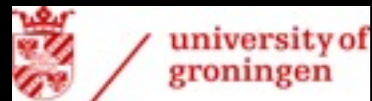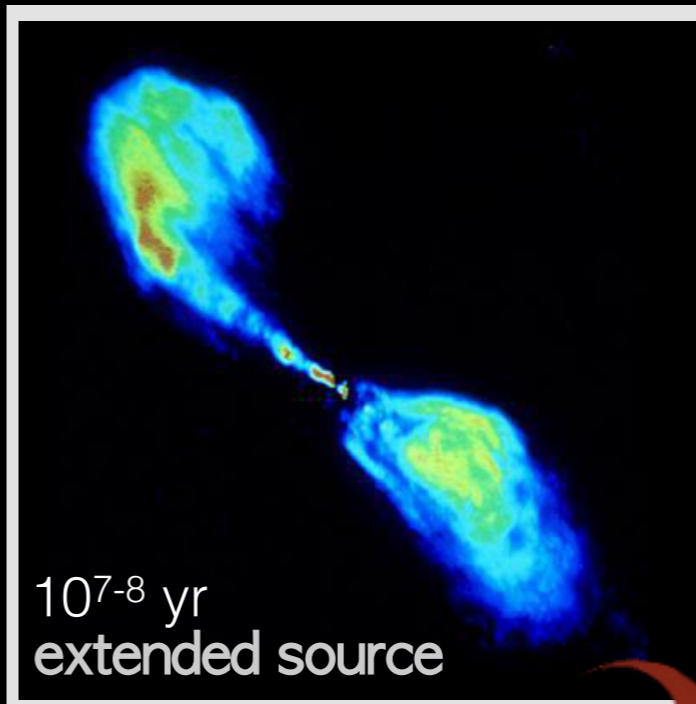# The fate of radio galaxies: a LOFAR perspective
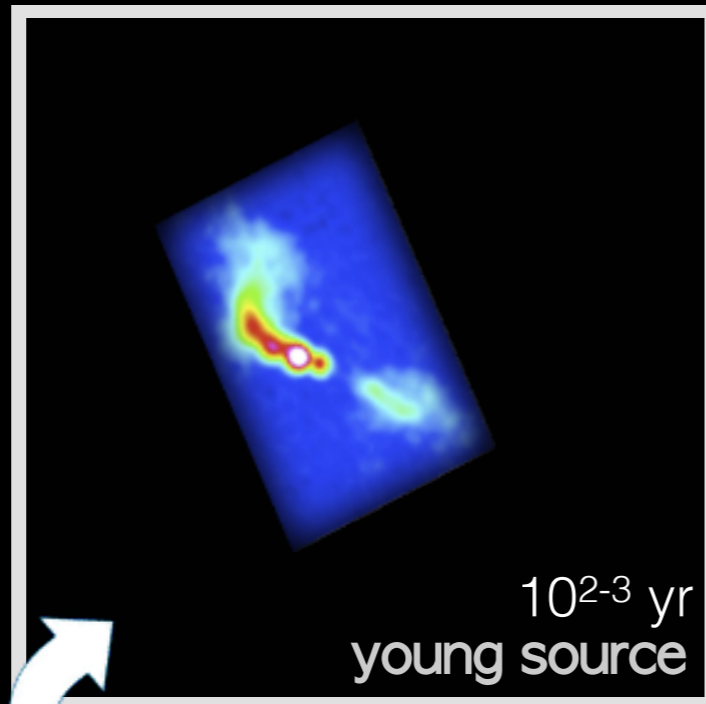
Marisa Brienza – LOFAR Science meeting 2015
Supervision: Morganti R., Godfrey L.

LOFAR

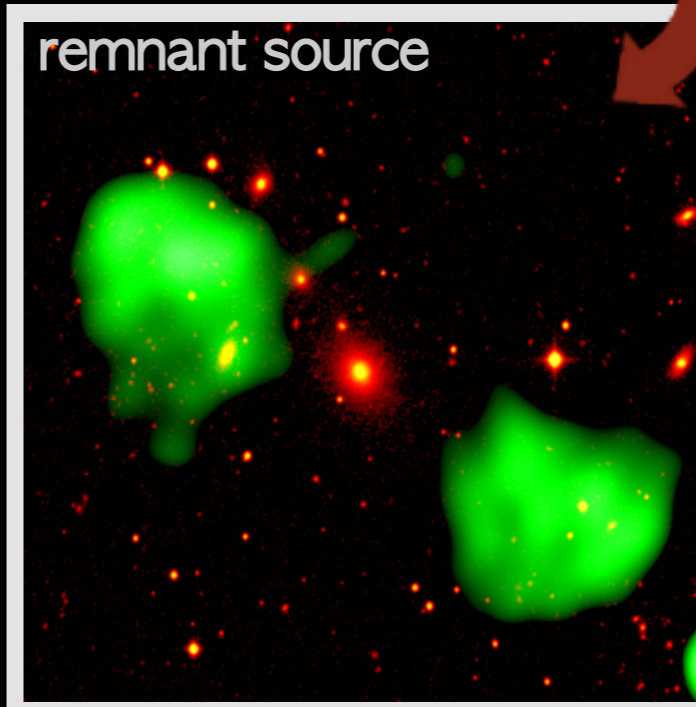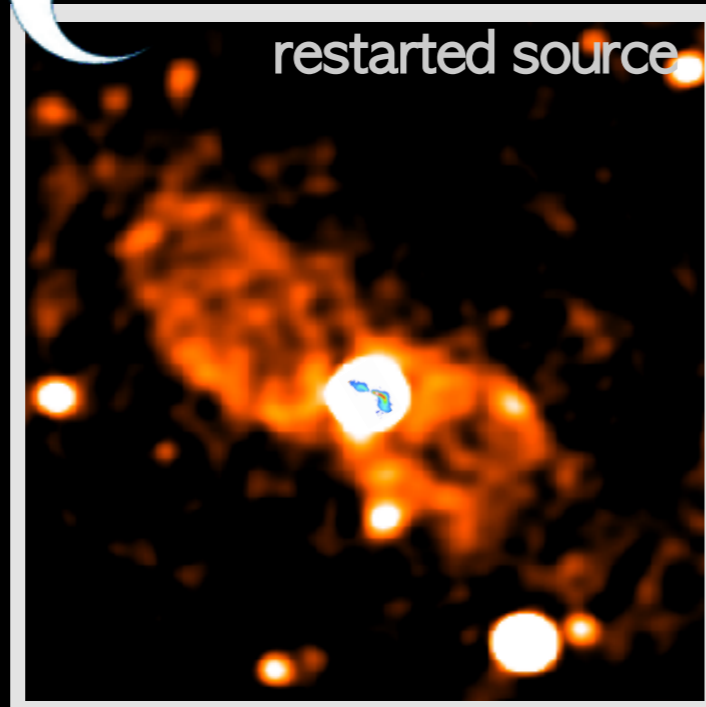★ High sensitivity at low frequency

★ Variety of resolutions

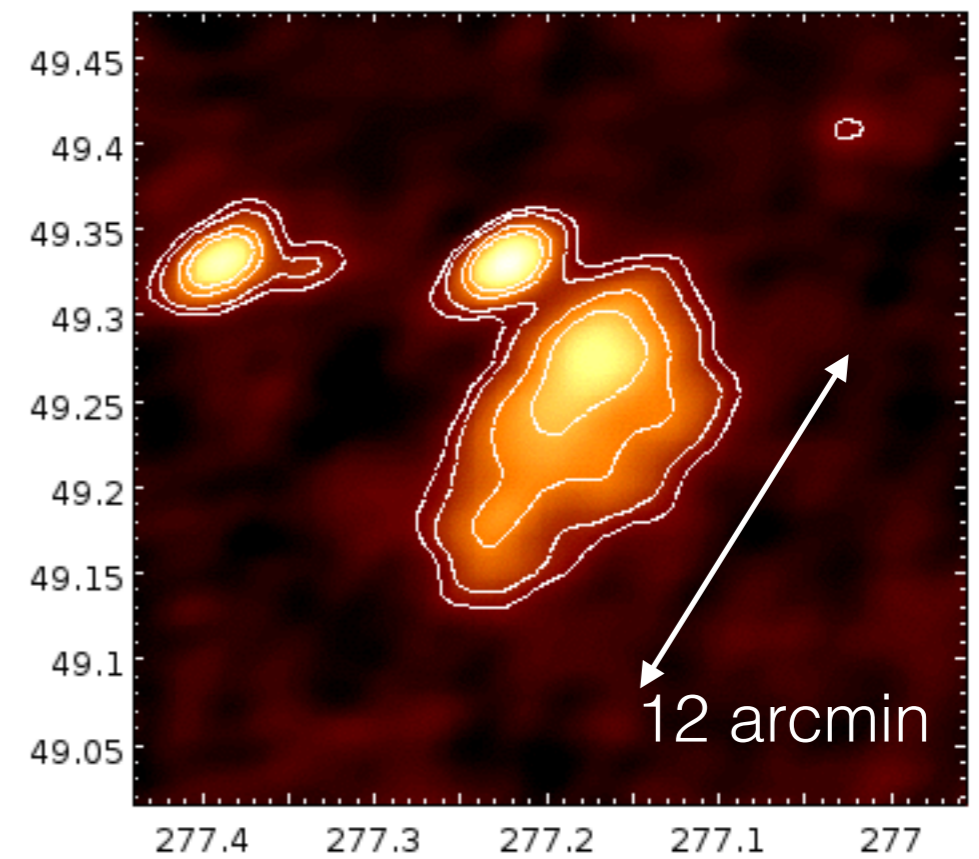# How?

