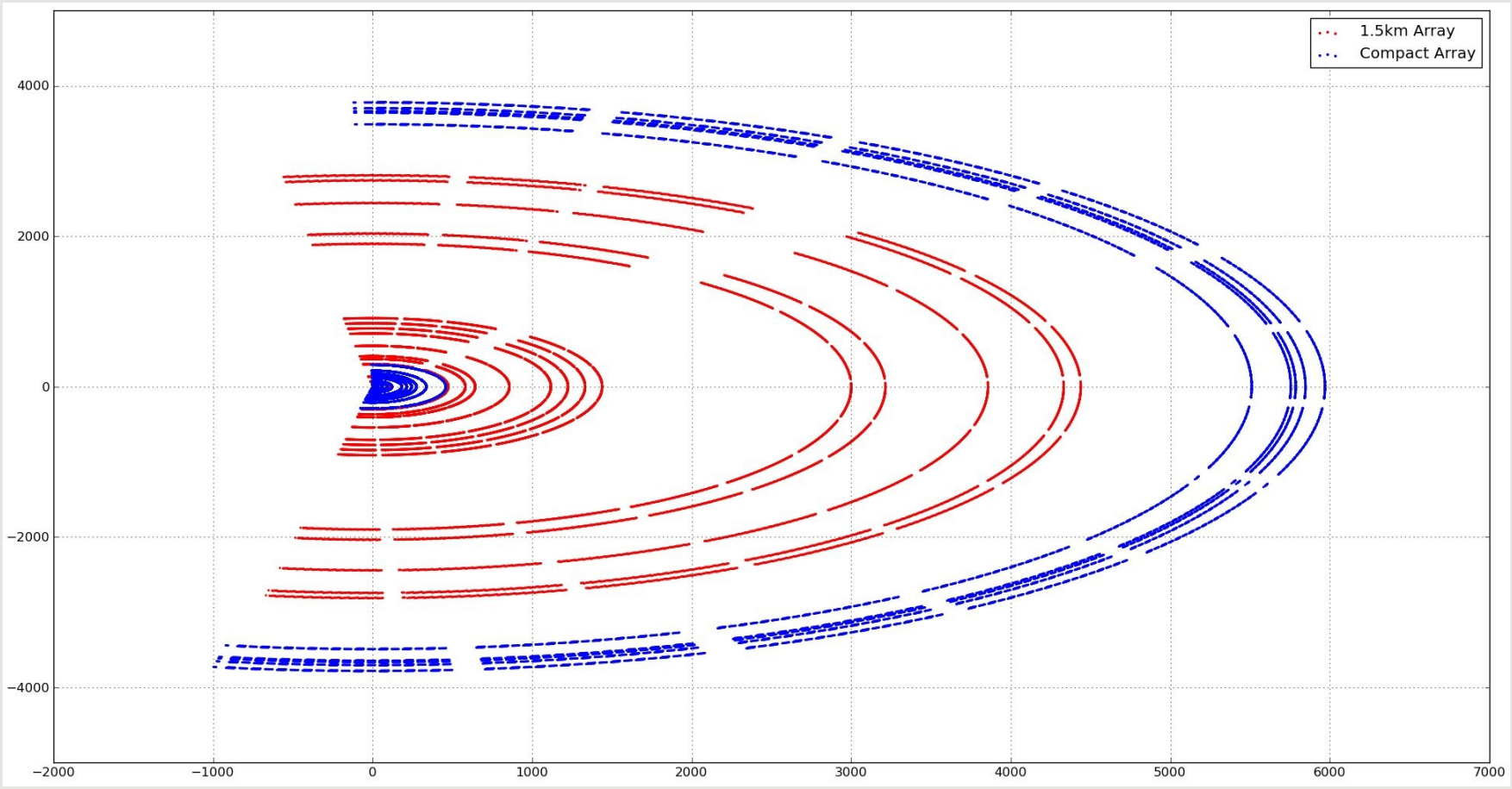
Combined both 20cm datasets to achieve resolution and extended emission



