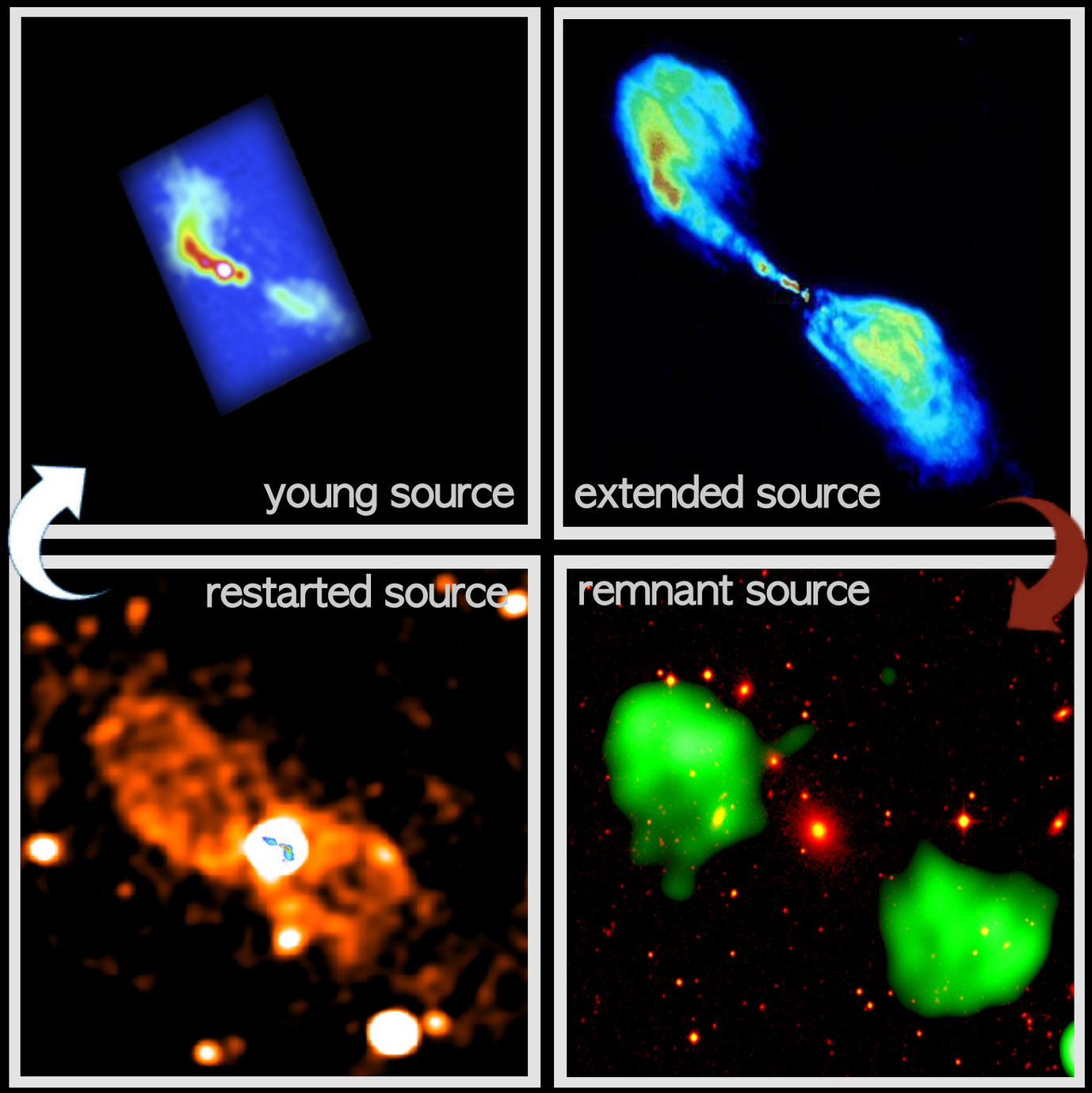
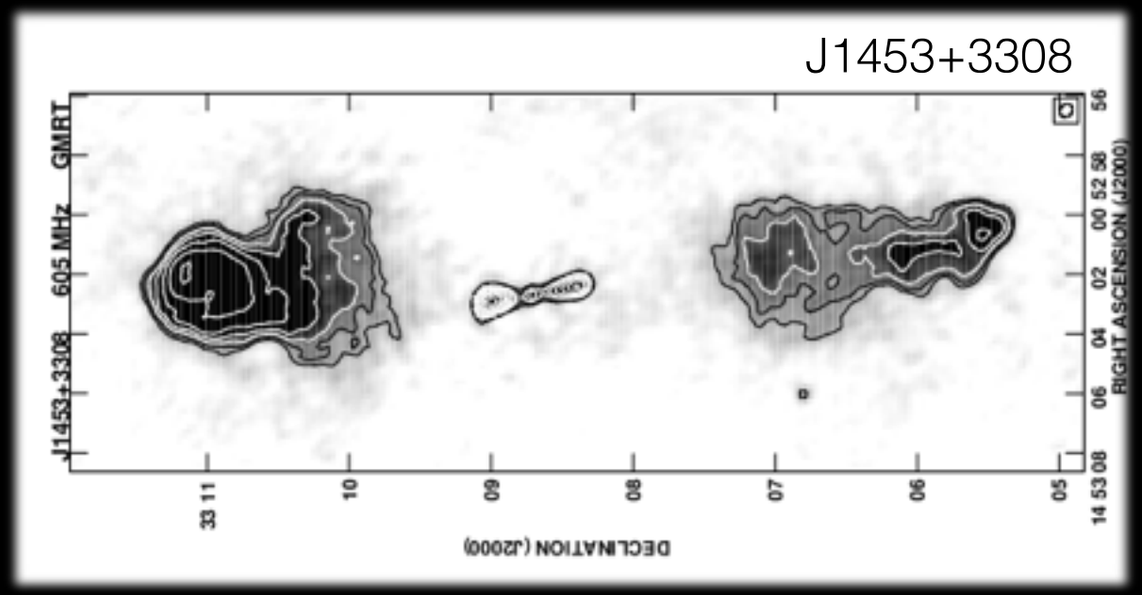
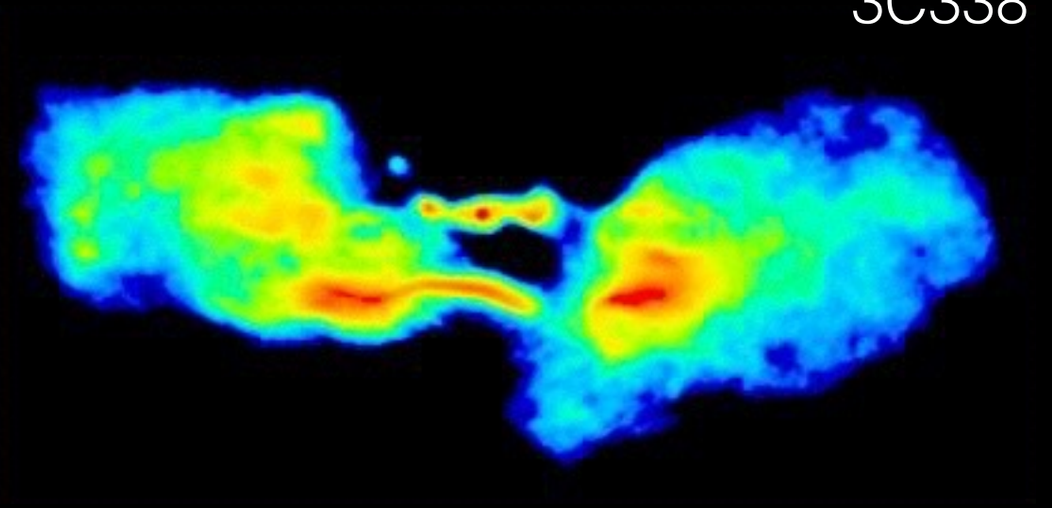
Phoenecis in the LOFAR sky: restarted radio galaxies

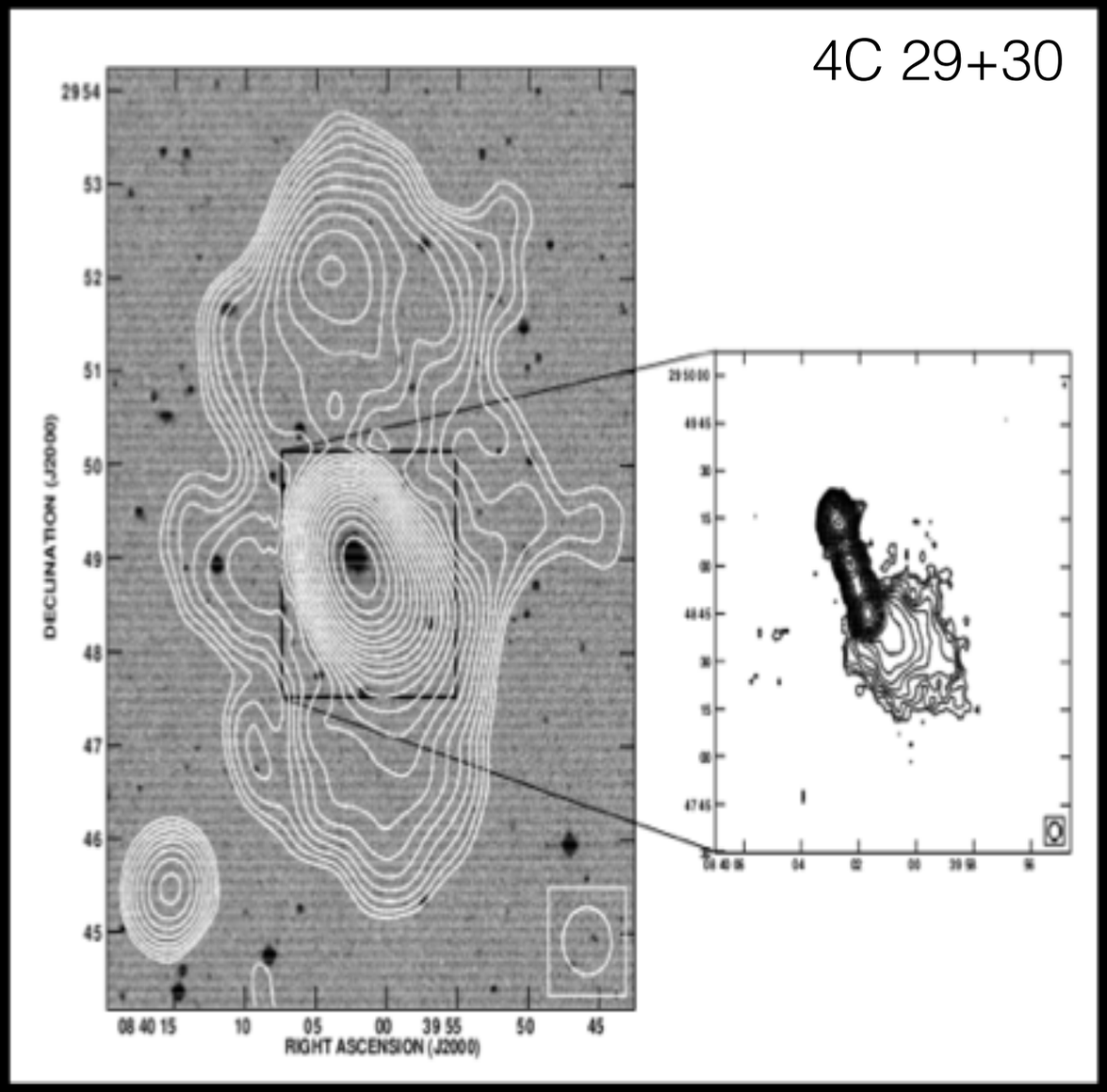
Marisa Brienza – GPS-CSS workshop, Rimini, 27 May 2015
Supervision: Morganti R., Godfrey L.