★ Individual sources

★ New samples

TALK OVERVIEW

★ BLOB1: a serendipitous remnant radio galaxy discovered by LOFAR (Brienza et al. to be submitted)

★ B2 0258+35 a restarted radio galaxy as seen by LOFAR

★ Sample selection

BLOB1: a serendipitous discovery
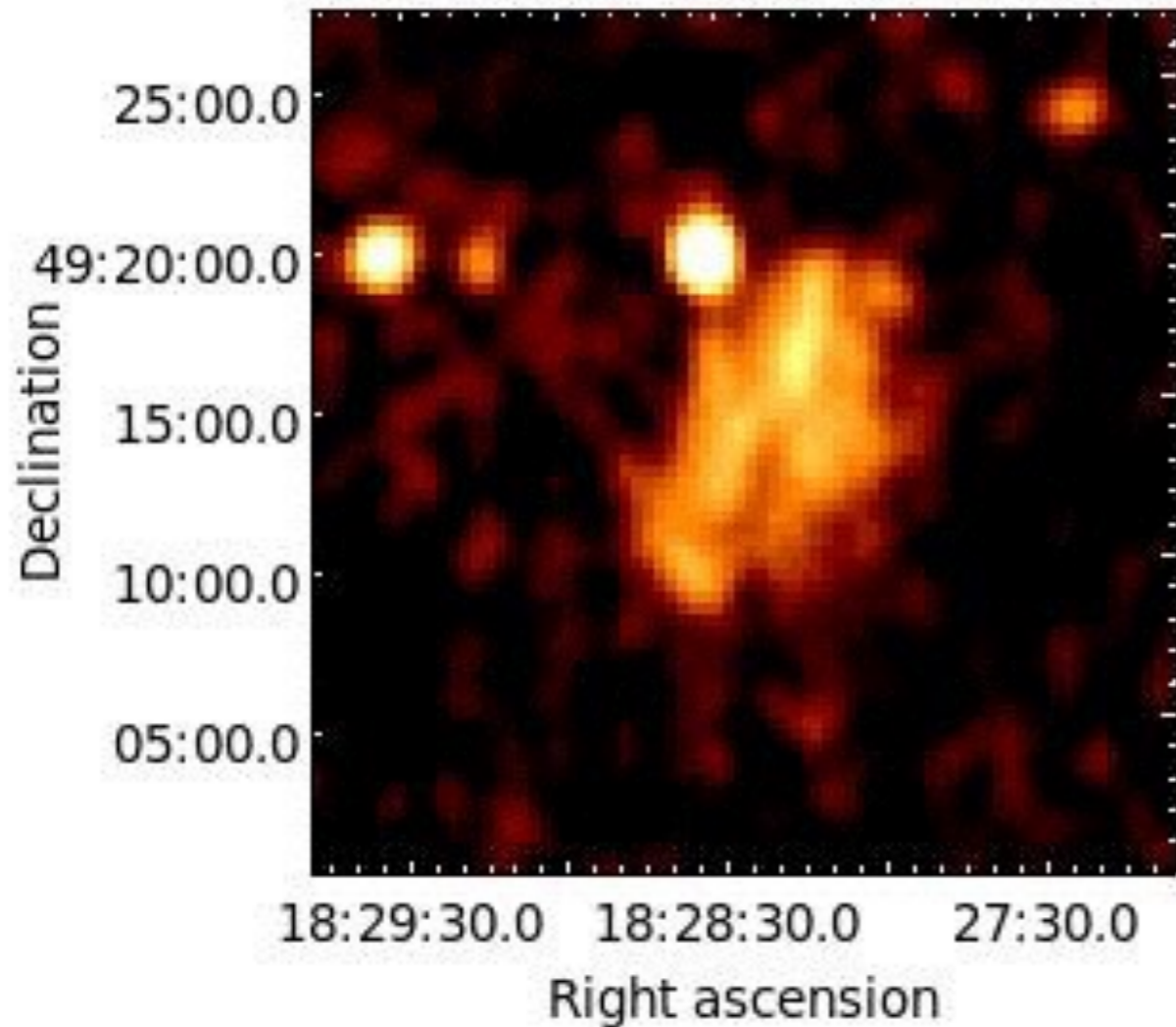LOFAR 150 MHz - 1' beam - noise 10mJy/beam - 8 MHz bandwidth
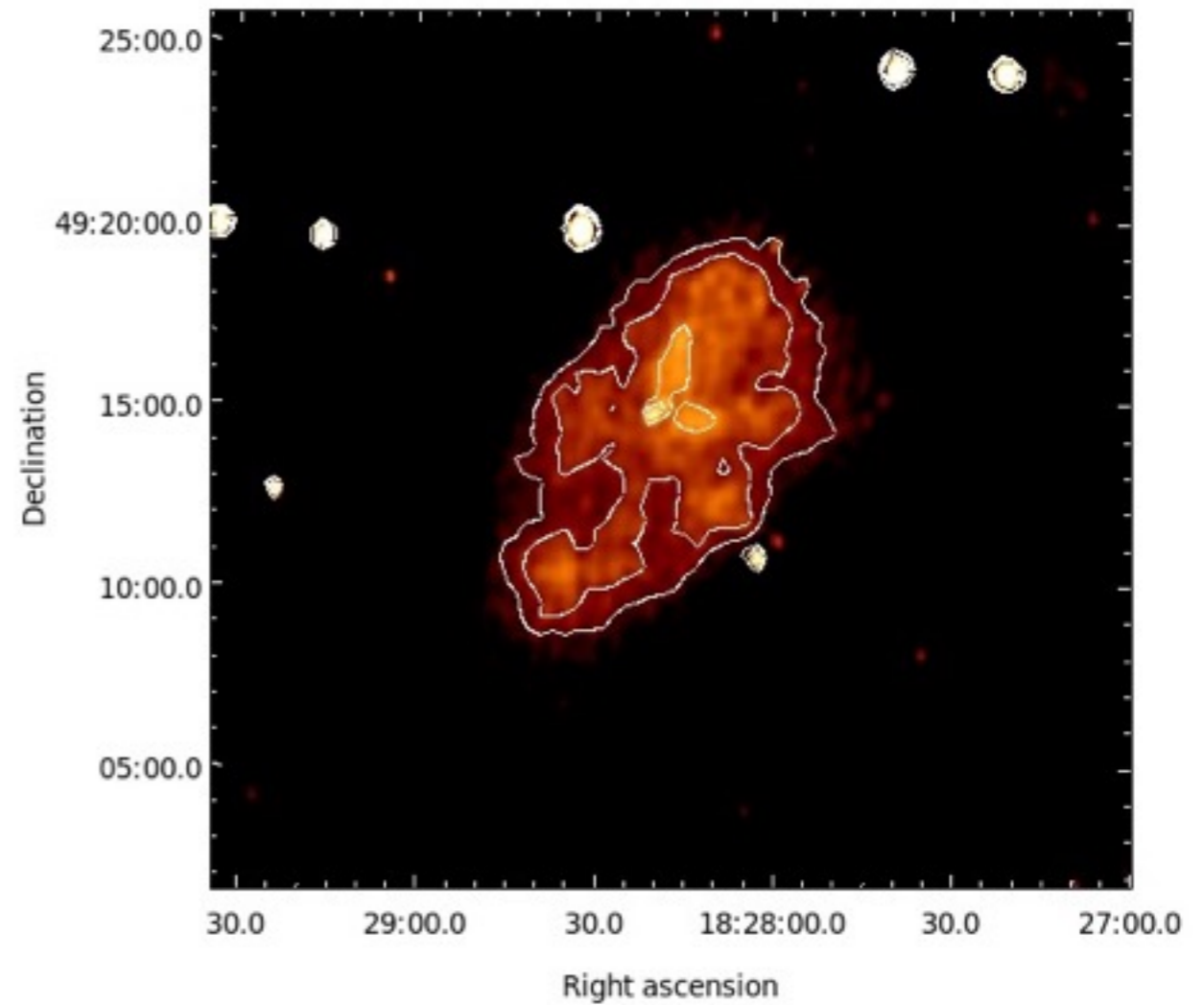
3C380