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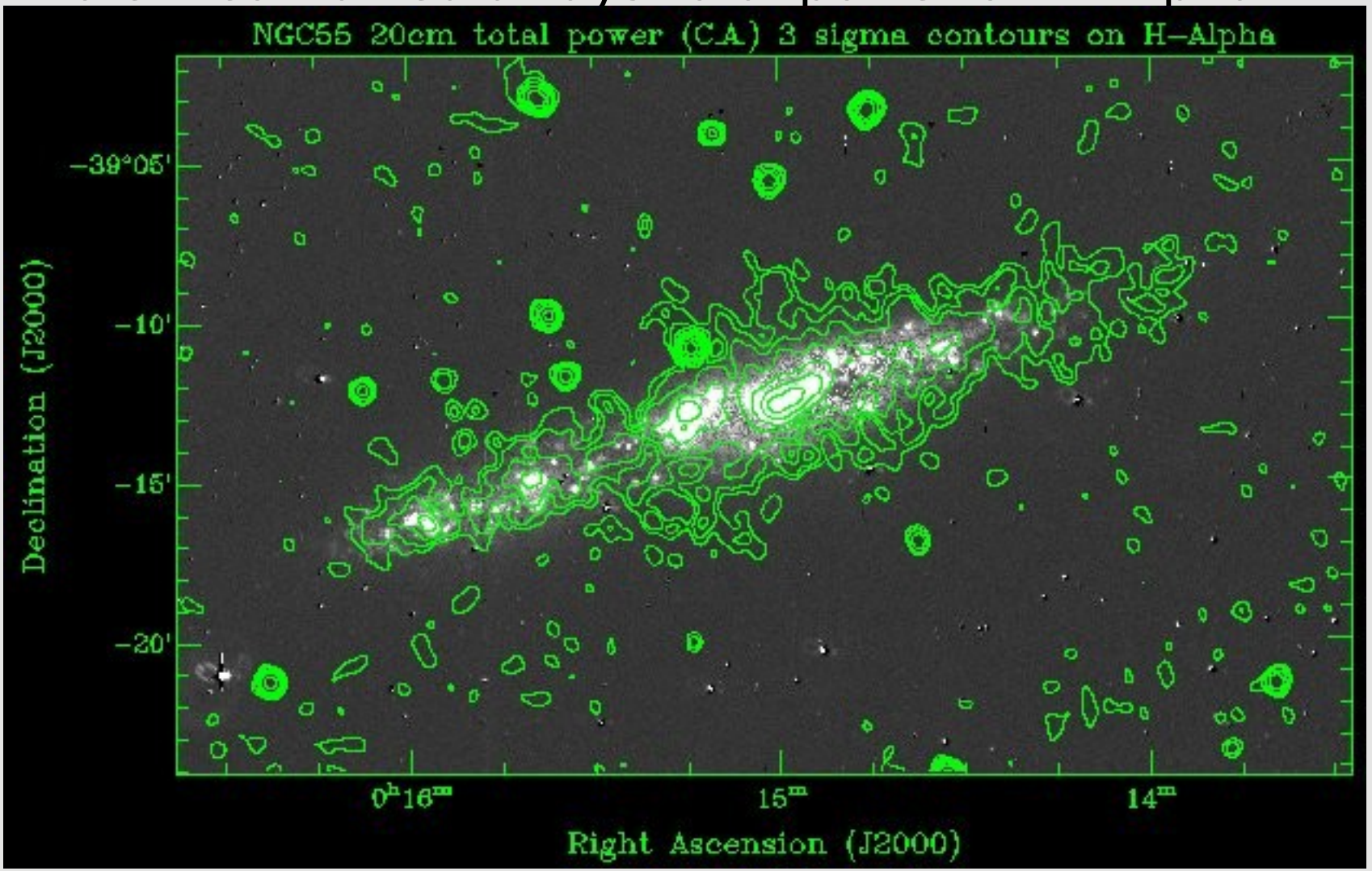
20 cm combined arrays total power on H-Alpha:



„Briggs“

Robust = -0.5

Uvtaper = 5klambda

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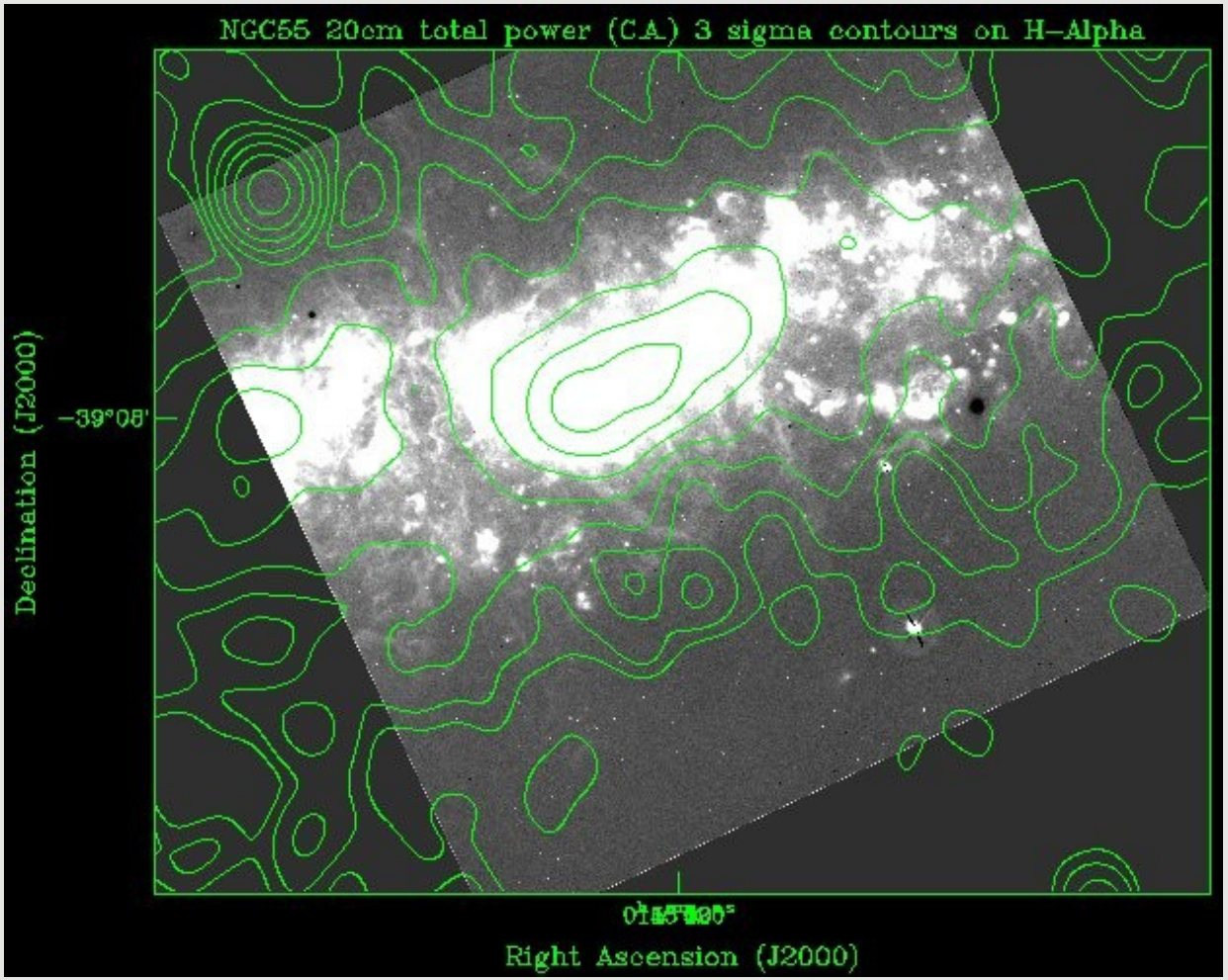
20 cm combined arrays total power on H-Alpha:



VLT image by Dominik Bomans (priv. comm.)