Restarted radio galaxies

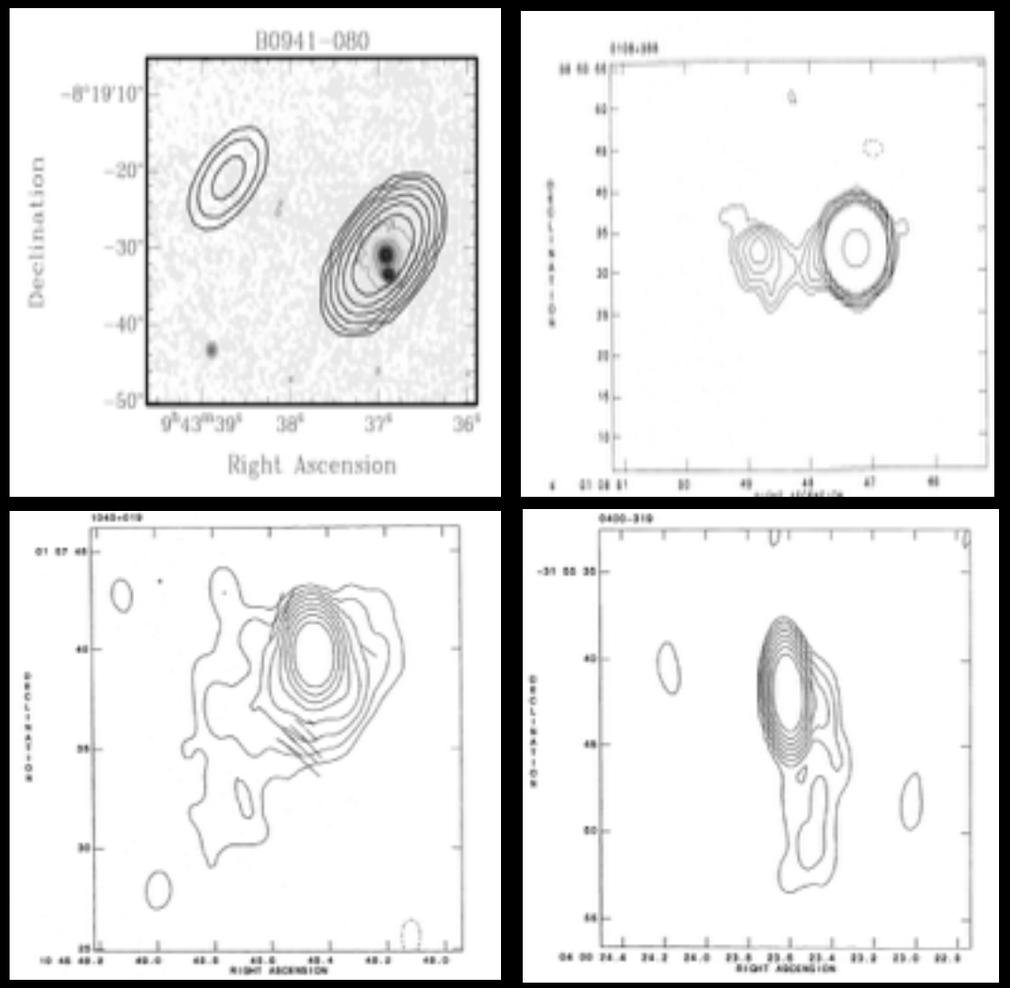






The key to understand the black hole duty cycle

Search for extended emission around GPS-CSS sources

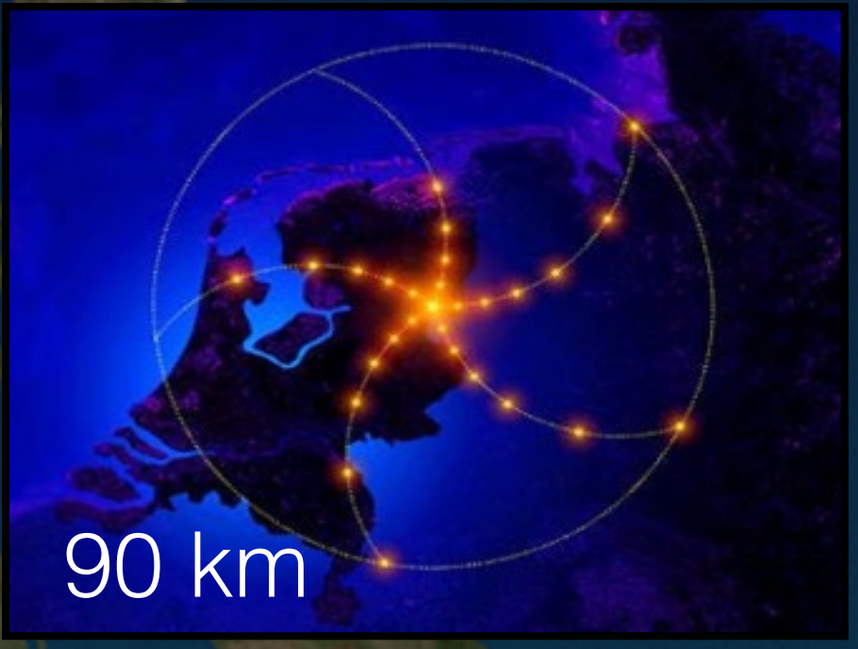


1400 MHz Stanghellini+1990,2005

10-20% of the samples show extended emission

IS IT RELIC EMISSION?

LOFAR
30-220 MHz

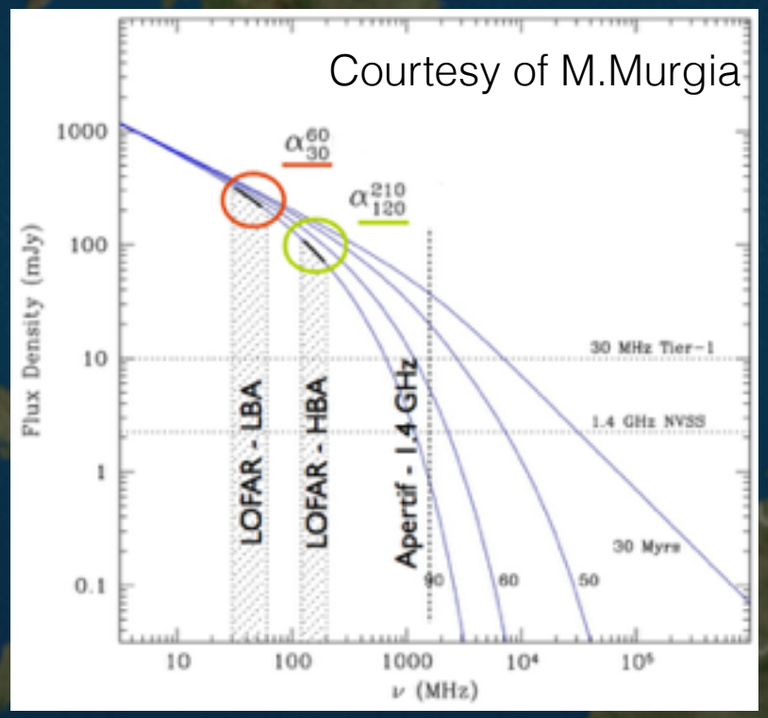


Onsala
Norderstedt
Baldy
Potsdam
Borówiec
Chilbolton
Jülich
Effelsberg
Taufenburg
Łazy
Unterweilenbach
Nançay

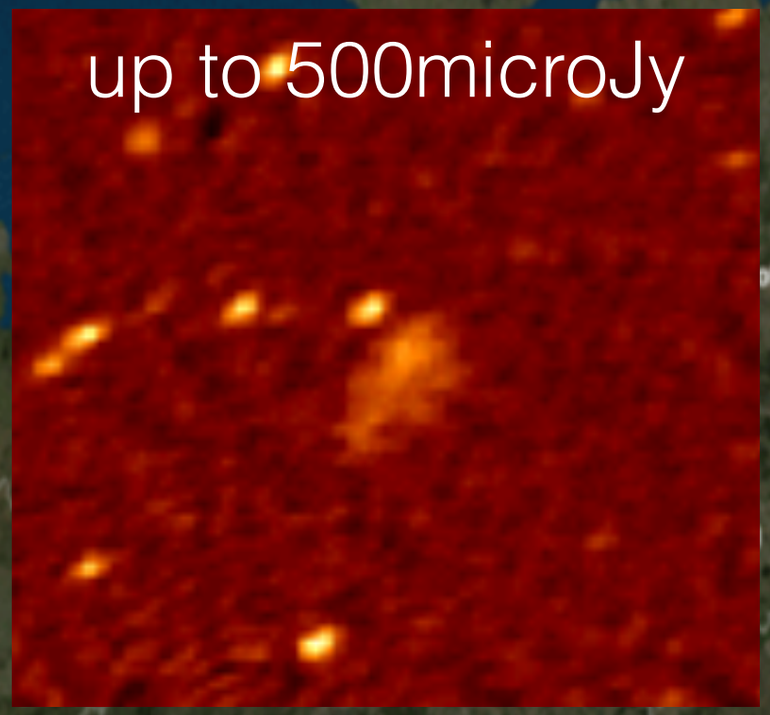
1500 km

Why LOFAR?