self-calibration pipeline
+
manual imaging

12 arcmin

Higher frequency
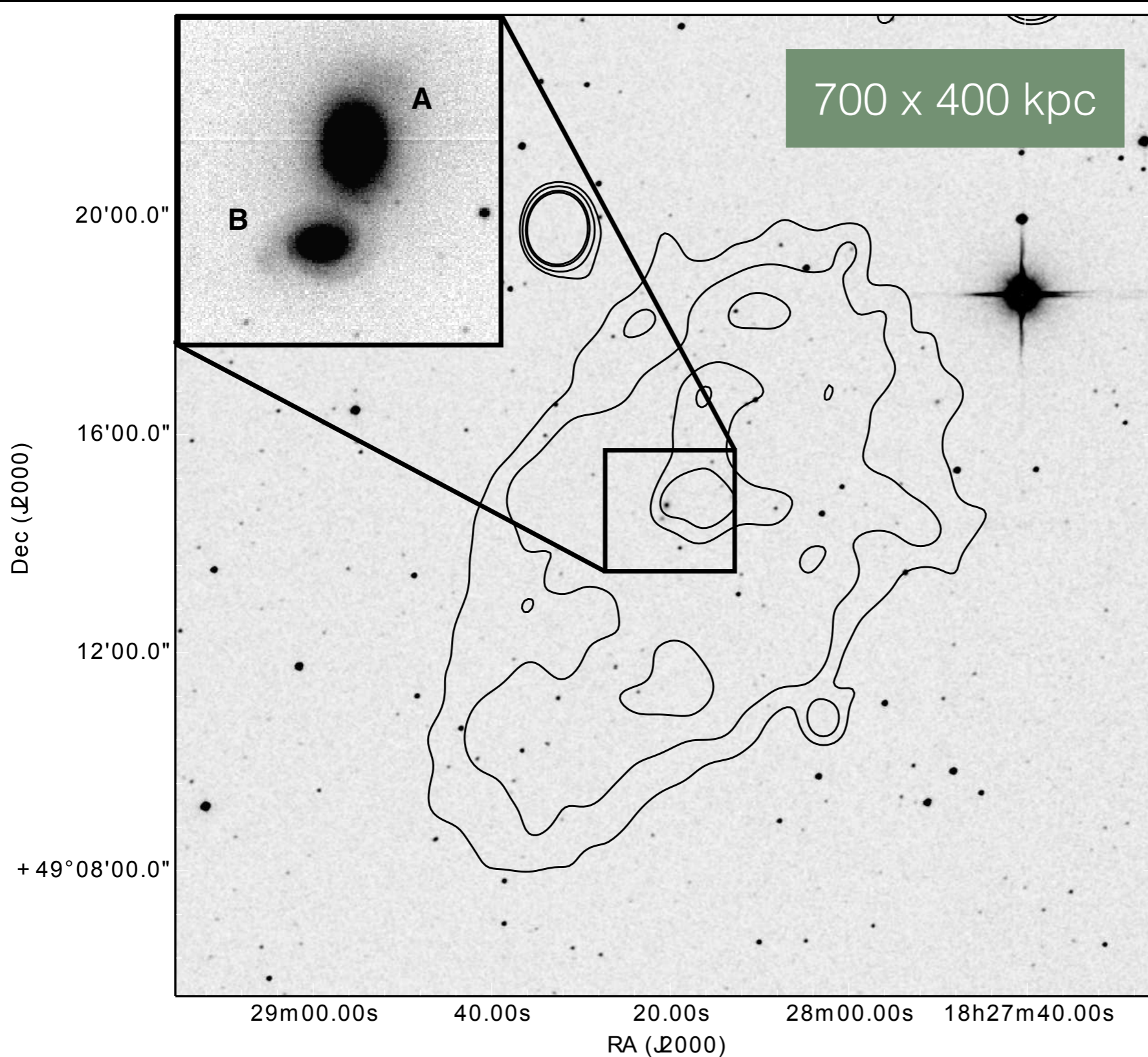
325 MHz

WENSS - 45' beam

GB6 5GHz upper limit

1400 MHz

WSRT - 35' beam
FOLLOW-UP

4 mJy/arcmin²
! not detected in surveys like NVSS

Host galaxy

700 x 400 kpc

Mag_1(K_s-band) = 12.9
Mag_2(K_s-band) = 13.8
from 2MASS
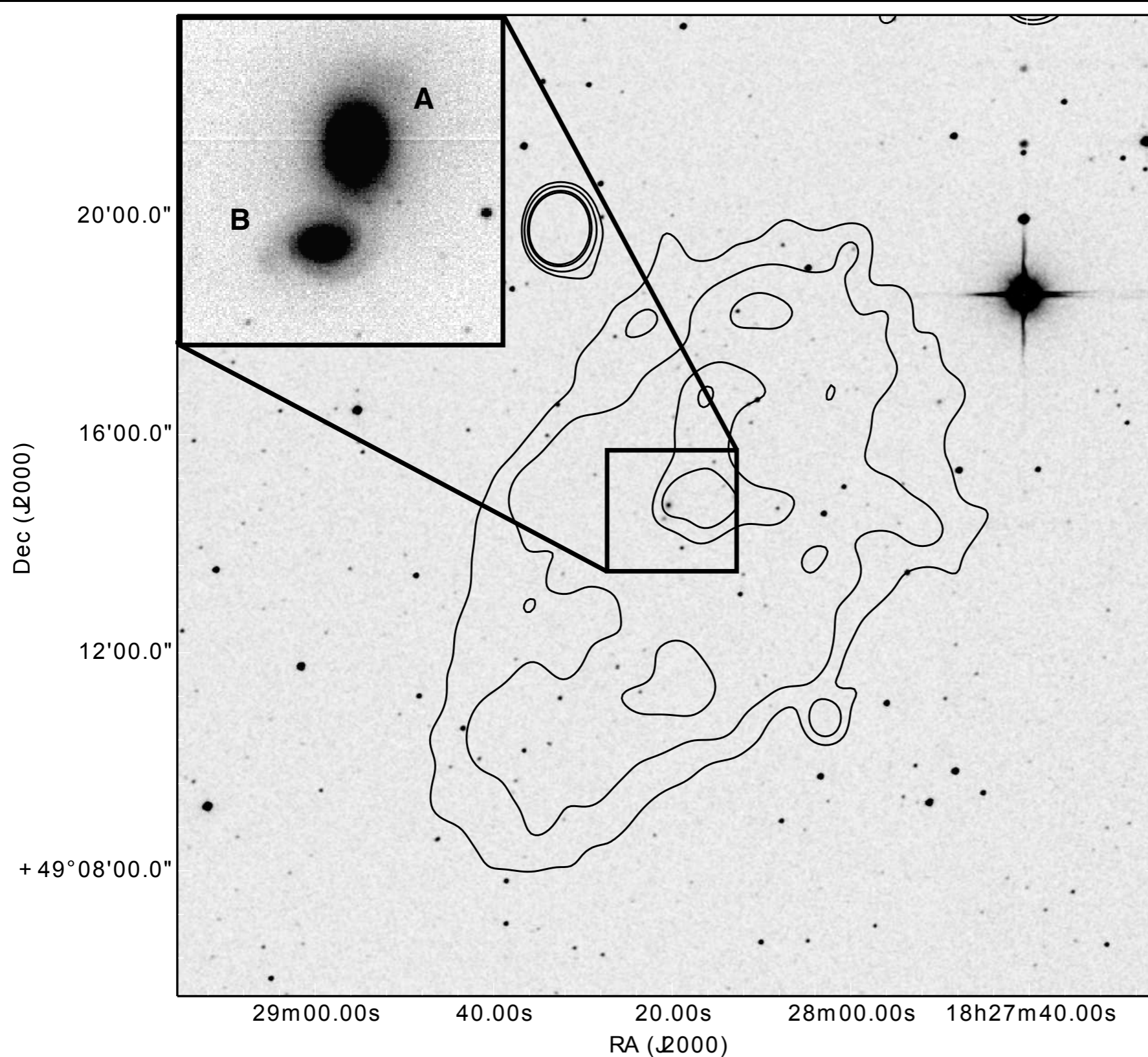
early type spectra,
no emission lines

z_A = 0.051
z_B = 0.052
WHT

Dynamical timescale
= d_{proj}/v_{rel}
= 15kpc/300kms^{-1}
= 60 Myr

interaction?

Host galaxy … and local environment

Morphology
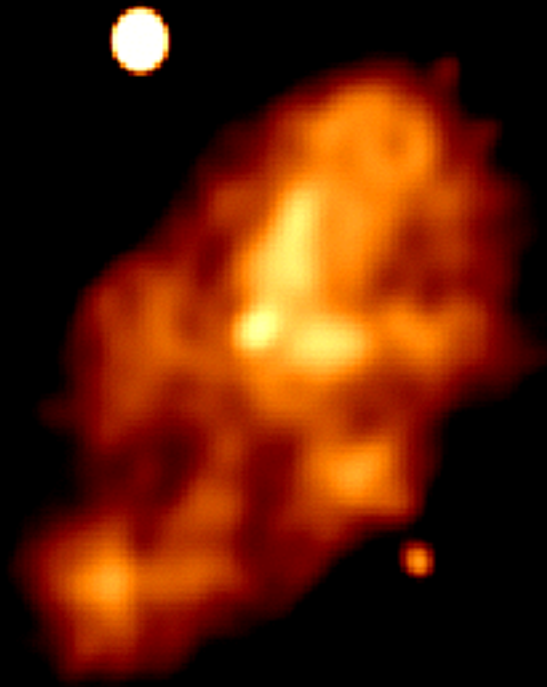
$L1.4GHz,tot = 1.4 \times 10^{24}$ W/Hz below FRI/FRII