To find magnetic fields, one needs polarization!

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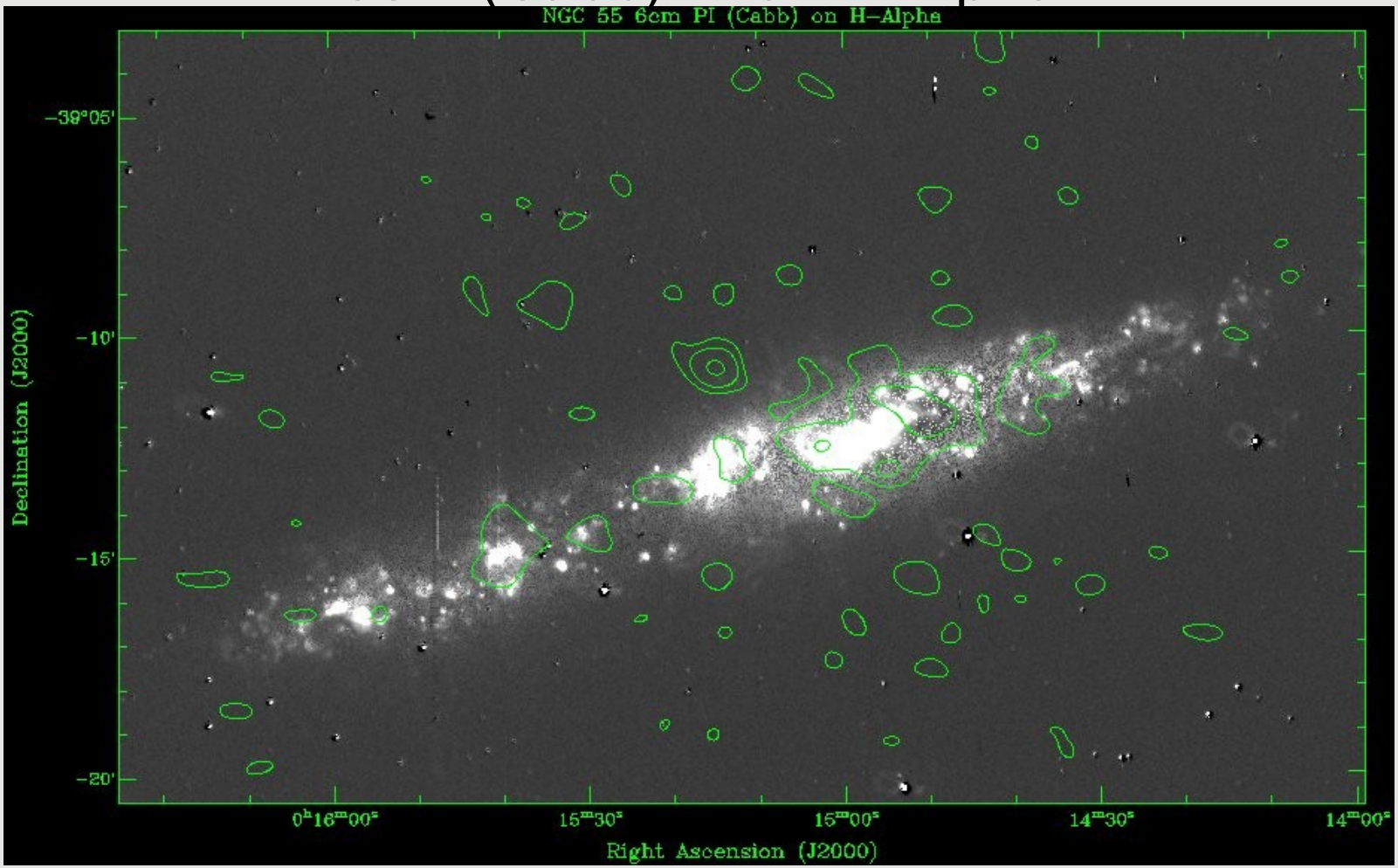
6cm (Cabb) PI on H-Alpha:



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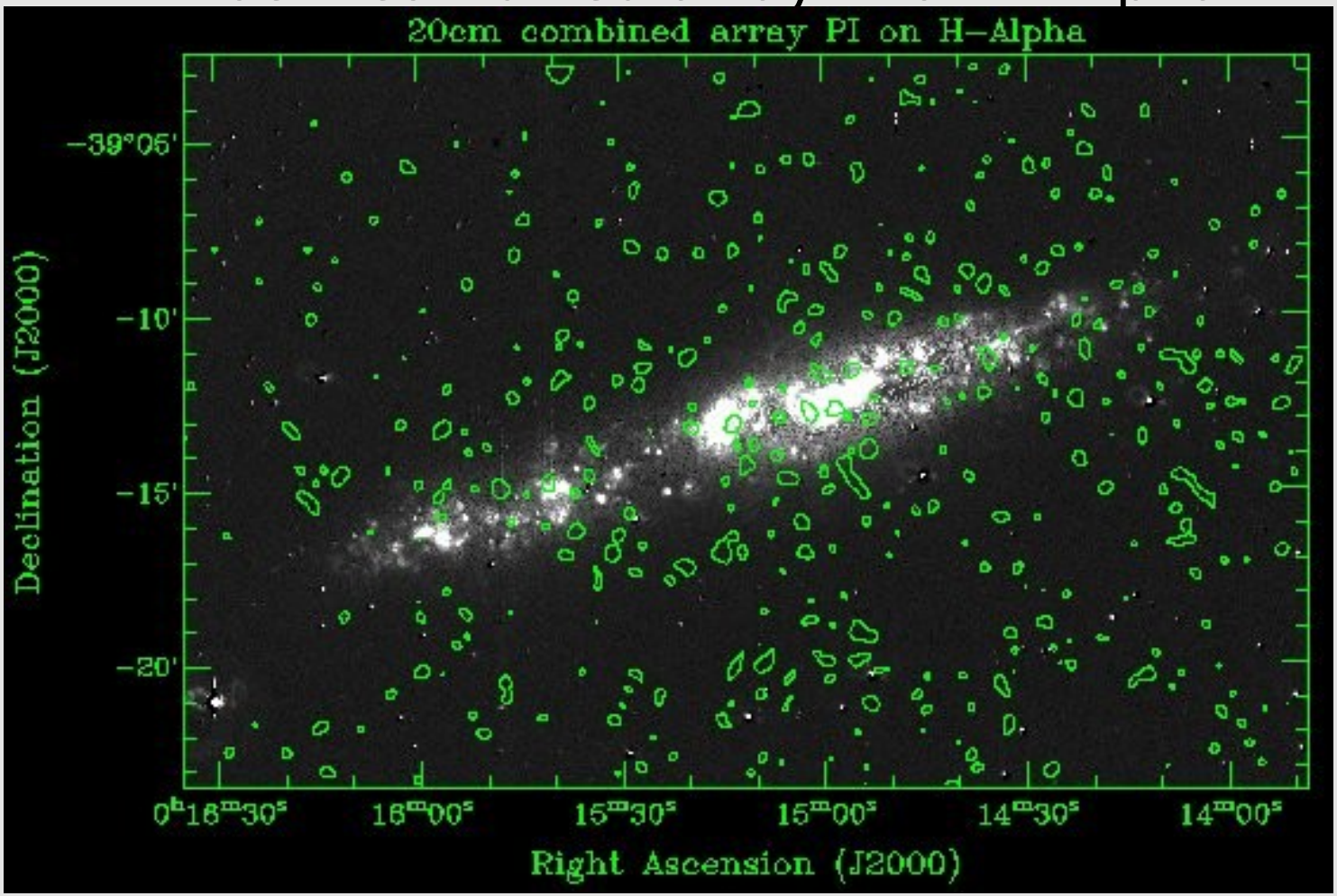
20cm combined array PI on H-Alpha:



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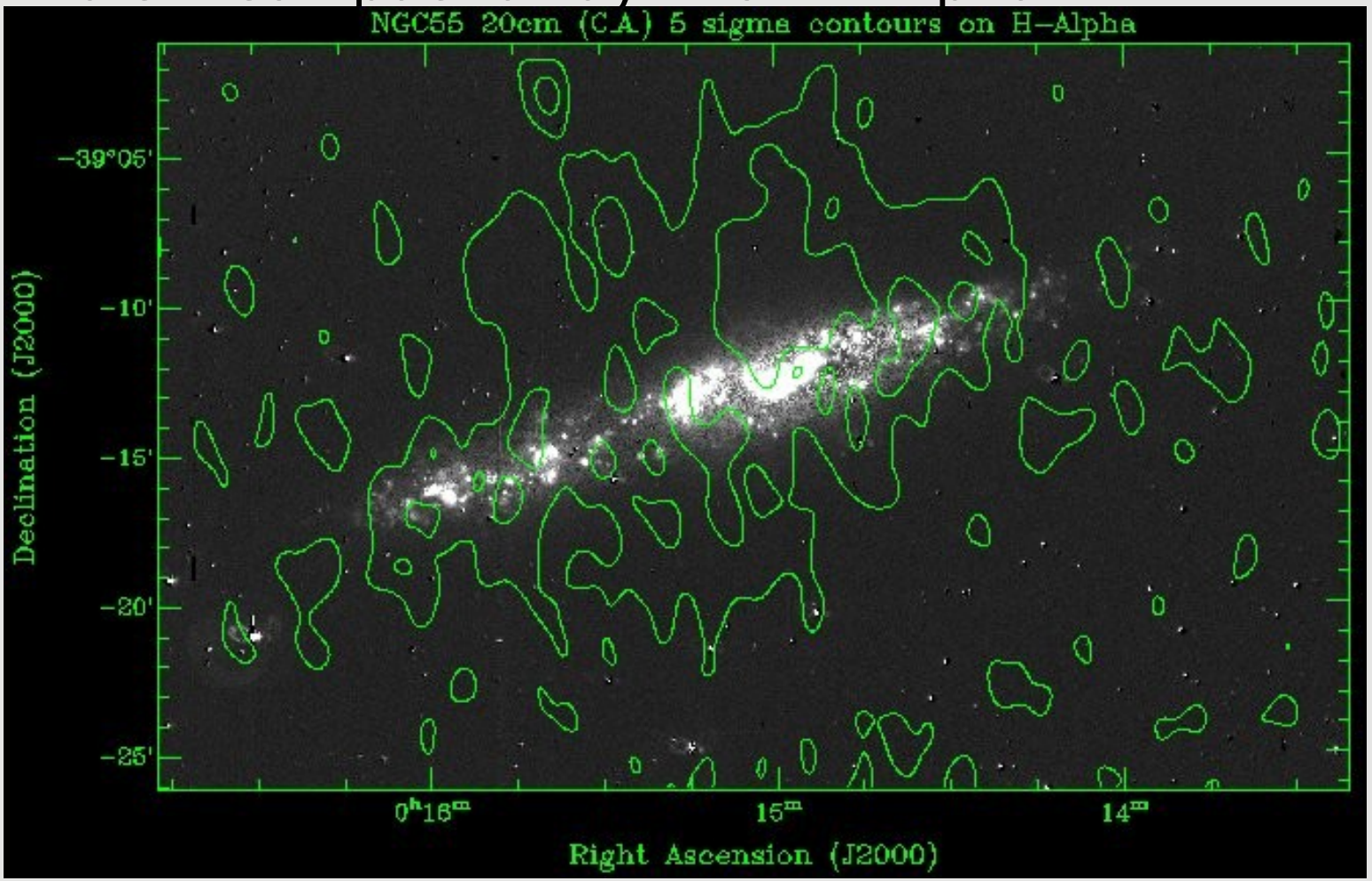
20 cm compact array PI on H-Alpha:



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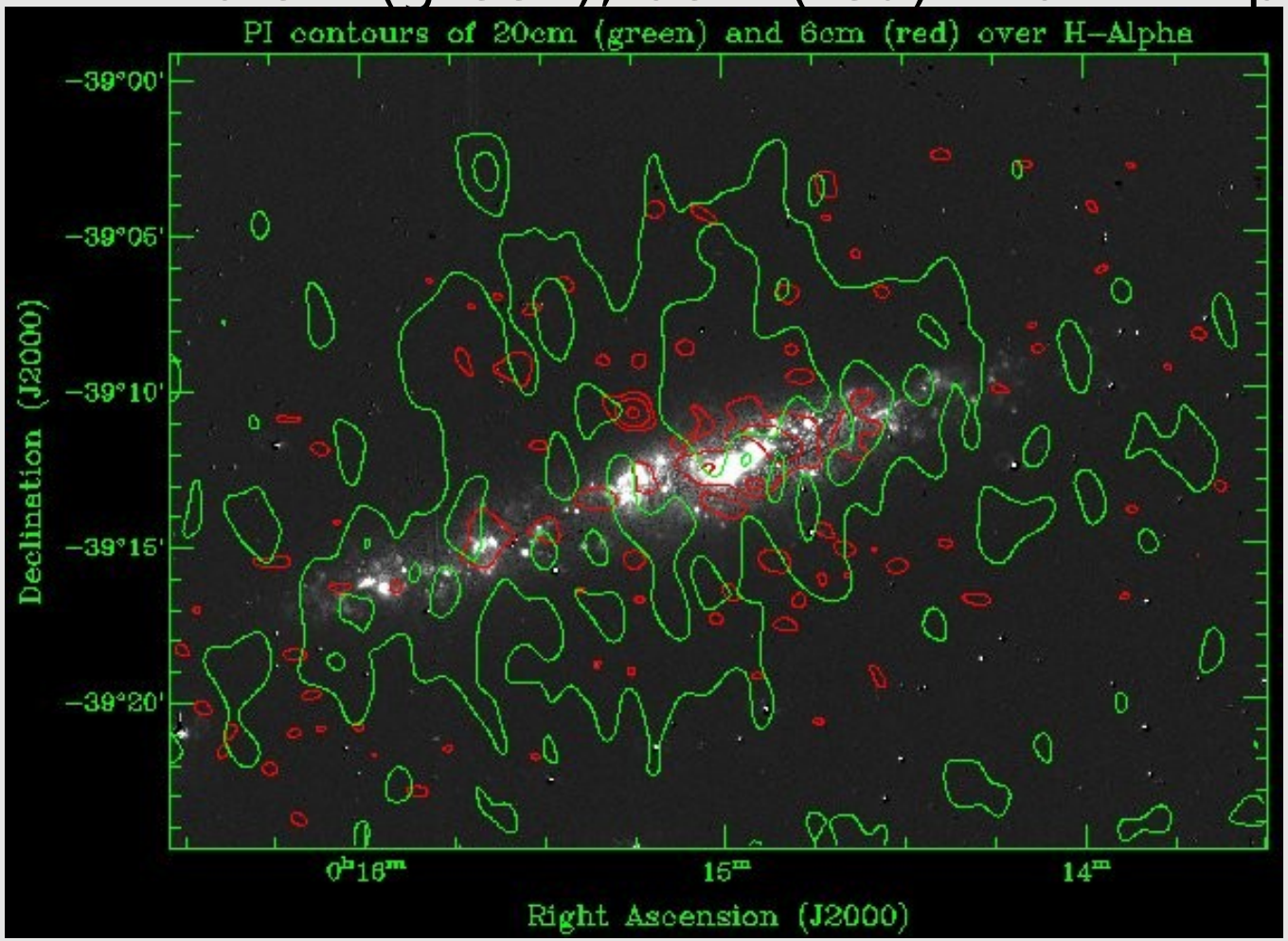
20 cm (green), 6cm (red) PI on H-Alpha:



Error ?

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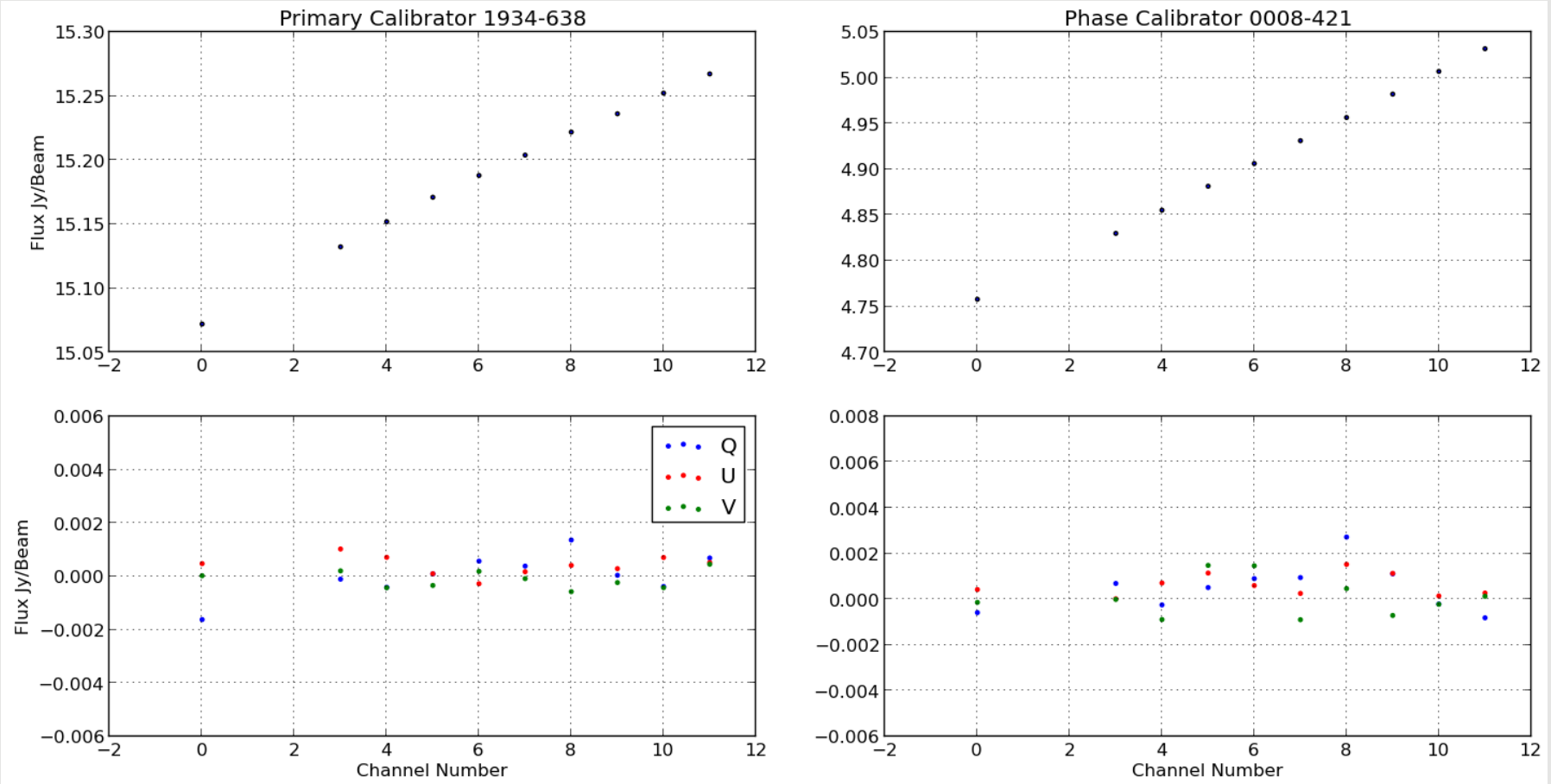
Probably(!) not.