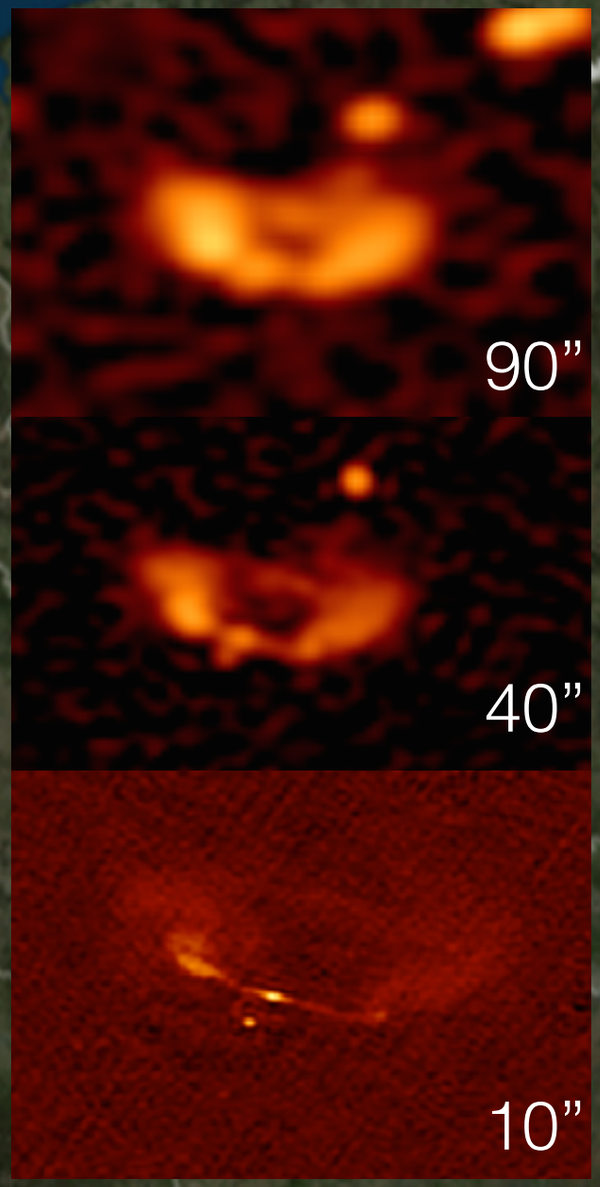
★ LOW FREQUENCY



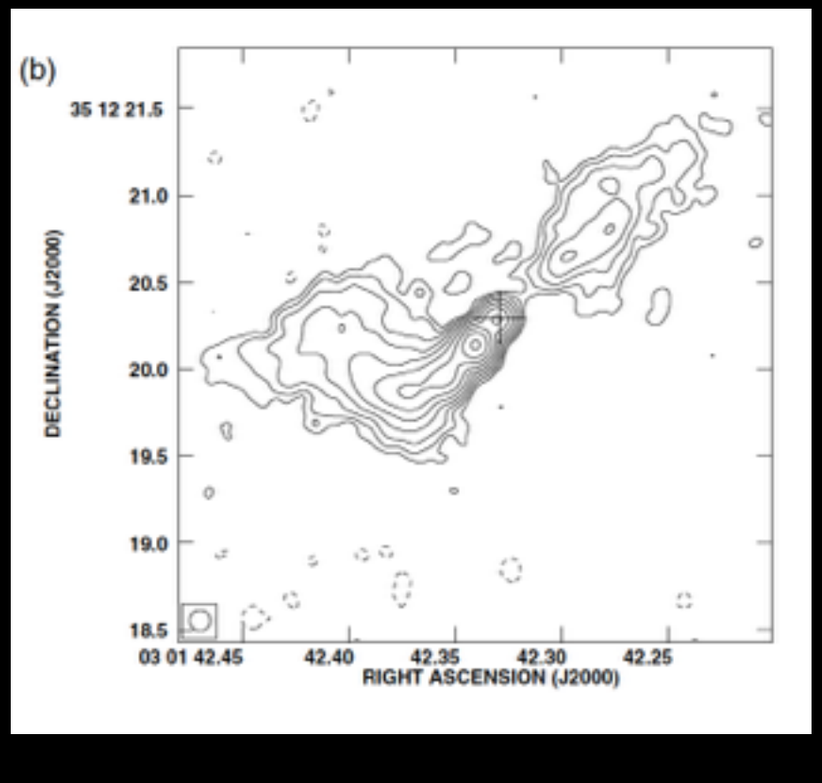
★ HIGH SENSITIVITY



★ RESOLUTION



The case of B2 0258+35

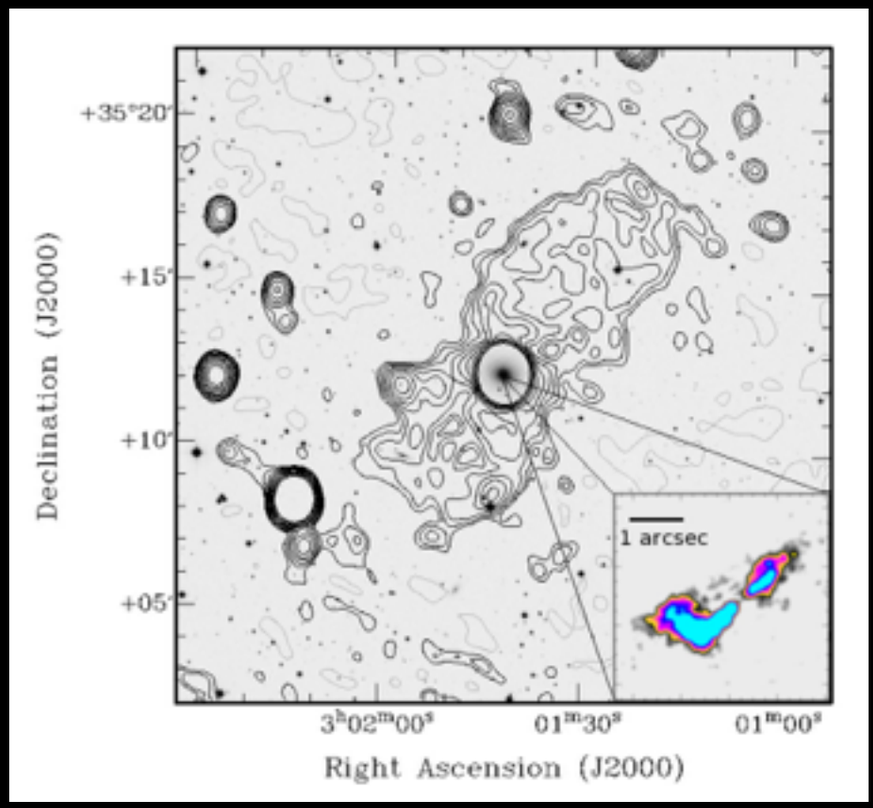


Field early-type galaxy NGC 1167 (z = 0.01651)

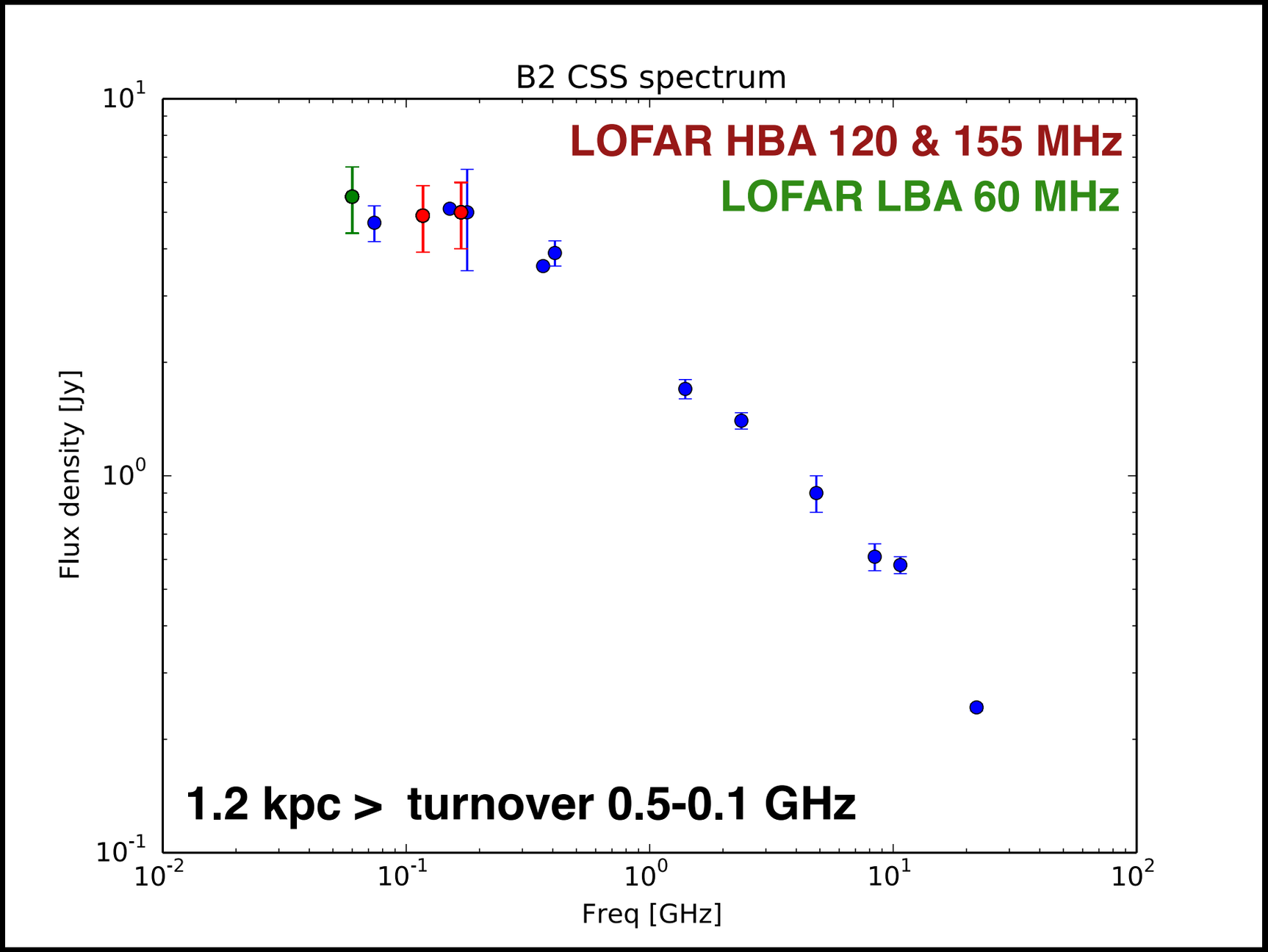
CSS source in the centre (Giroletti+2005, Giovannini+2001)
size 1.2 kpc
logL(408MHz)=24.37
age 9×10^5 yr

Extended emission at 1.4 GHz (Shulevski+2012)
size 240 kpc
surface brightness 1.4 mJy/arcmin^2
age 80 Myr

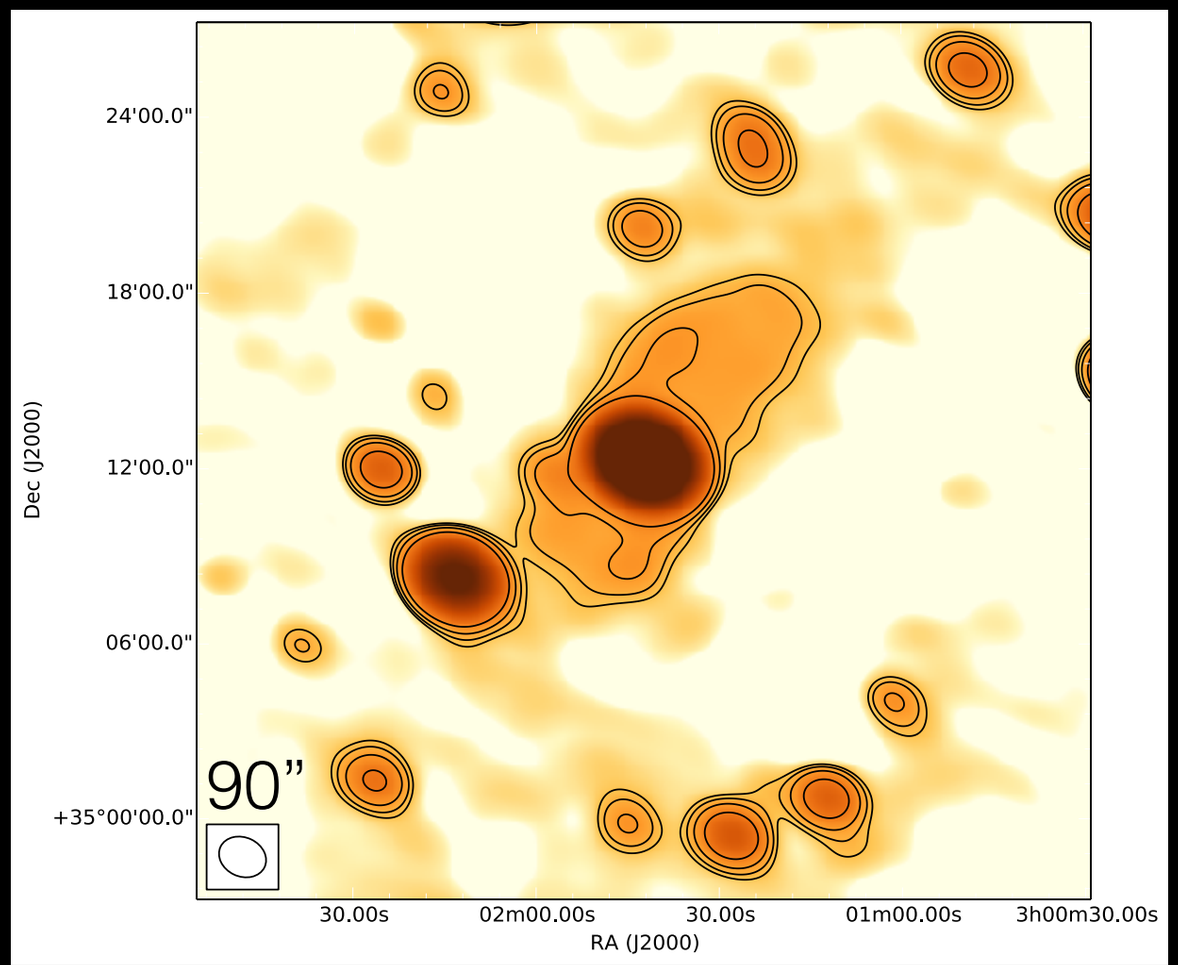
Relic emission?