- Axial ratio 1.8
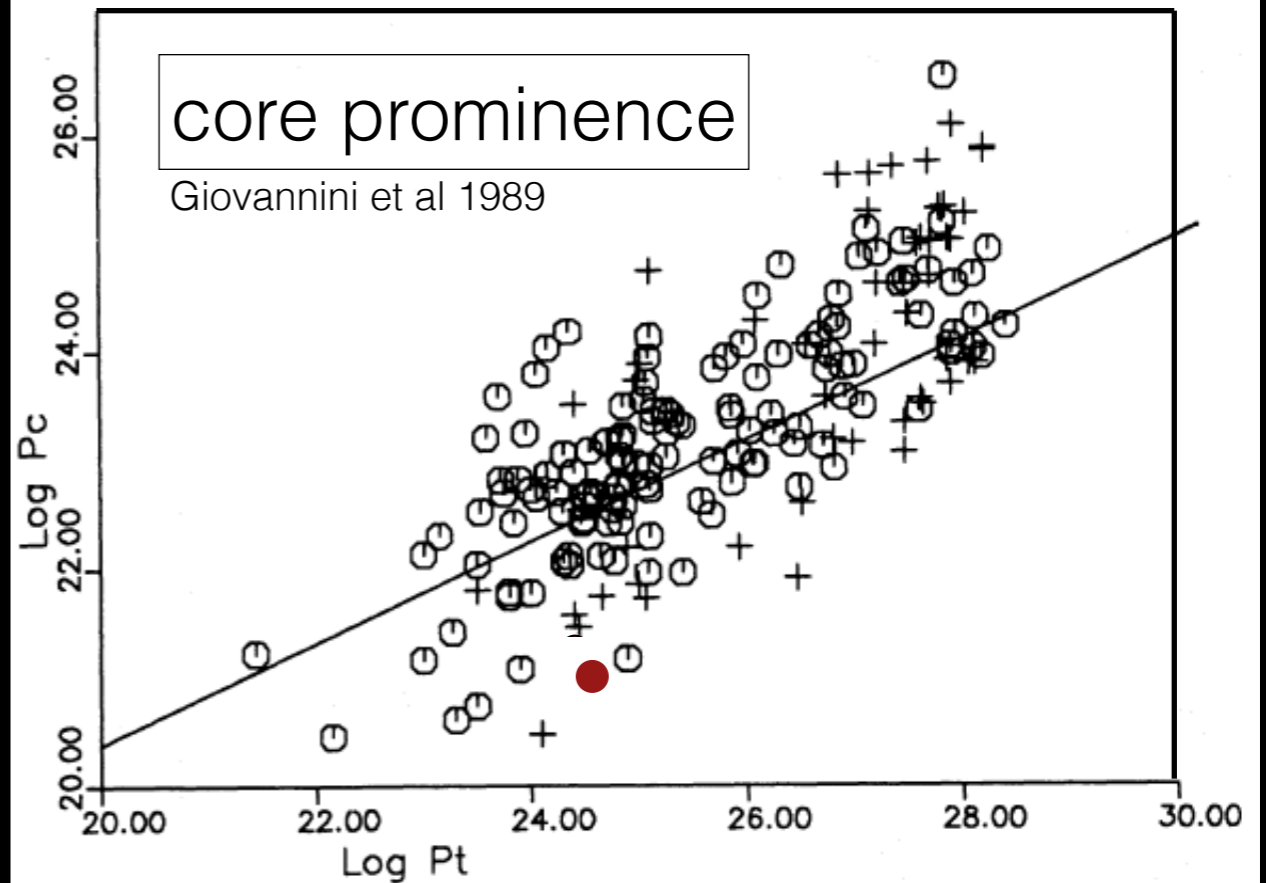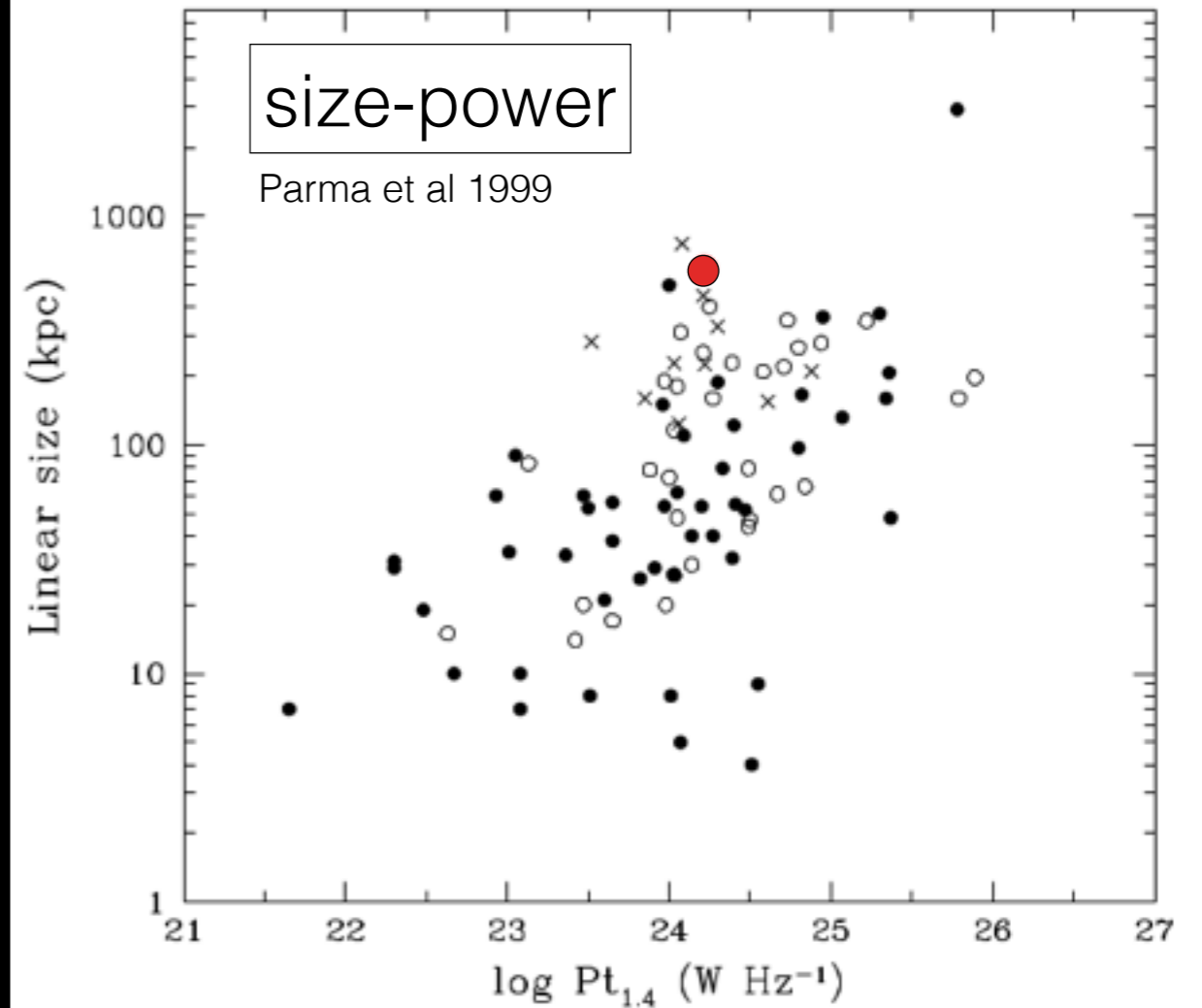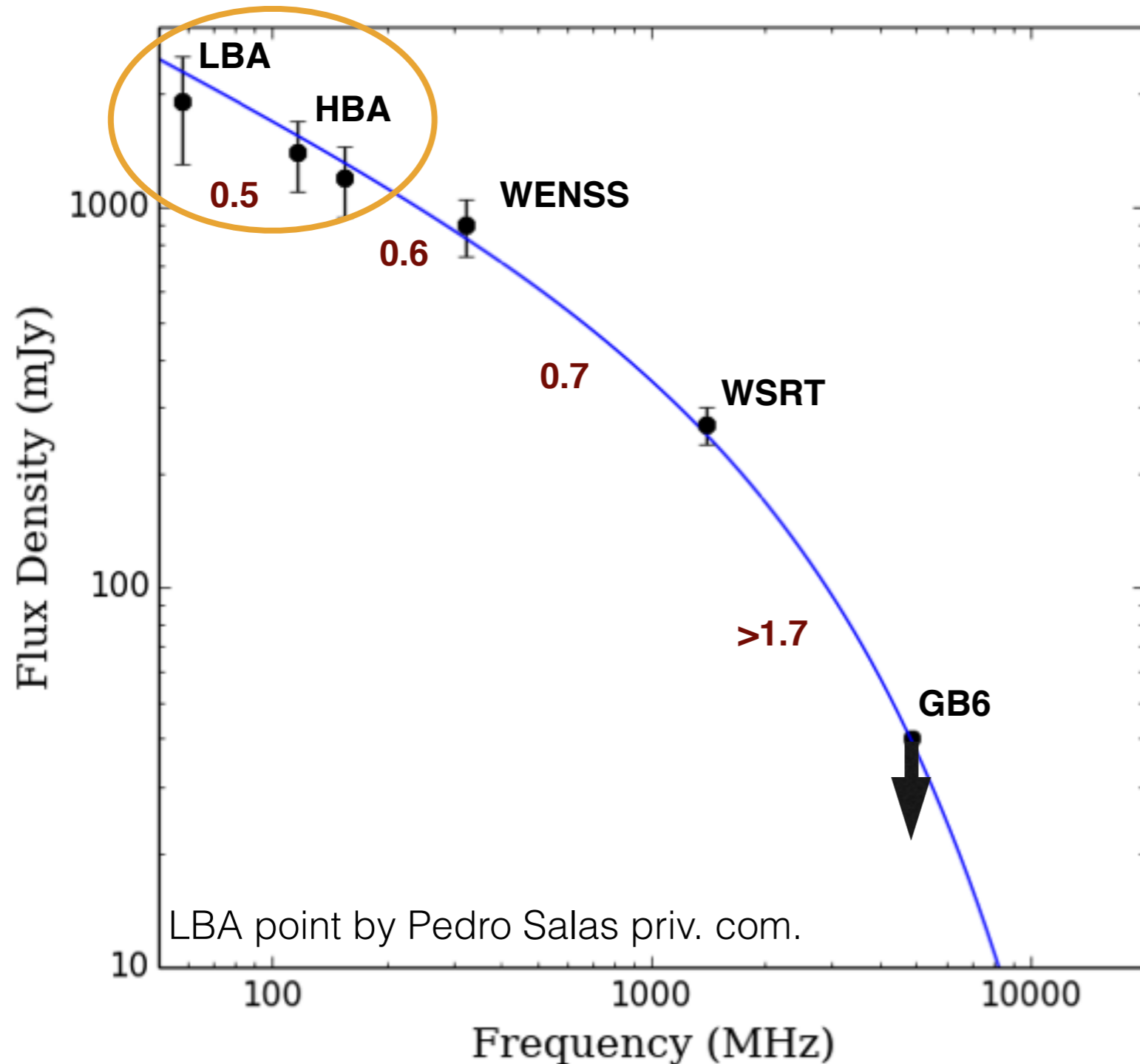- Core prominence 6e-4
- Broad features north west
- **Surface brightness
    at 1.4 GHz 4 mJy/arcmin²**

WHICH PROGENITOR?

size-power
Parma et al 1999

core prominence
Giovannini et al 1989

Spectral modeling : continuous injection + OFF (CIOFF)
(Komissarov et al. 94)

The case of B2 0258+35
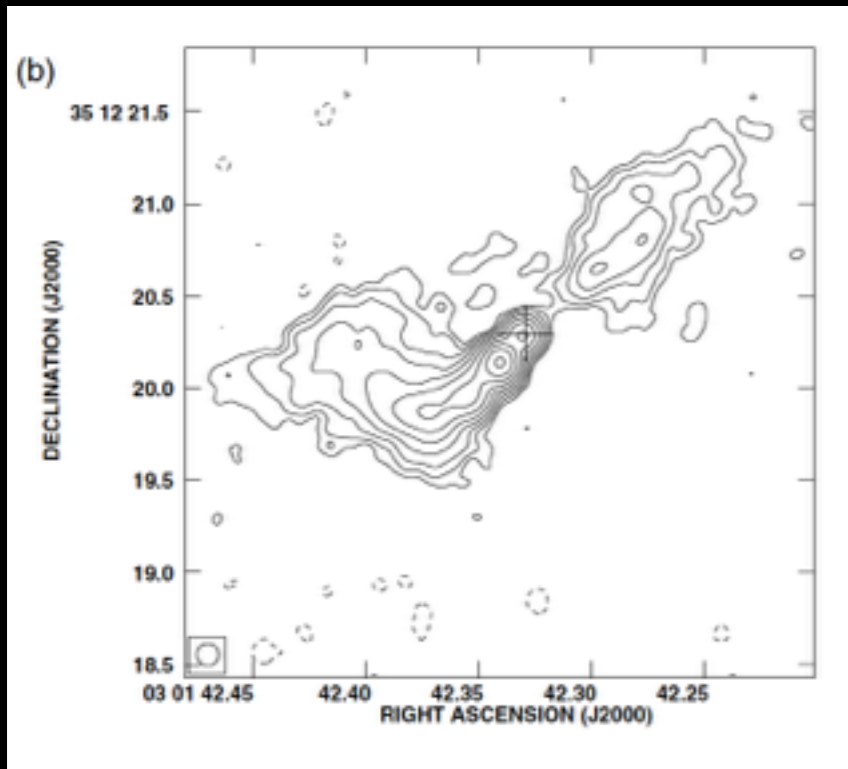
Field early-type galaxy NGC 1167 (z = 0.01651)

CSS source in the centre (Giroletti+2005, Giovannini+2001)
size 1.2 kpc
logL(408MHz)=24.37
age 9x10^5 yr