Unpolarized calibrators show no polarization !

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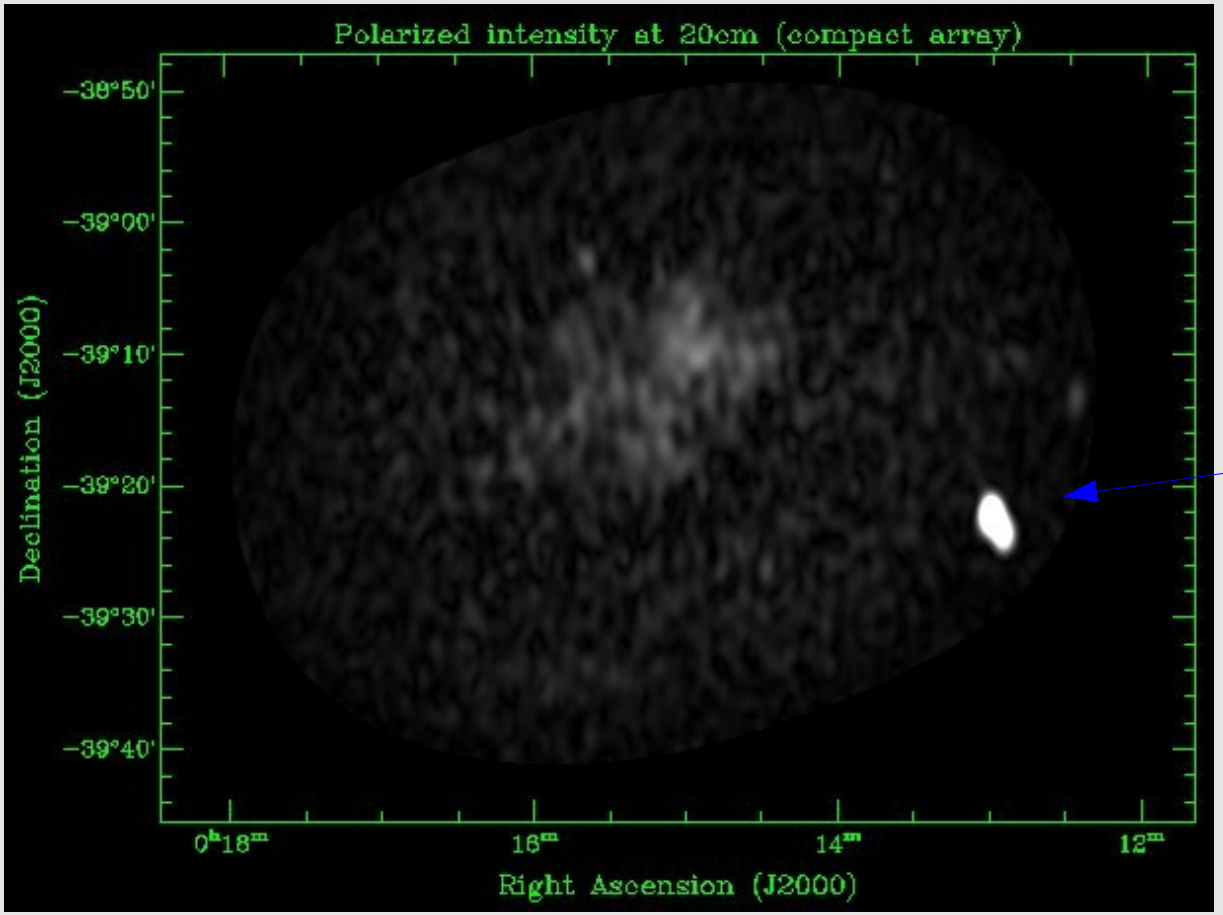

NVSS Source with PI of 12 mJy

Here it has a peak of 8 ± 0.07 mJy

NVSS fract. Pol: 22%
Here: 21%

Probably no error!

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Finally, RM Synthesis!