B2 0258+35 with LOFAR

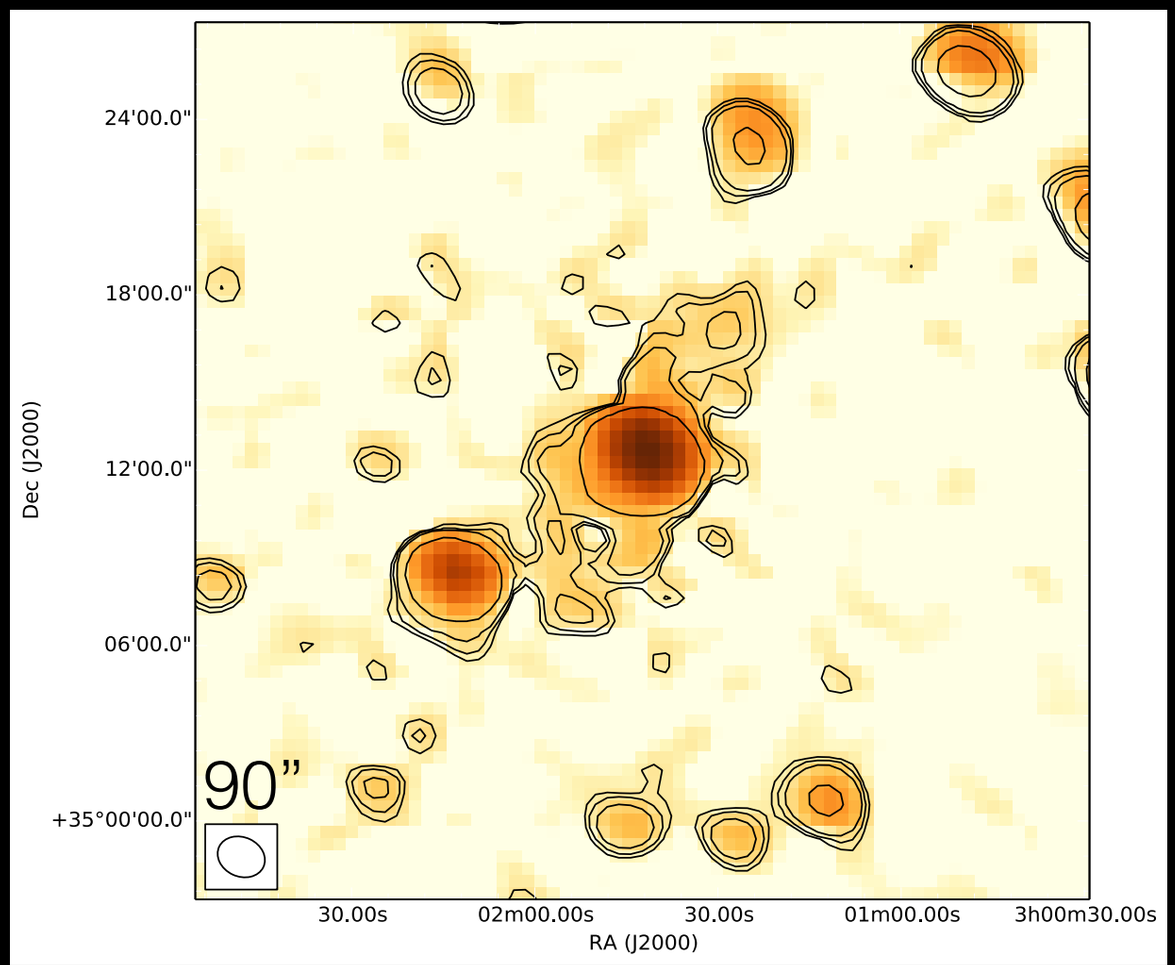


B2 0258+35
Low vs high frequency



noise 0.7mJy x 2, 3, 5, 10

1.4 GHz

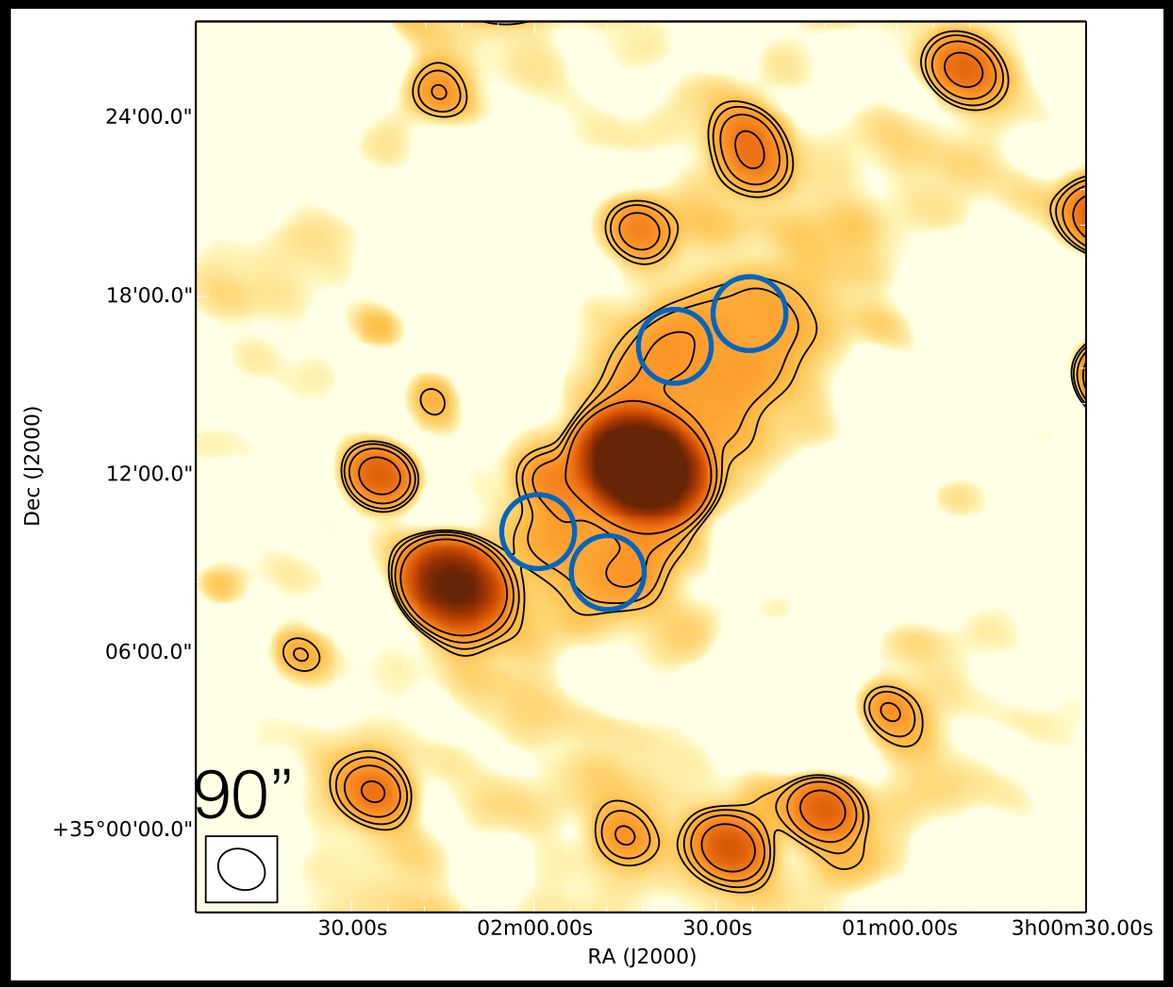


noise 3mJy x 2, 3, 5, 10

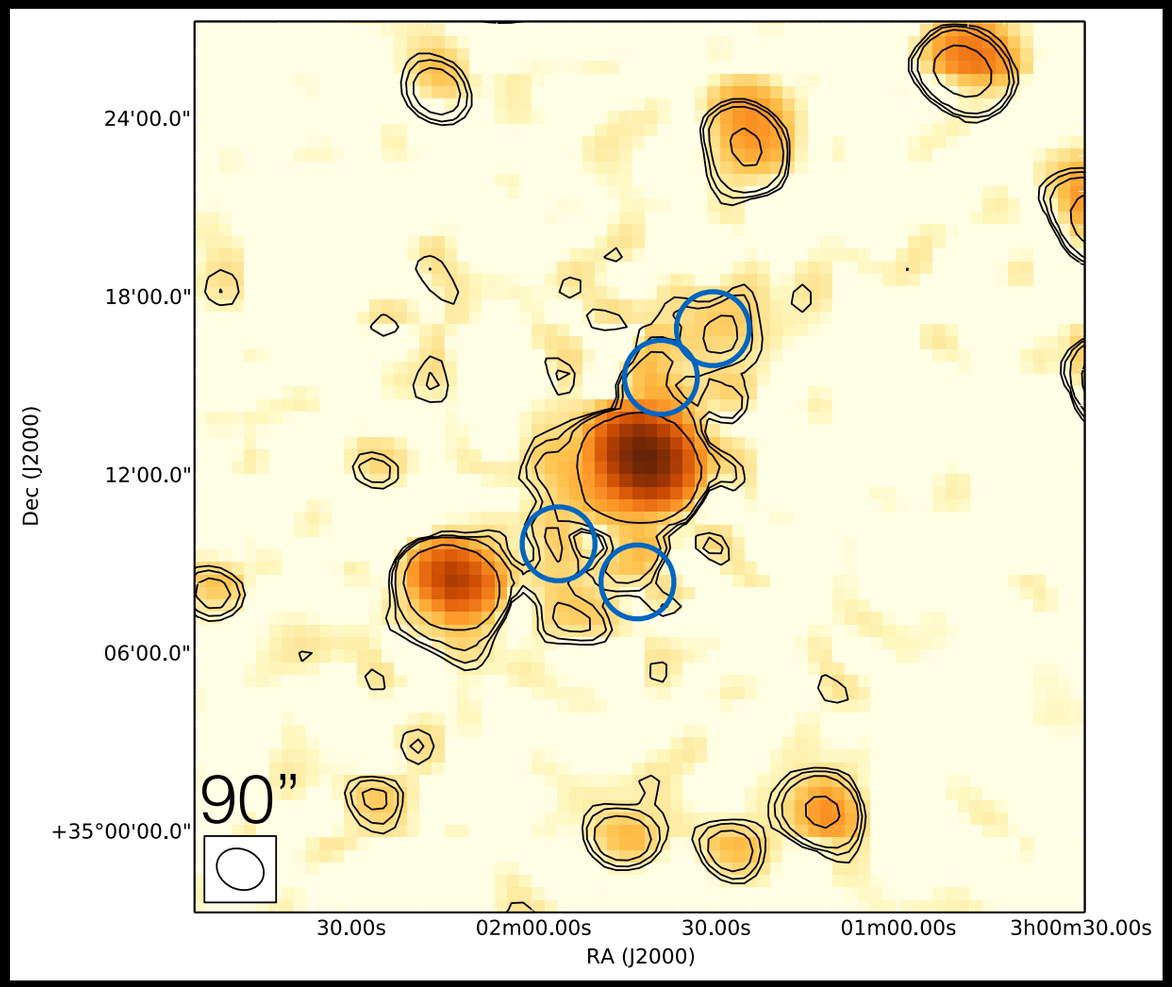
145 MHz

morphology match!