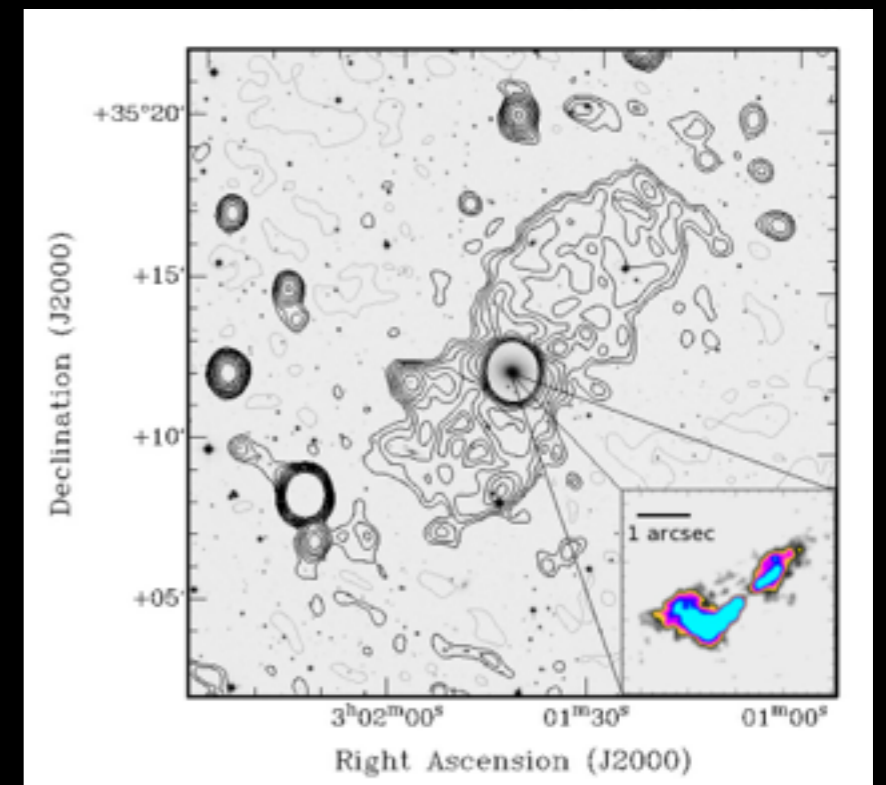Extended emission at 1.4 GHz (Shulevski+2012)
size 240 kpc
surface brightness 1.4 mJy/arcmin^2
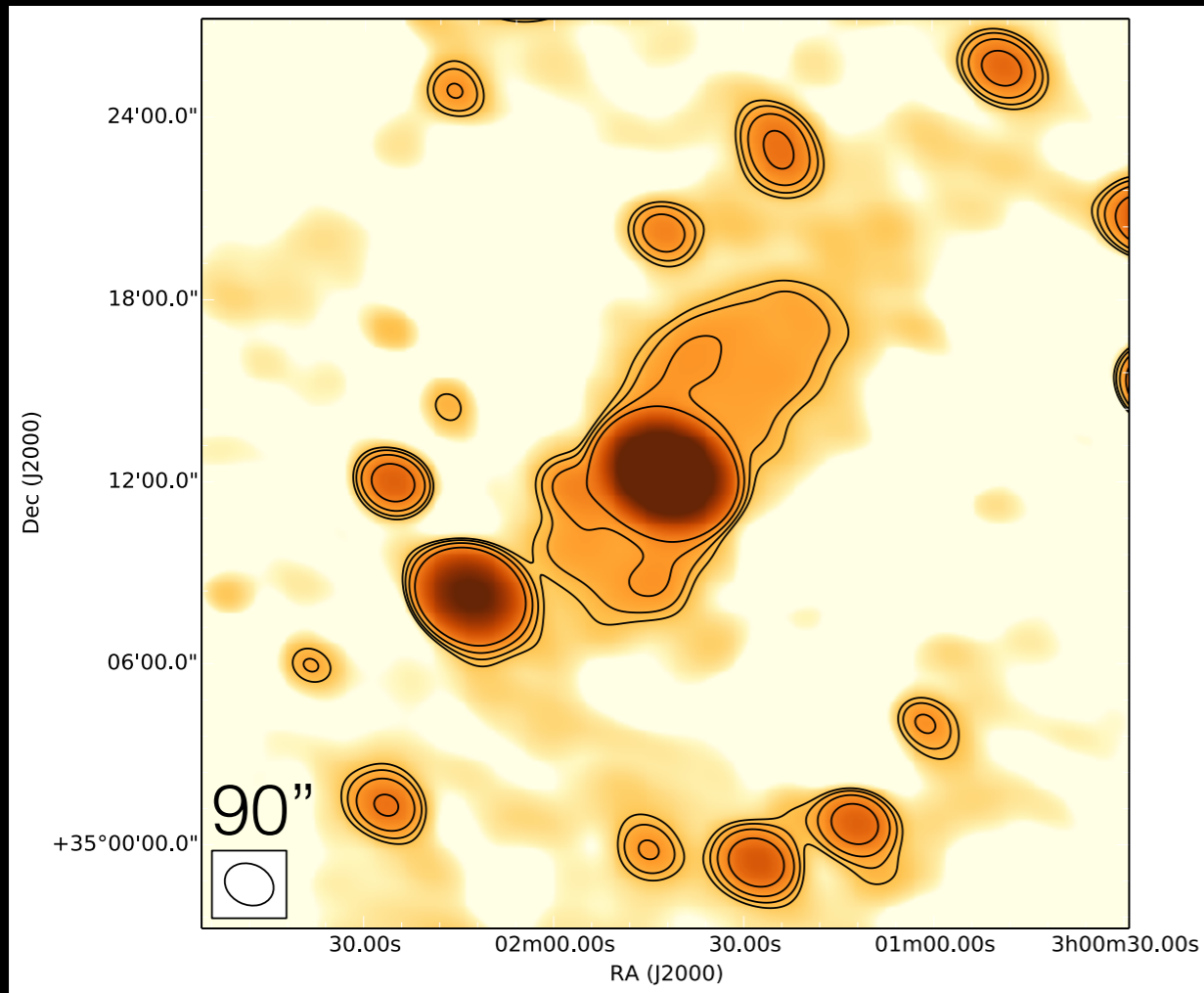age 80 Myr

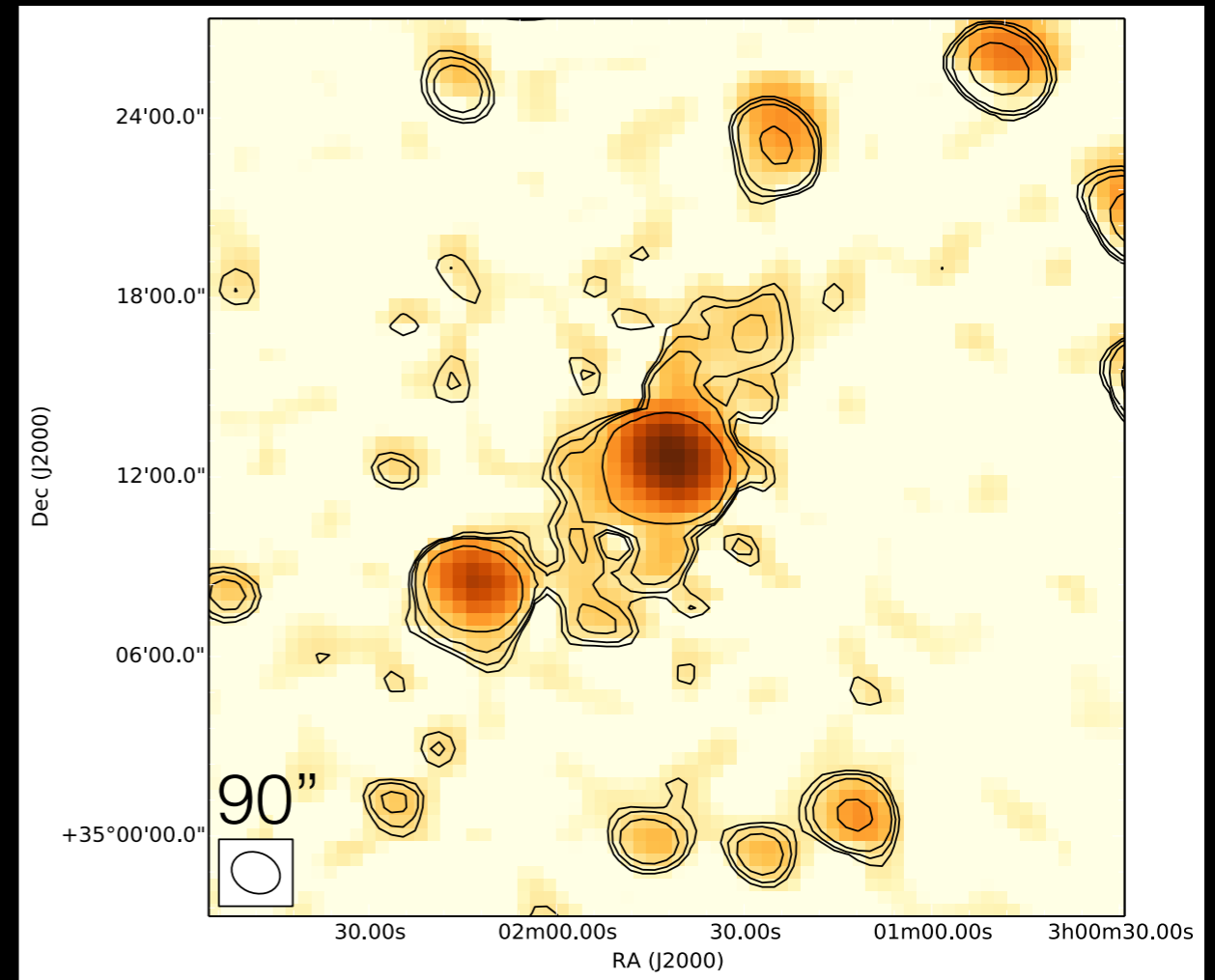Relic emission?