Used python code by Carlos Sotomayor

Used on the 6cm Stokes Q and U images

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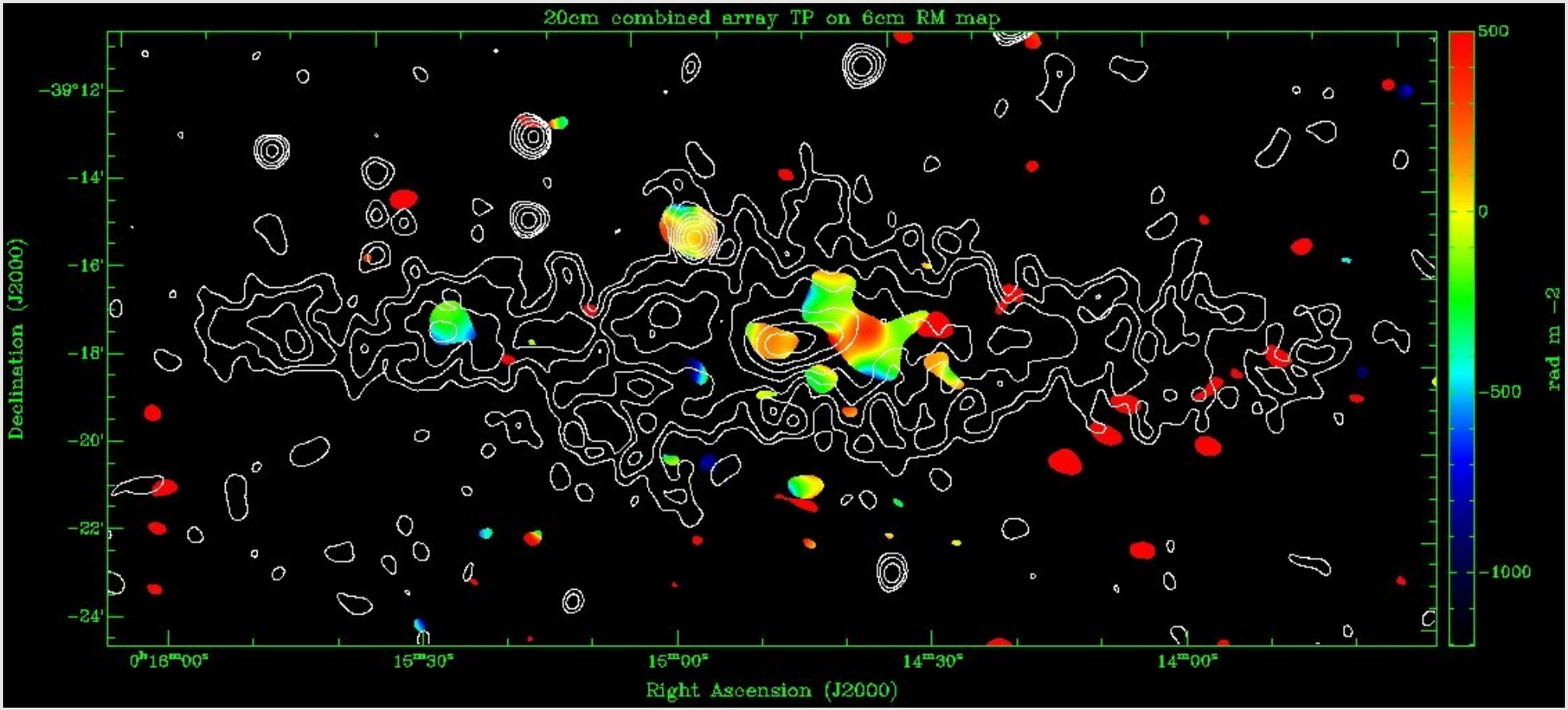

Shows RM's between -200 and 400 across the central regions

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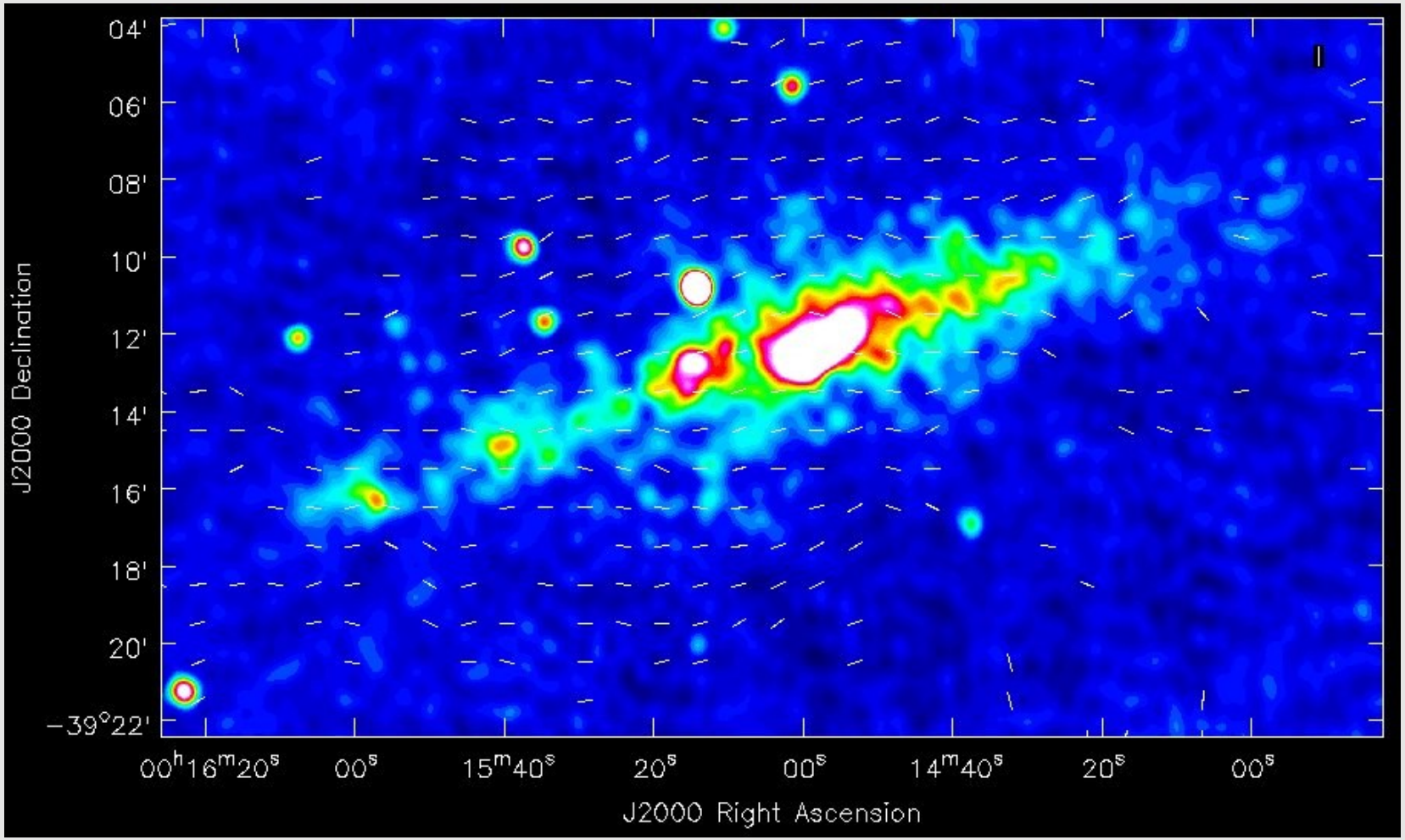