B2 0258+35
Low vs high frequency



1.4 GHz

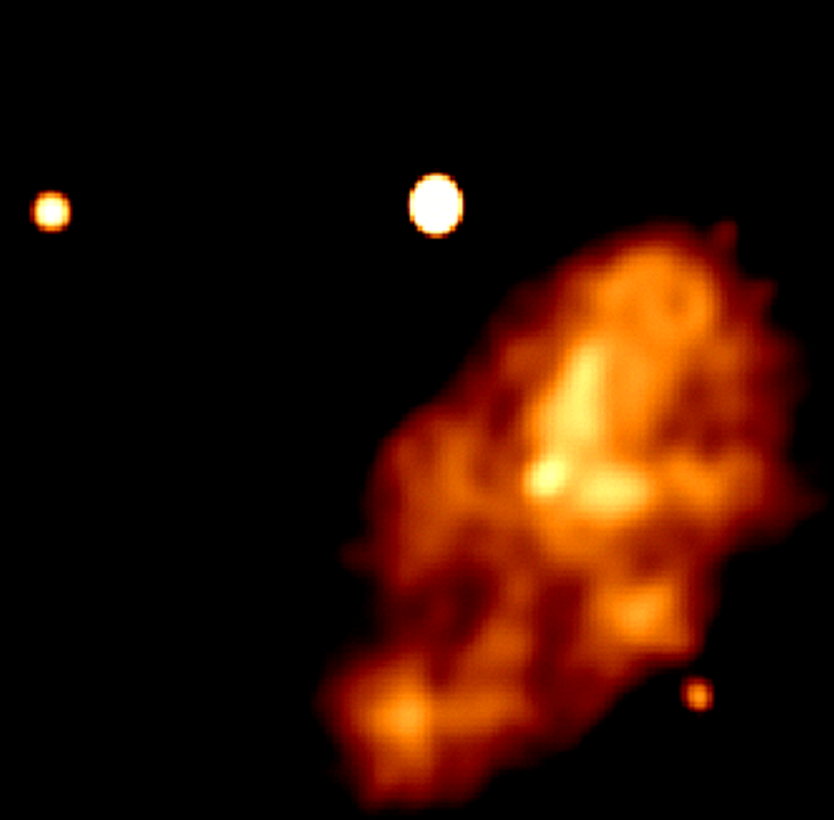


145 MHz

spectral index 0.5-0.6

VLA P-band observations upcoming

Interpretation?



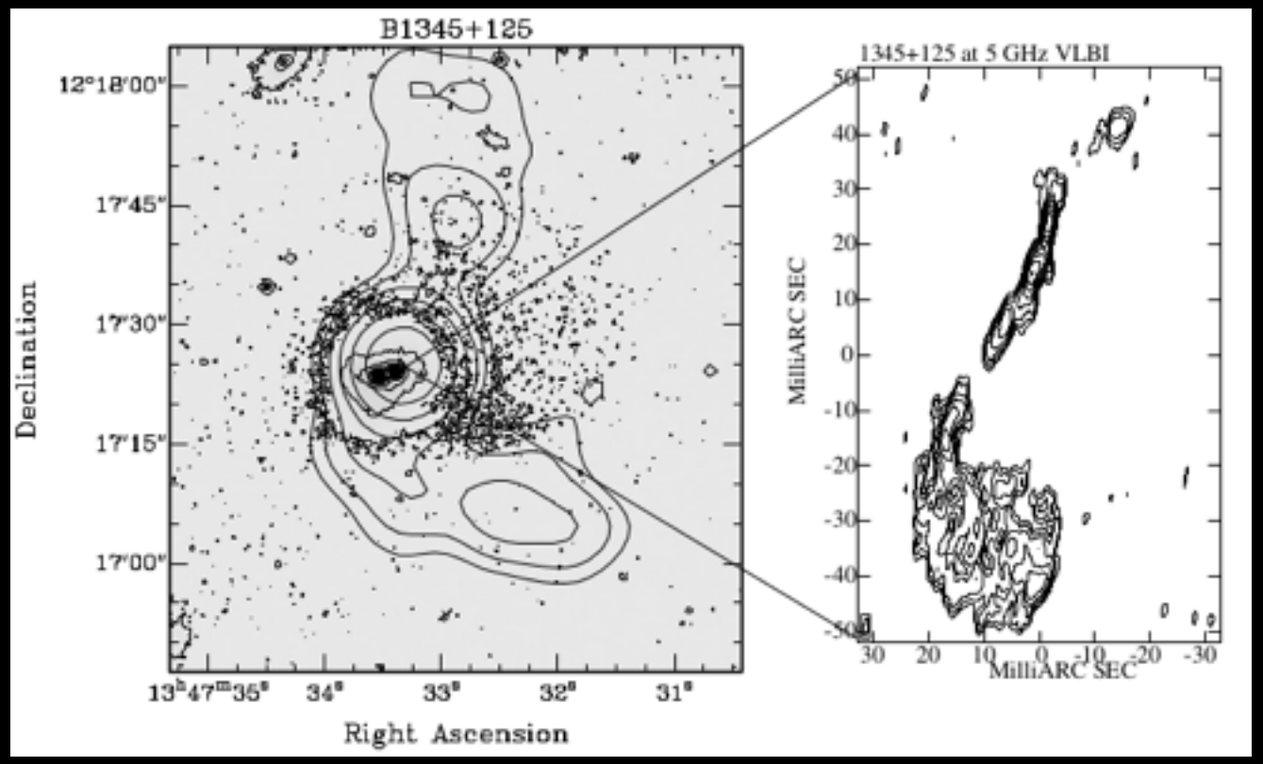
BLOB1

Old plasma with
spectral steepening
at v>1.4GHz (low B)