B2 0258+35
Low vs high frequency

Shulevski+2012

noise 0.7mJy x 2, 3, 5, 10
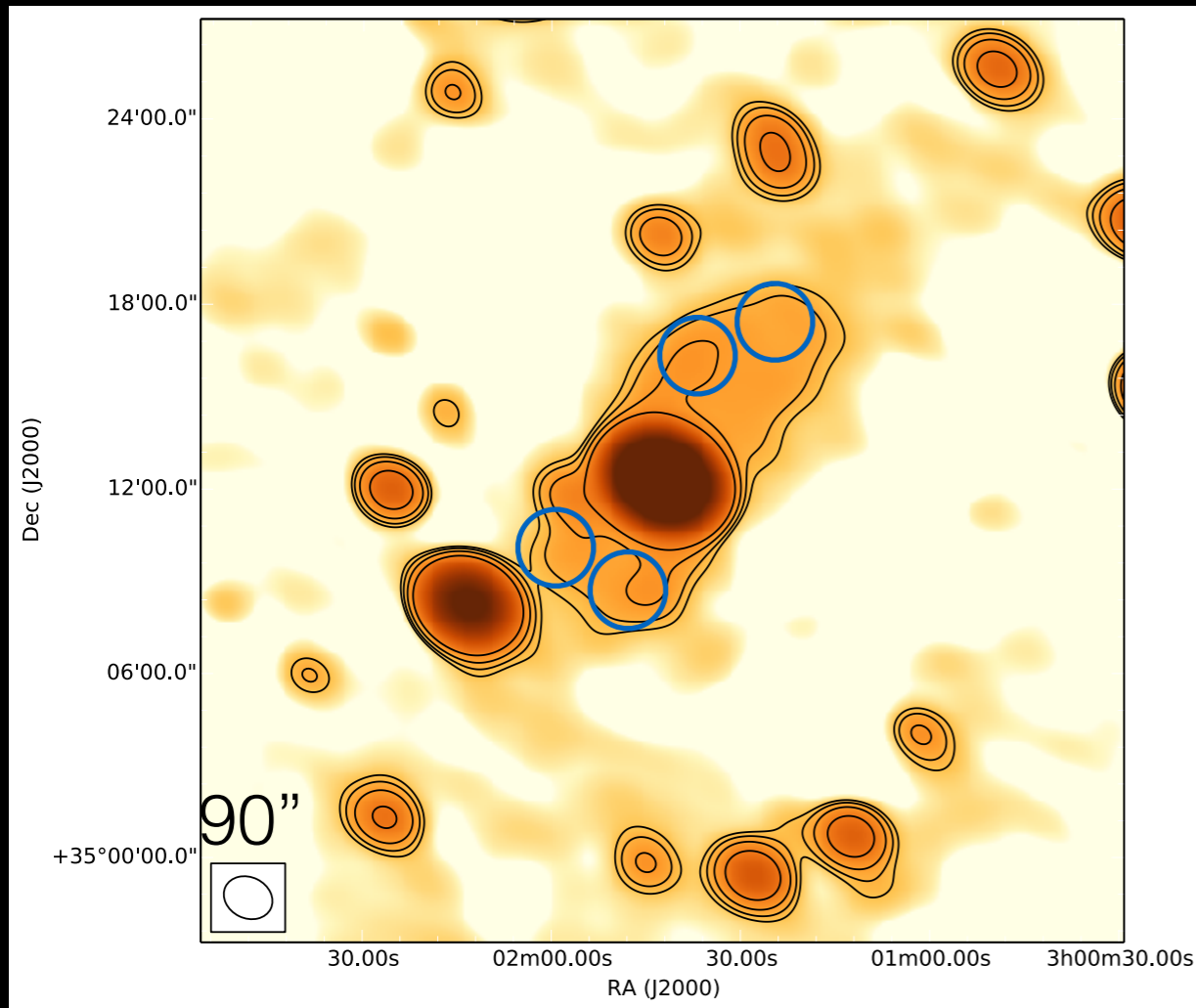
1.4 GHz

noise 3mJy x 2, 3, 5, 10
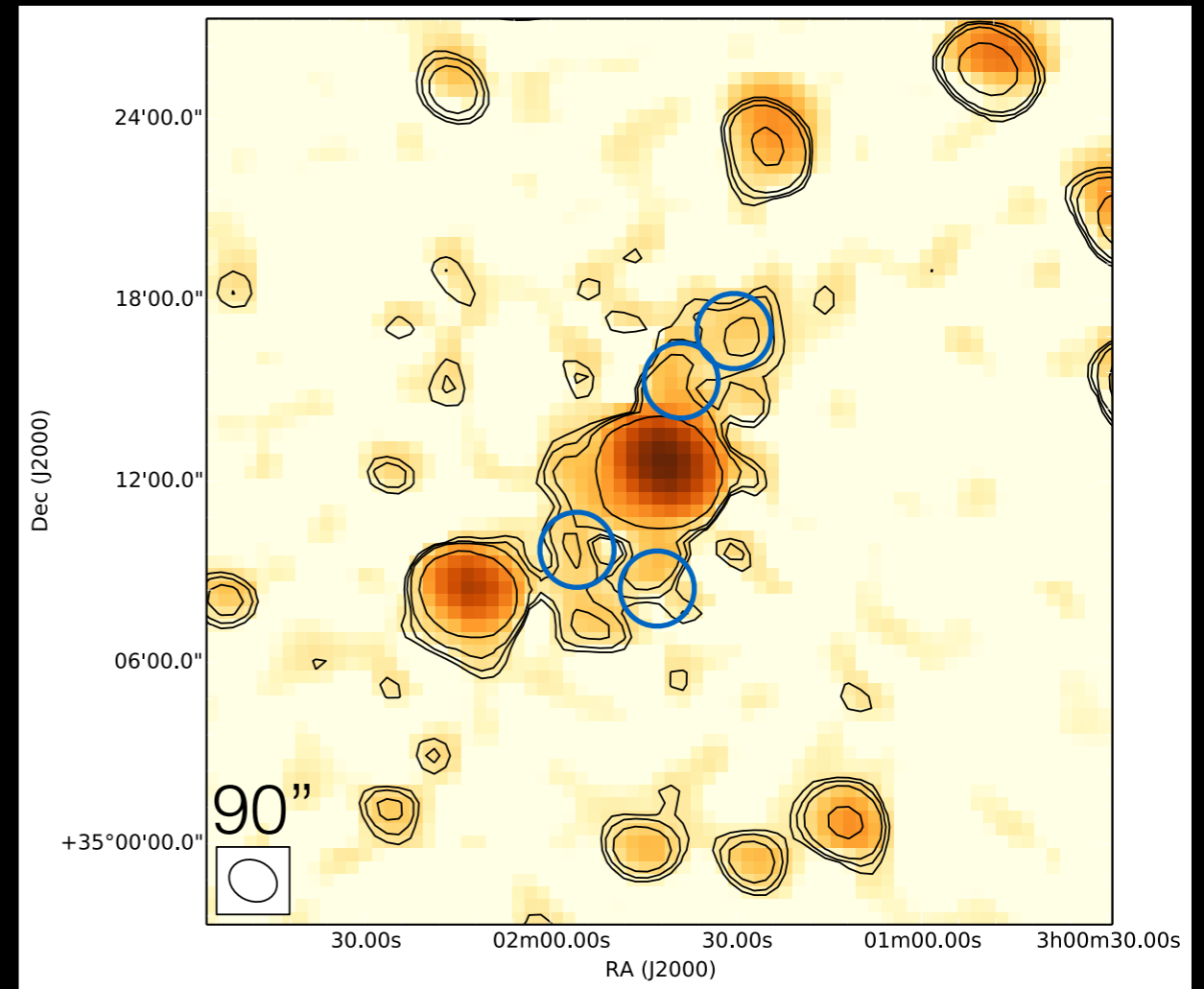
145 MHz

morphology match!

B2 0258+35
Low vs high frequency

Shulevski+2012

1.4 GHz

145 MHz

spectral index 0.5-0.6

VLA P-band + 5 GHz Effelsberg observations upcoming

Interpretation?

BLOB1

CenA
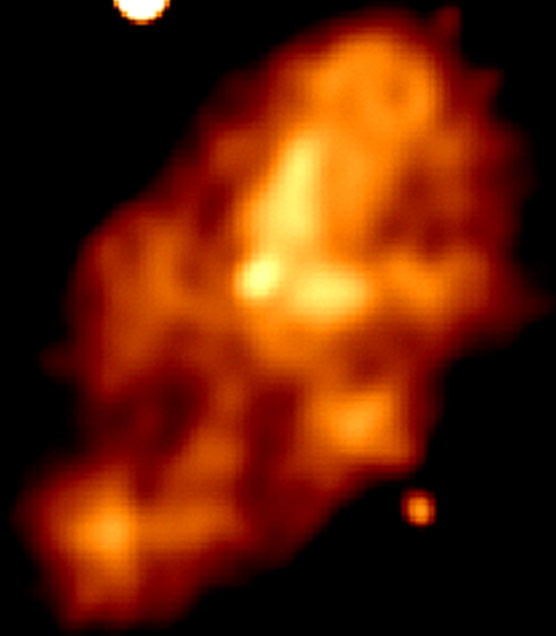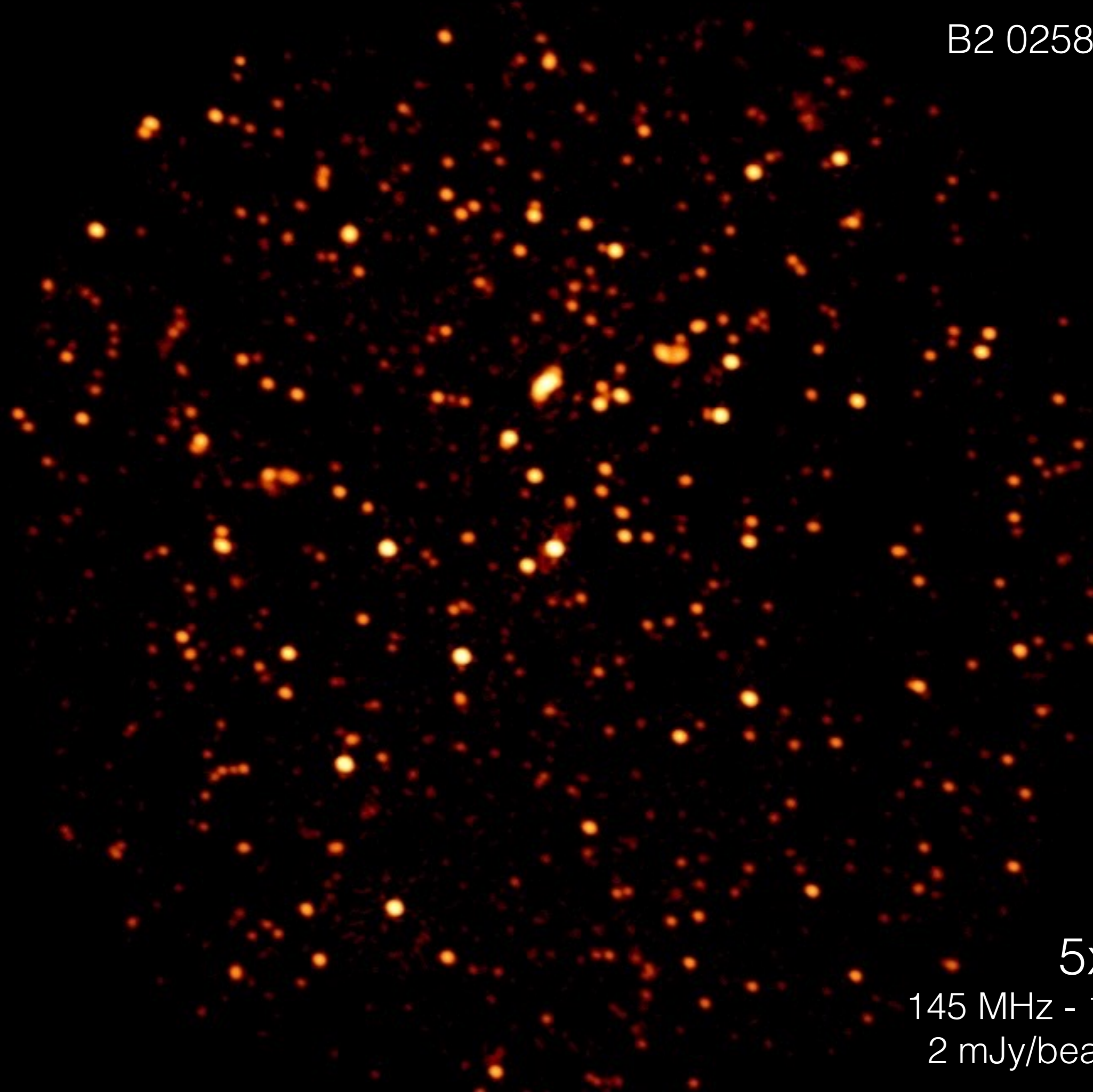
I. Feain et al. (CSIRO/ATNF)