Magnetic field vectors from 20cm compact array image

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Probably not trustworthy since, if 6cm RM's are correct:

$$\Delta \chi = RM \, \lambda^2$$

For RM of 100 at 20 cm, yields a change of about 229 Degrees

Proper RM synthesis!

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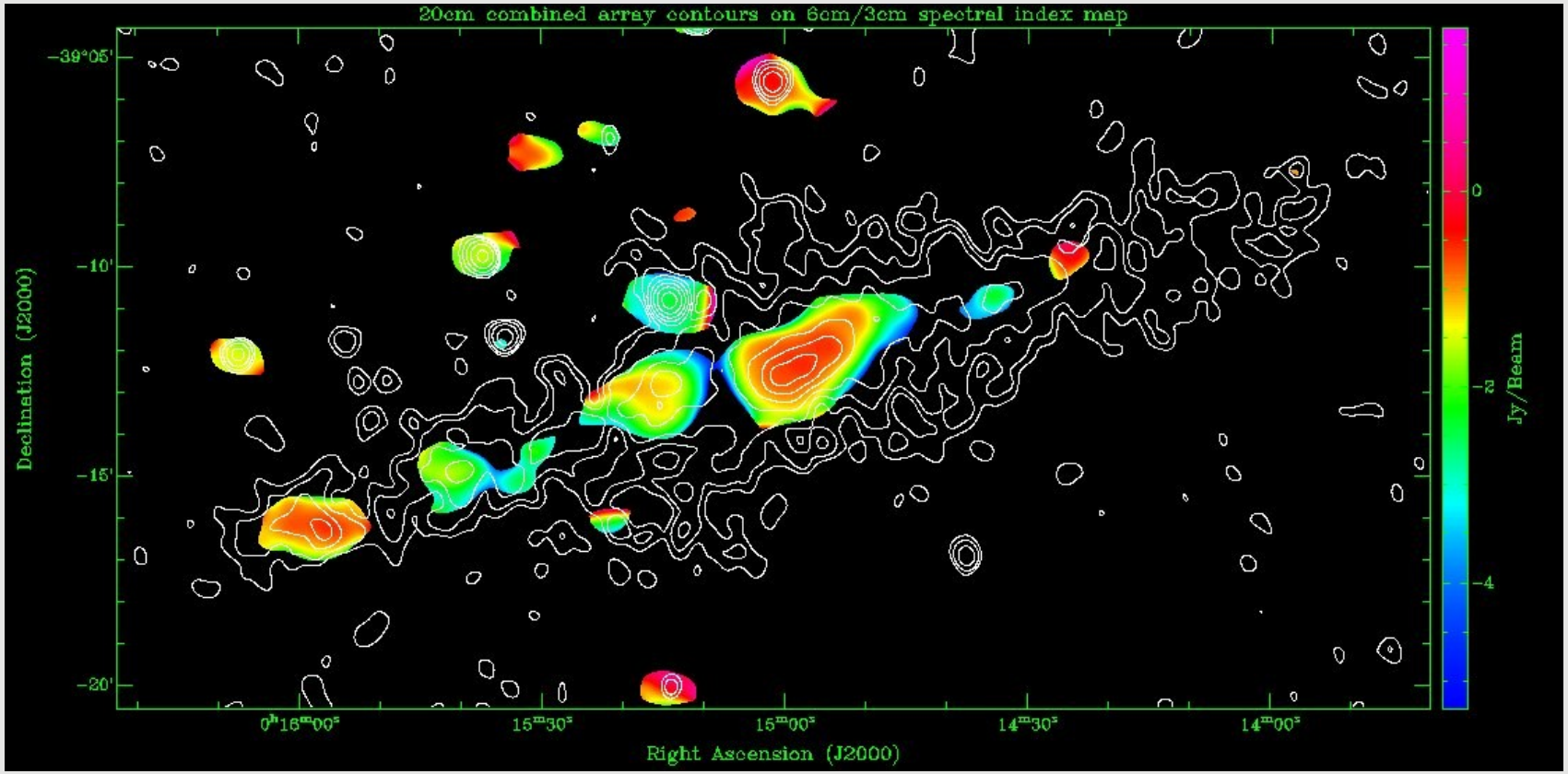
Spectral Index between 6cm/3cm shows an index of around -0.7 (synchrotron radiation) In the central region



Index steepens at the edge – S/N effect? Shocks?

In the near Future:

- Rm Synthesis on 20cm data
- Parkes data integration
- Physical interpration of the data

Thank you!