CenA

Injection on-going
in the outer lobes

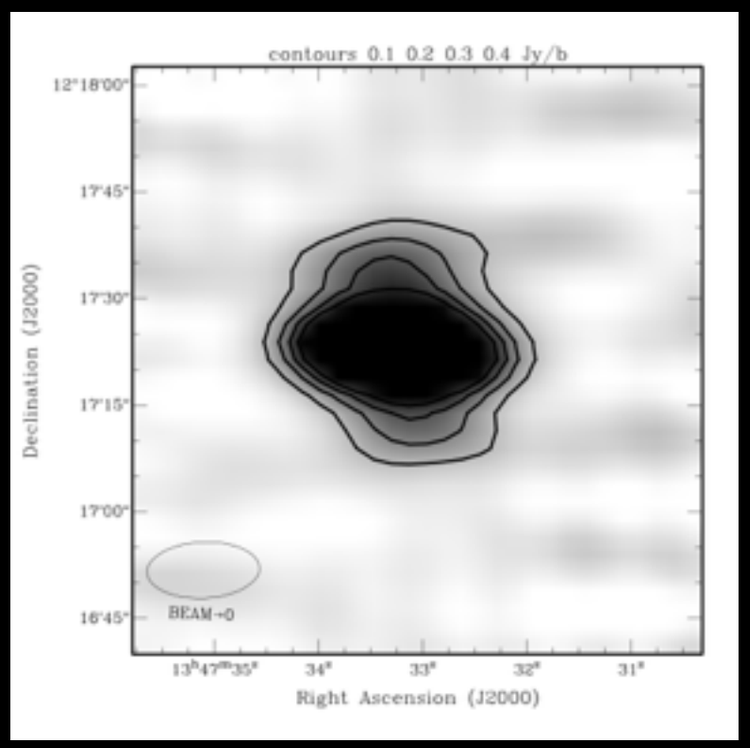
GPS 4C12.50

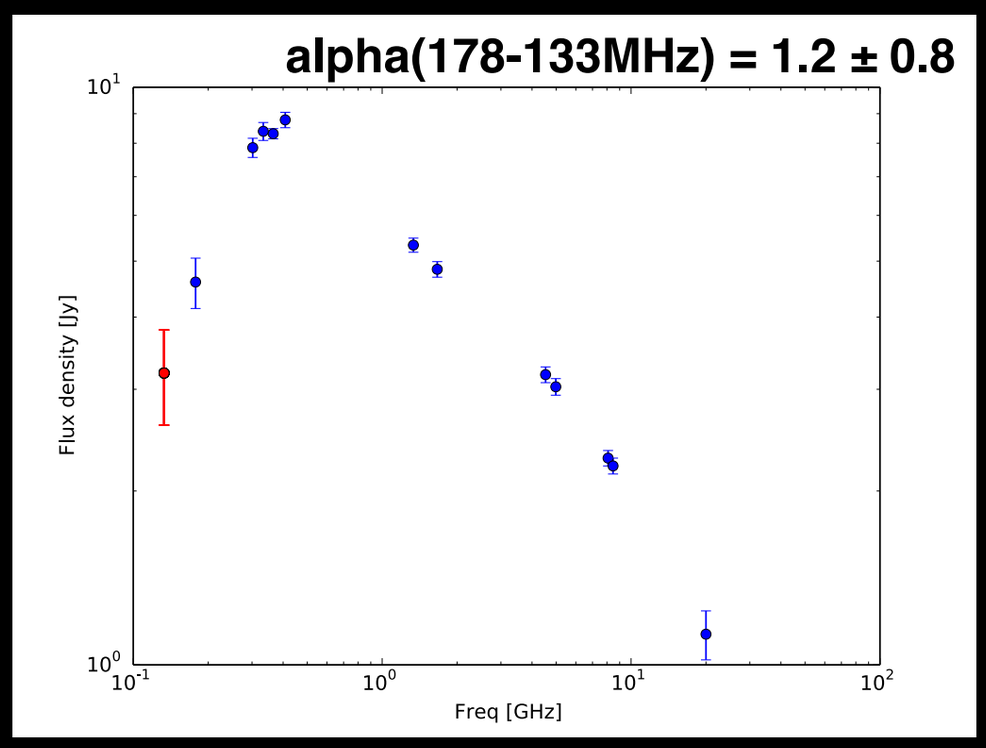


VLA 1.4 GHz

5” beam

Stanghellini+2005

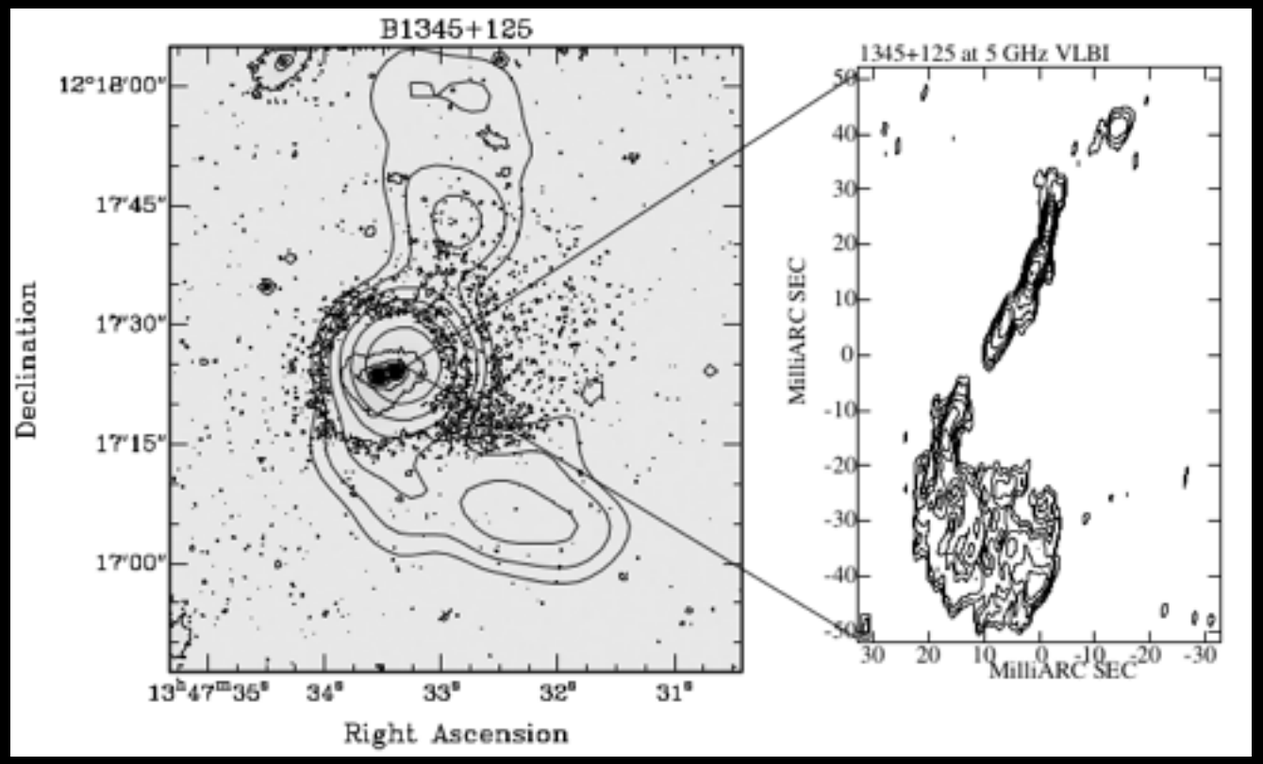




12x7” beam

LOFAR 133 MHz

GPS 4C12.50

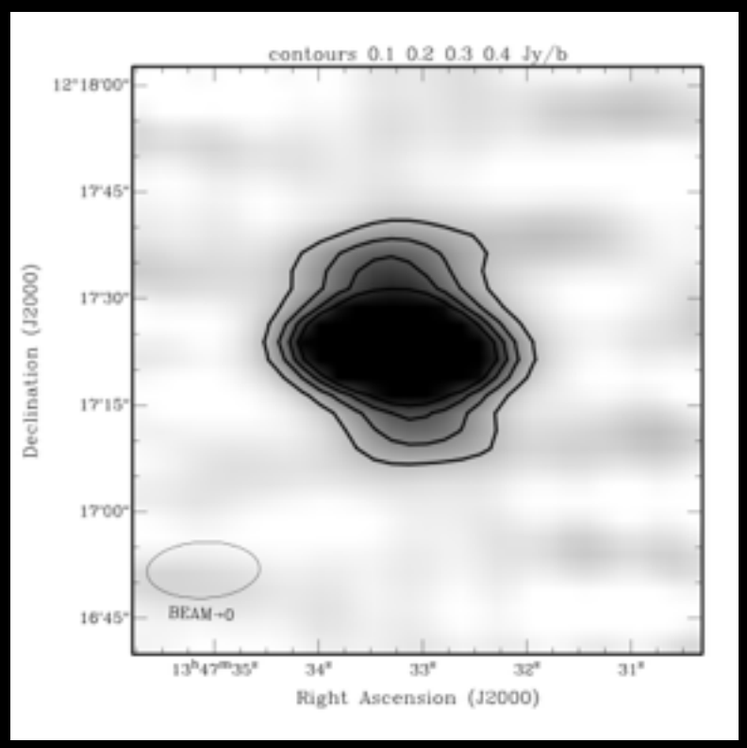


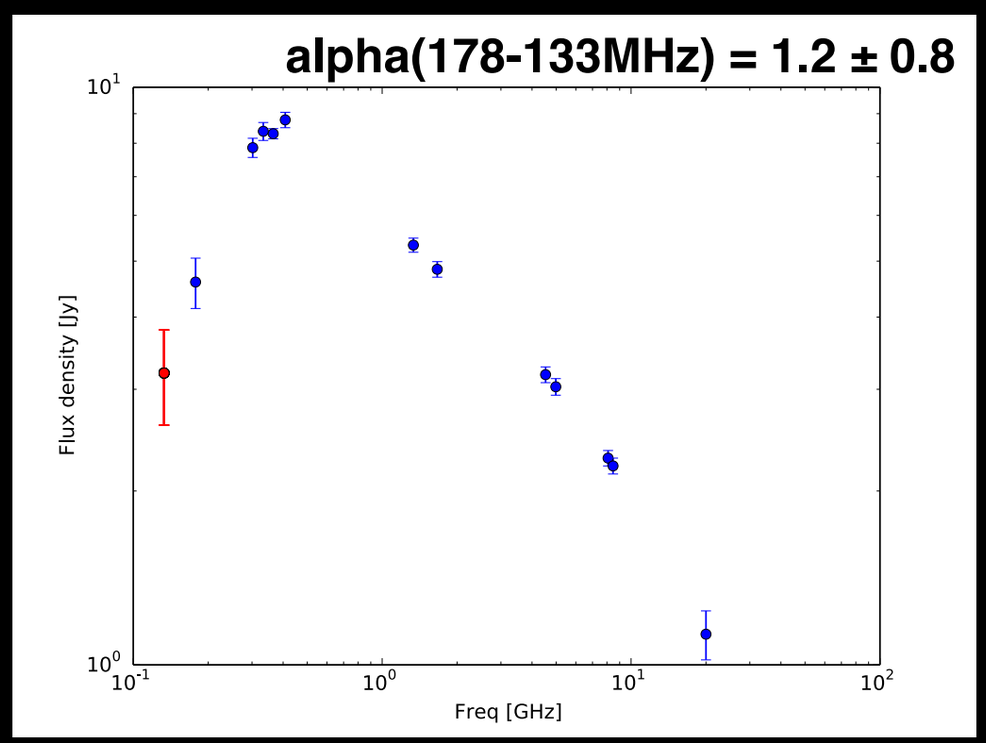
VLA P-band &
New LOFAR upcoming

VLA 1.4 GHz

5” beam

Stanghellini+2005



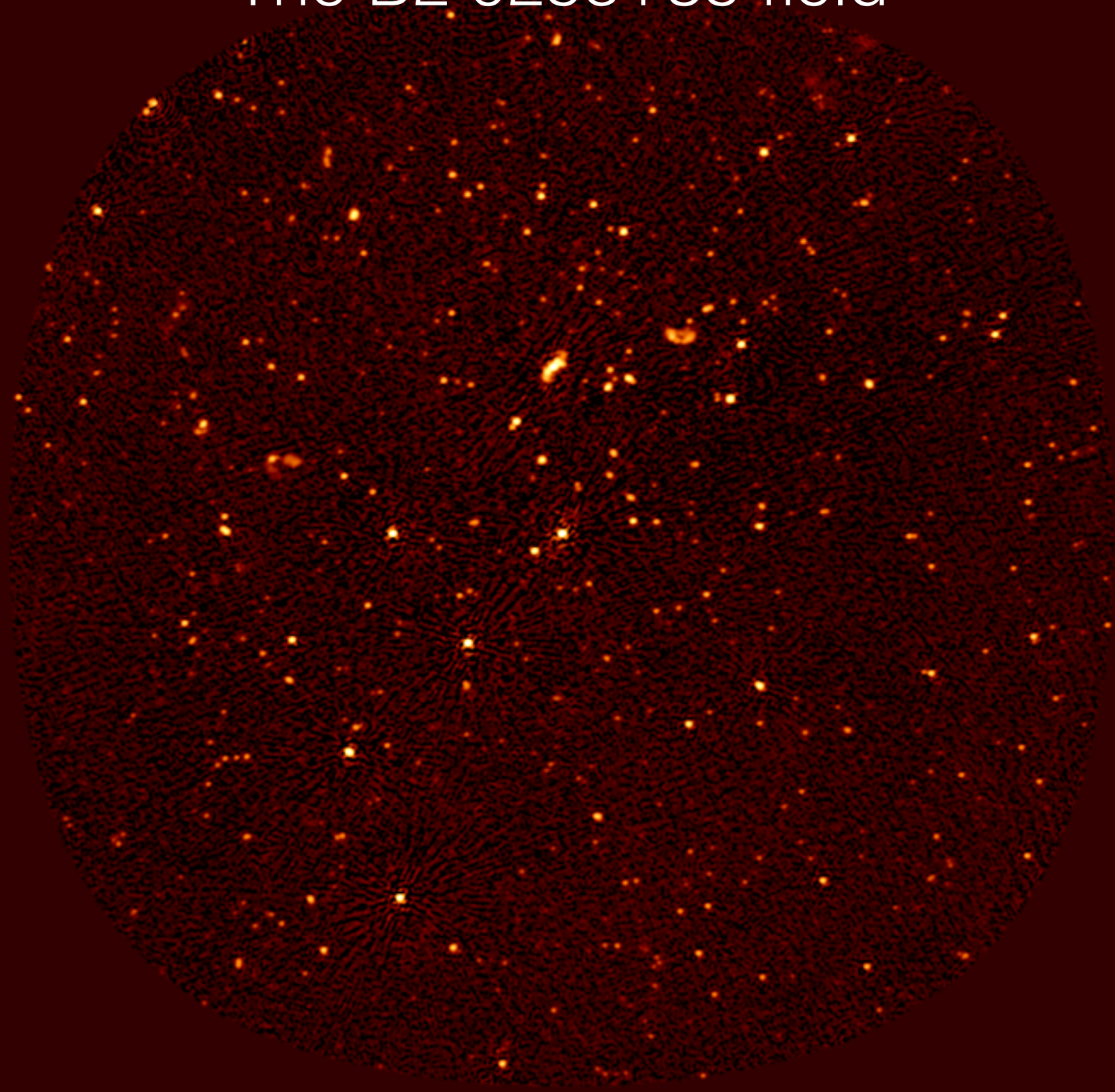


12x7” beam

LOFAR 133 MHz

What next?