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

Injection on-going
in the outer lobes
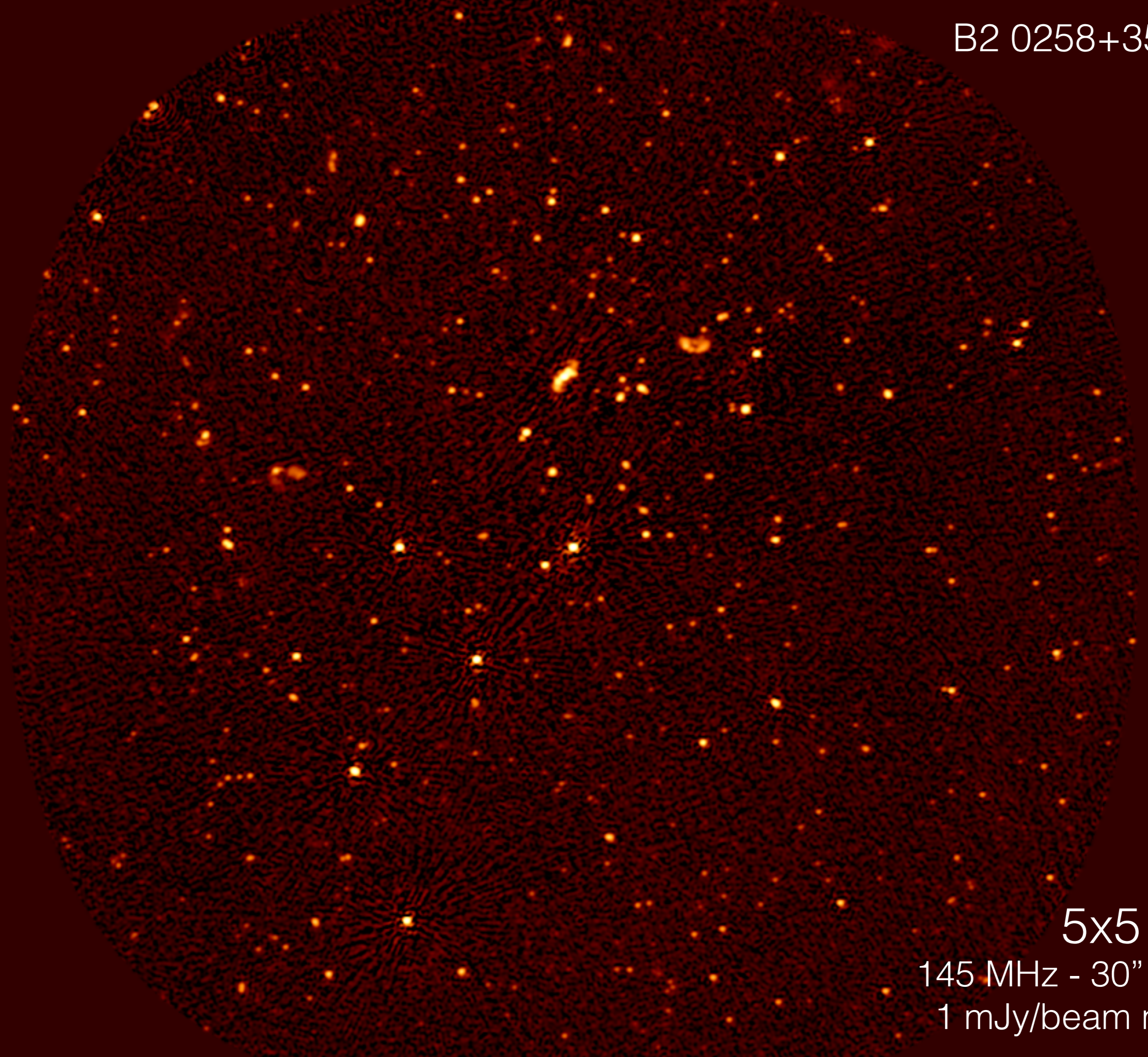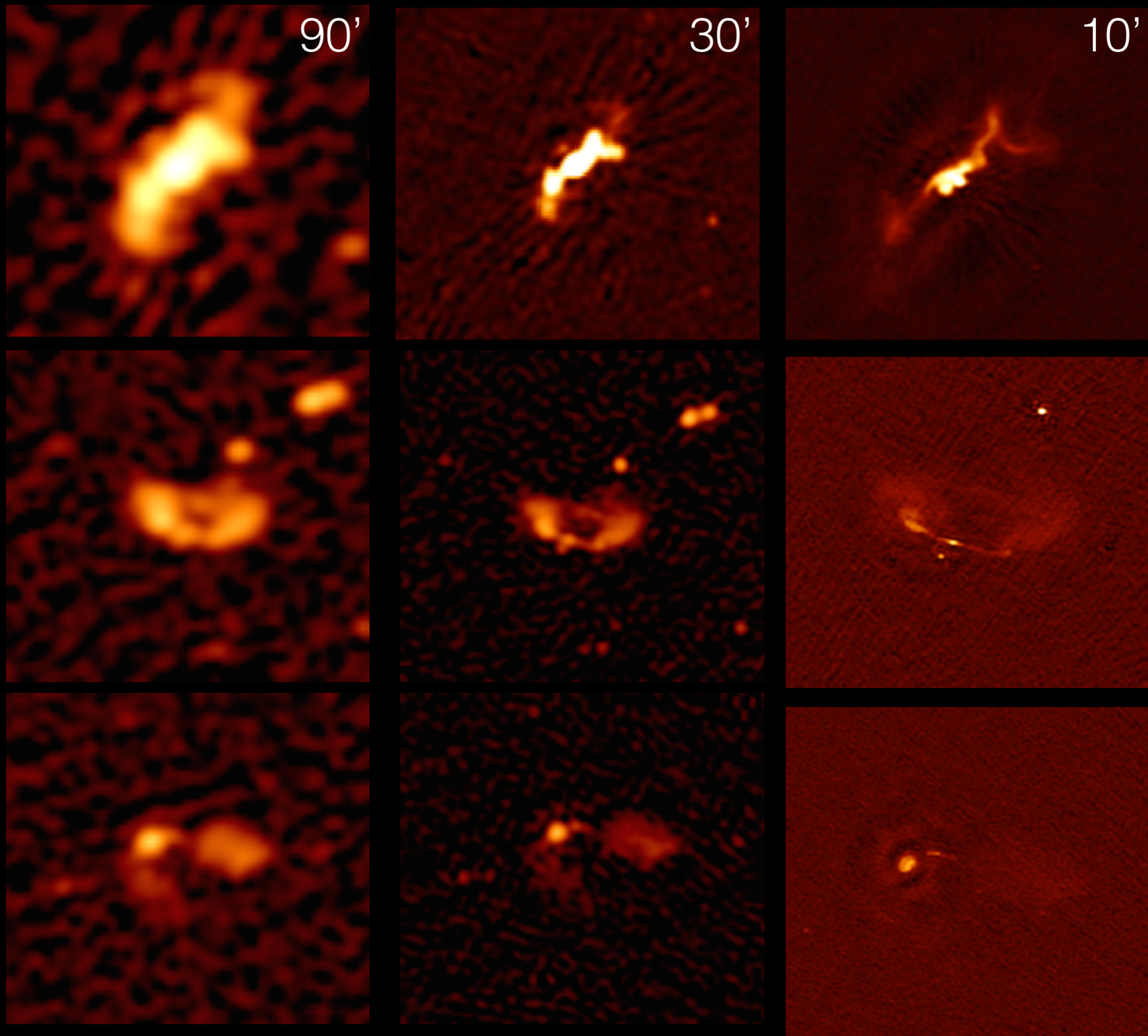
B2 0258+35 field