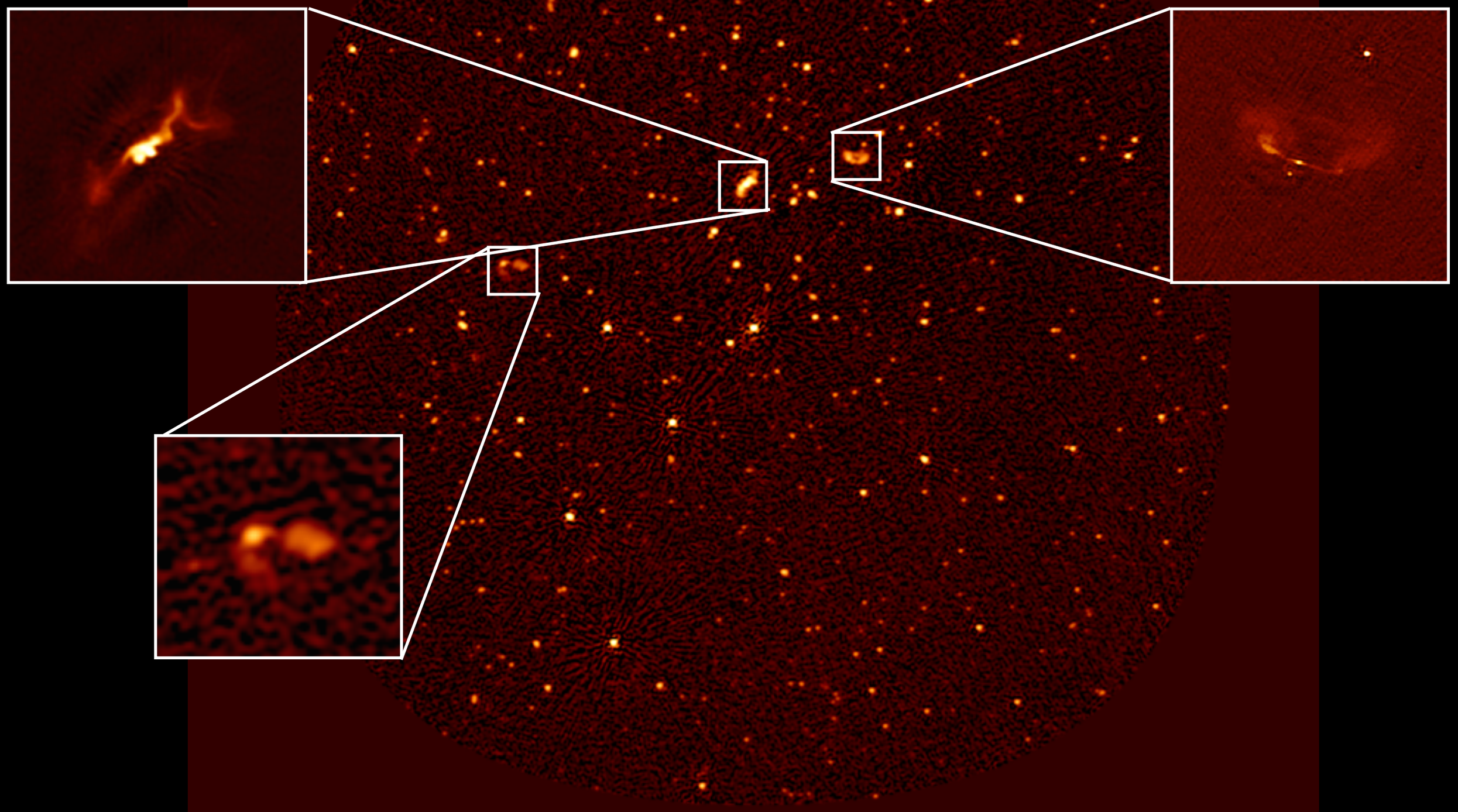
The B2 0258+35 field



No known GPS/CSS sources

5x5deg

The B2 0258+35 field



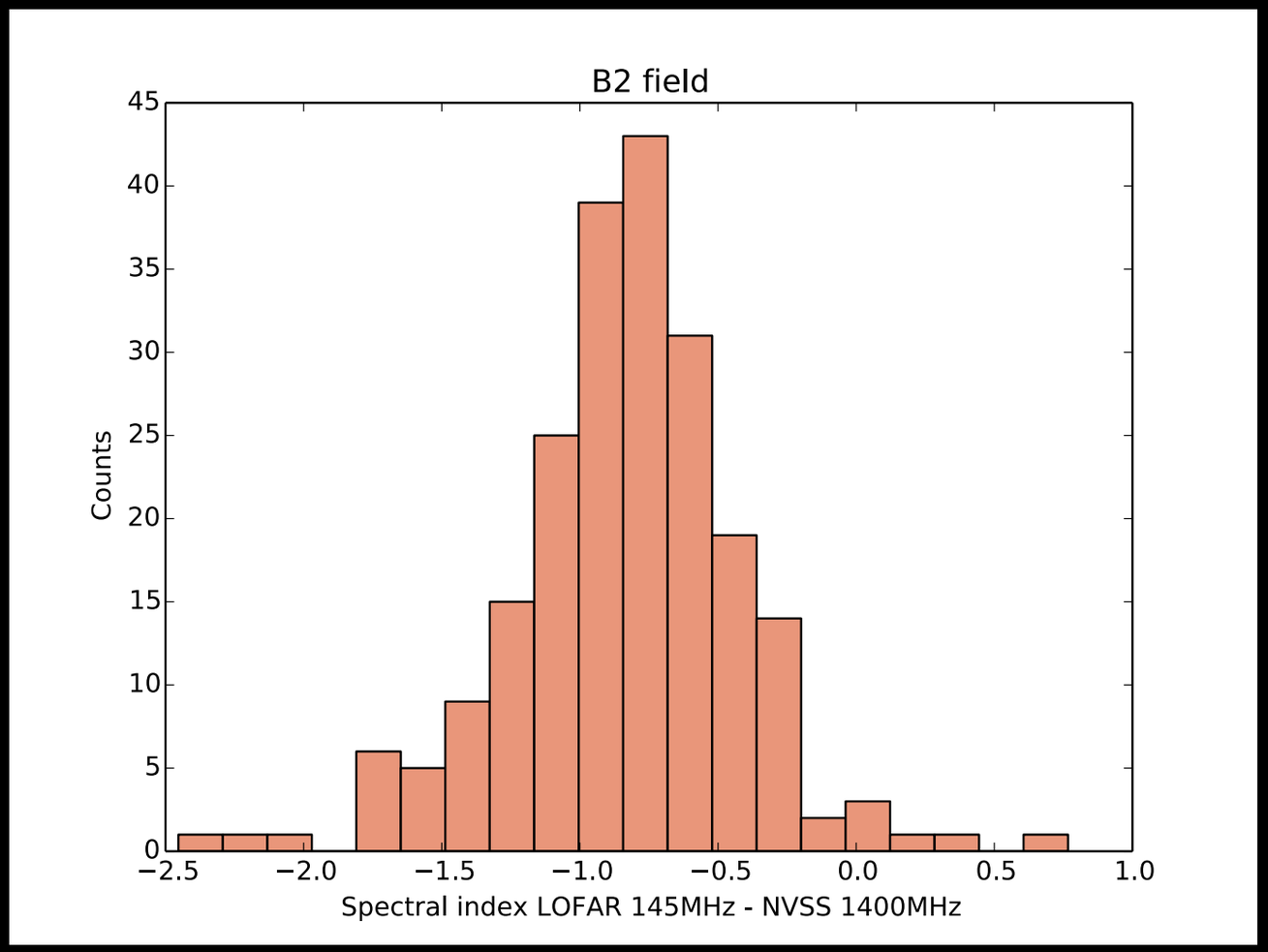
No known GPS/CSS sources

5x5deg

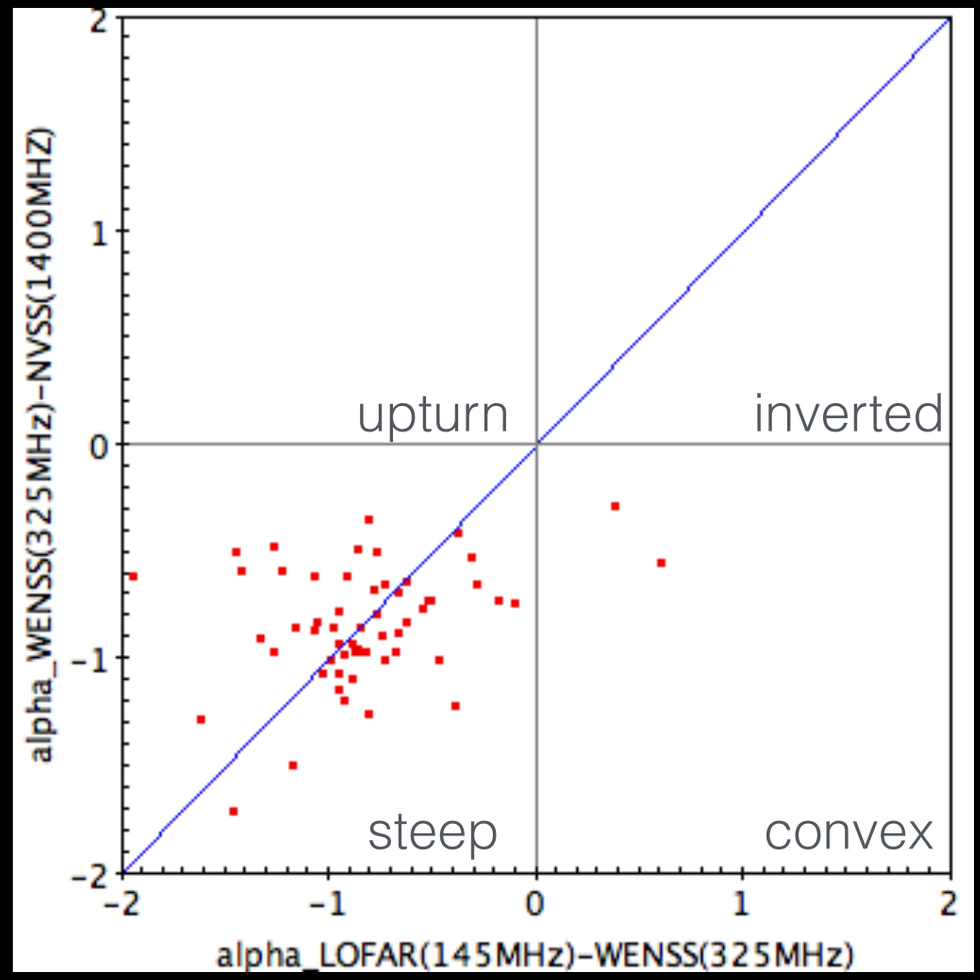
The B2 0258+35 field

a search for CSS and GPS sources

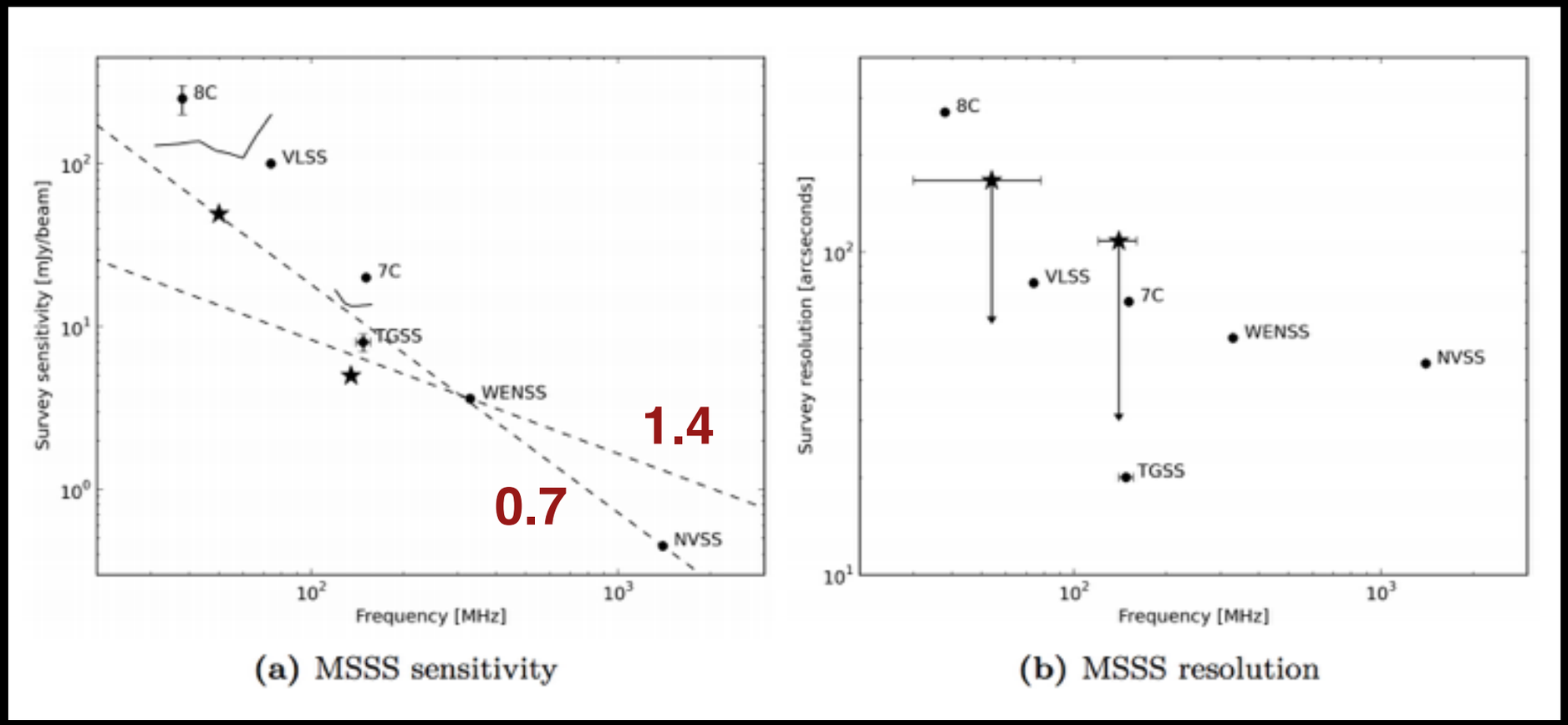
spectral index distribution



color-color plot

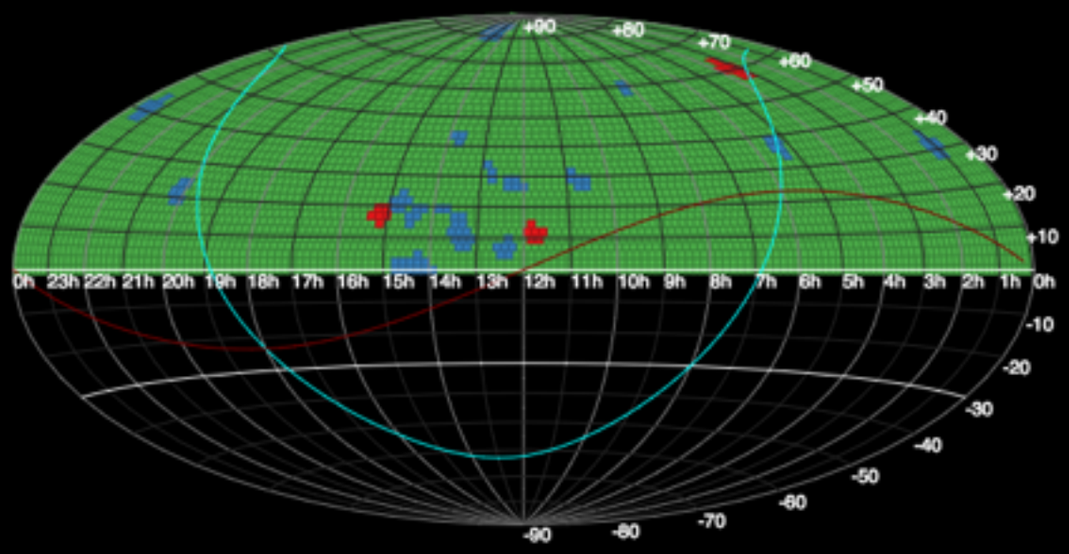


MSSS search for extended emission around GPS-CSS sources (Shulevski 2015 PhDthesis)



(a) MSSS sensitivity

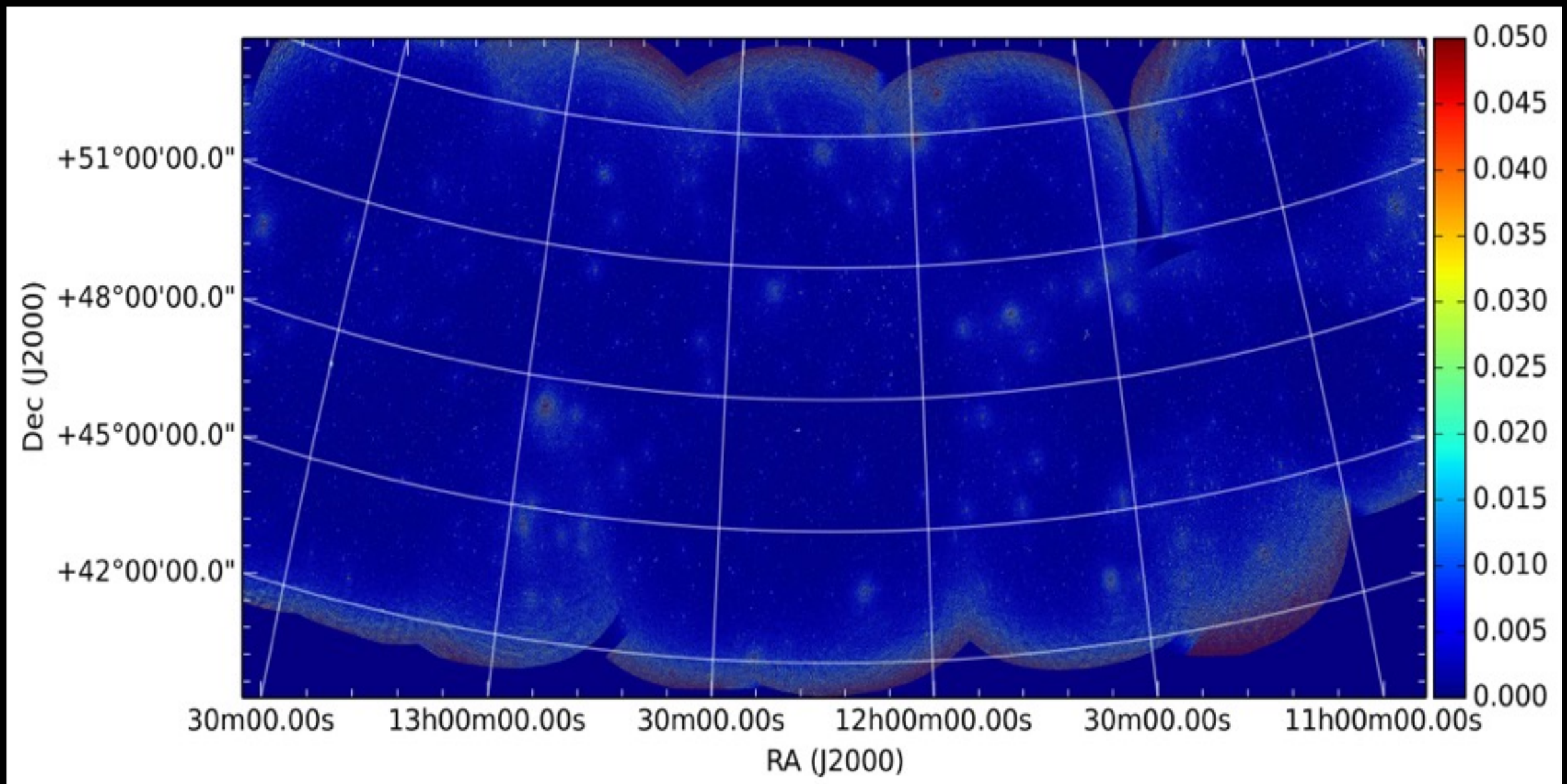
(b) MSSS resolution



HBA 140 MHz
64 MHz bandwidth
2.5’ beam
5 mJy/beam

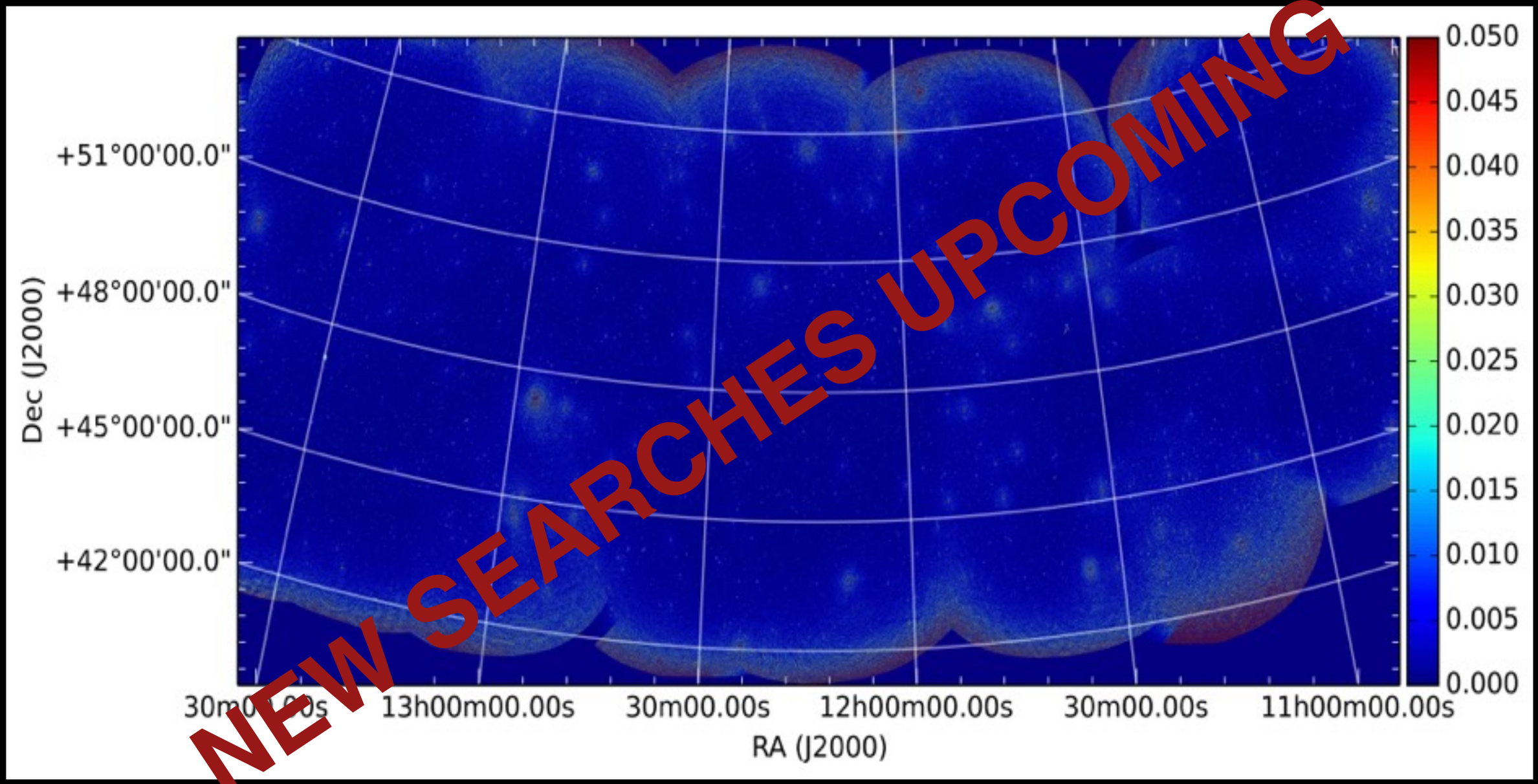
No detections

LOFAR Tier-1 survey



~1000 sq. degrees
noise - few 100 microJy/beam
beam = 20”

LOFAR Tier-1 survey



~1000 sq. degrees

noise - few 100 microJy/beam

beam = 20”

Conclusions

Extended emission around GPS & CSS sources can be used to probe the radio galaxy duty cycle

? how many GPS-CSS do show extended emission

? Is the extended emission connected or disconnected to the active radio jets

Is time for LOFAR for new systematic searches!!