5x5 deg
145 MHz - 1.5' beam
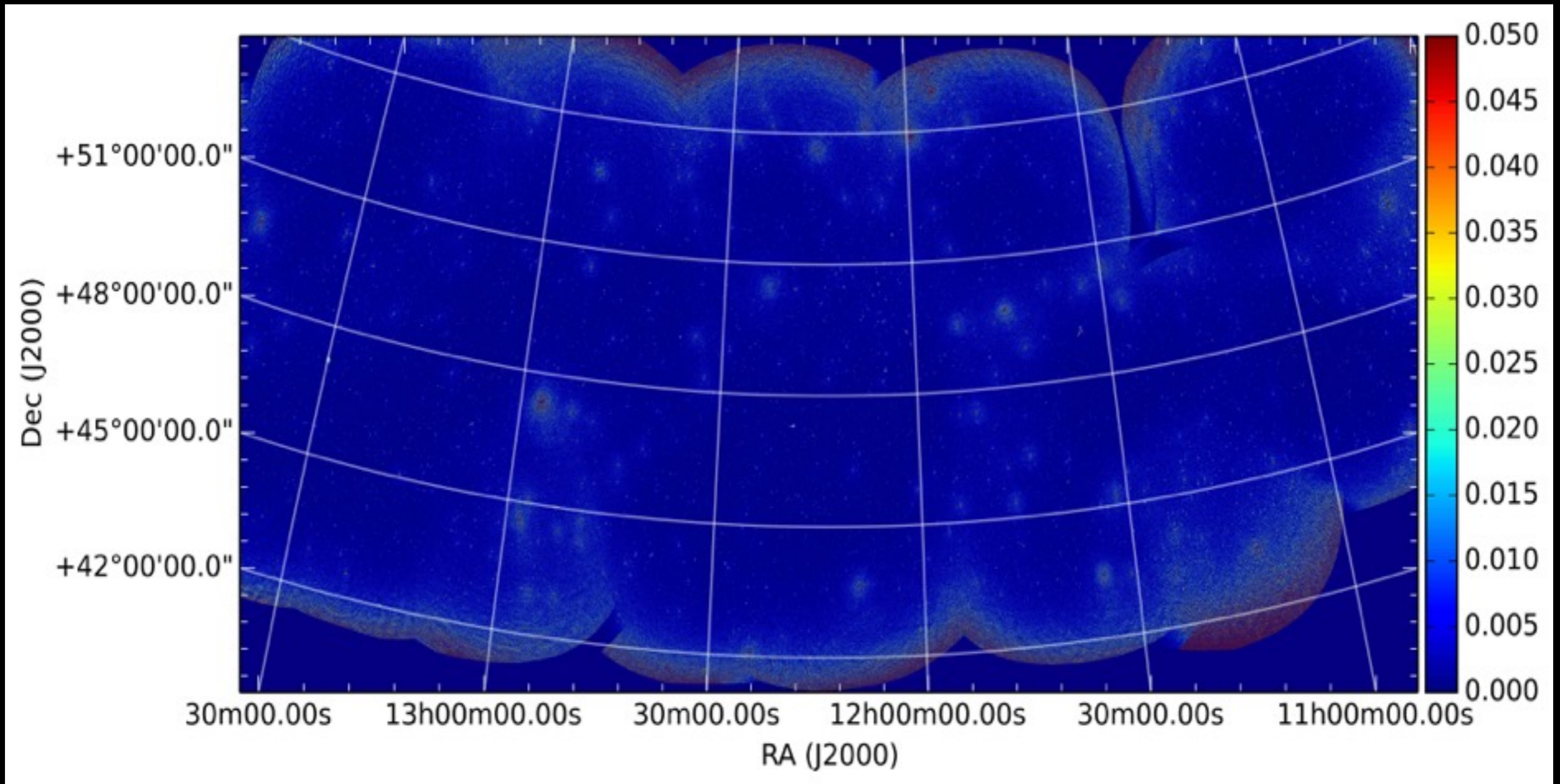2 mJy/beam noise

B2 0258+35 field

5x5 deg
145 MHz - 30" beam
1 mJy/beam noise

Extended sources in the field

LOFAR Tier-1 survey

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

Selection criteria

?

Selection - 1

Steep spectral index at low frequency alpha > 1.2

Parma+2007, Dwarakanath +2009, van Weeren+2009 **using VLSS-WENSS-NVSS**
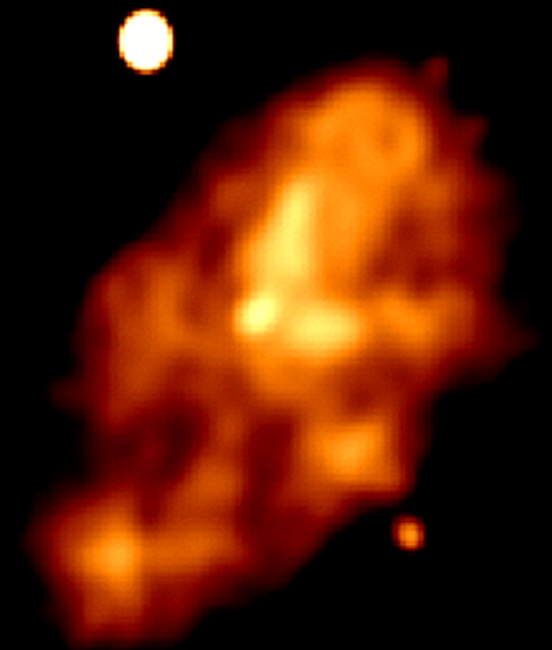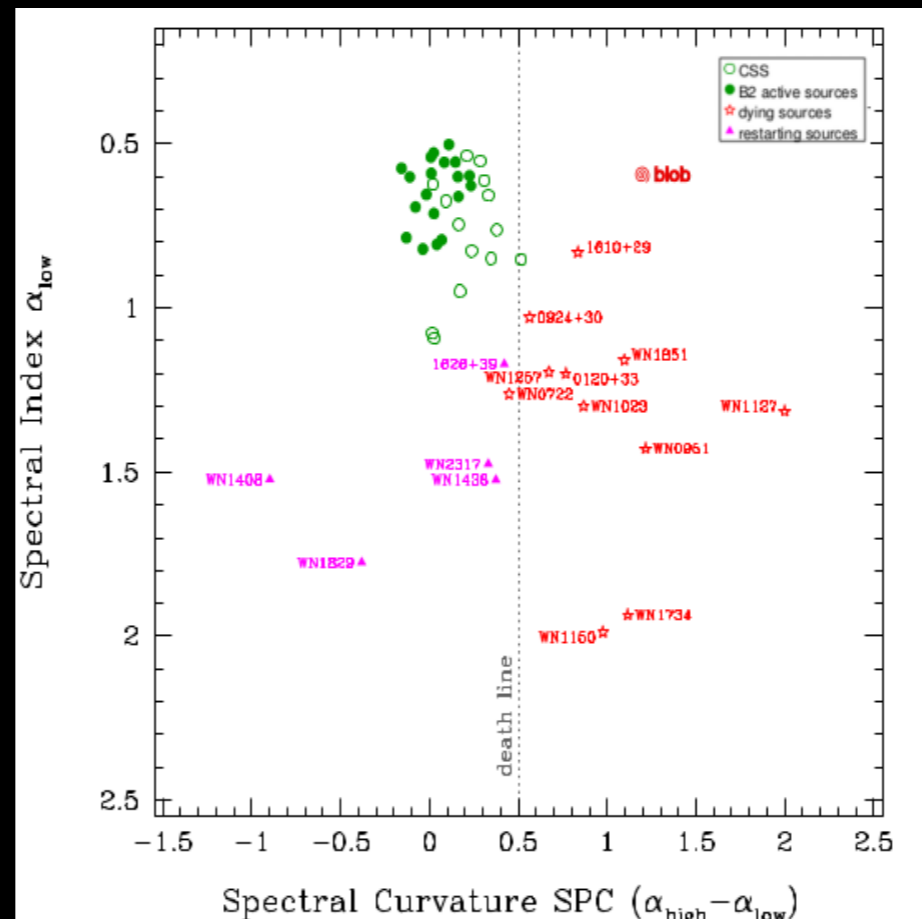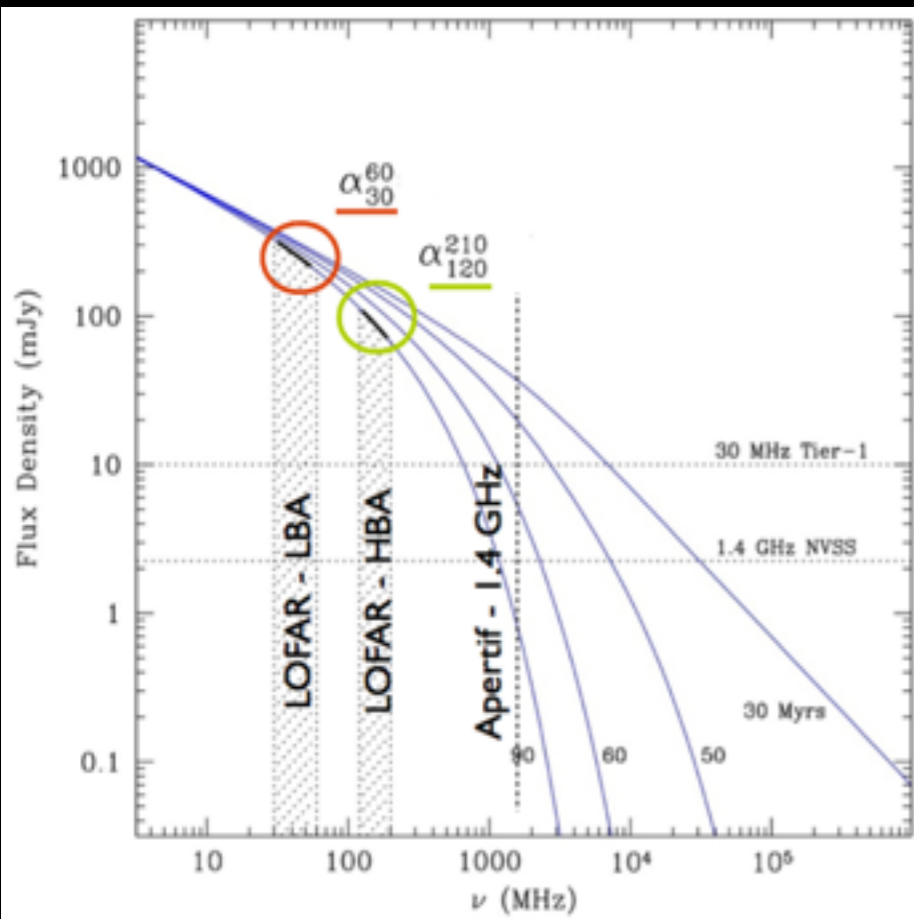
Selection - 2

Spectral curvature SPC = alpha(low)-alpha(high) > 0.5

Murgia+2011 **using VLSS-WENSS-NVSS + follow up**

Selection - 3

Morphology = low surface brightness + lack/weak compact components

Saripalli+2012, Jones2001 **using ATLBS, VLSS**

courtesy of M. Murgia

Summary

Remnants radio galaxy can show
a variety of physical properties:

★ steep or not-so-steep spectral indices
★ survive outside clusters for comparable
time as inside clusters
★ still fuelled by renewed activity

need for new **complete samples** to assess our knowledge on
the remnant phase evolution (as function of power, environment..)

which **selection criteria**?
-spectral index
-spectral curvature
-morphology