ASTRON

LOFAR

Netherlands Institute for Radio Astronomy

A LOFAR view of the radio relic B2 0924+30

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LSM
01.04.2015
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Setup and processing

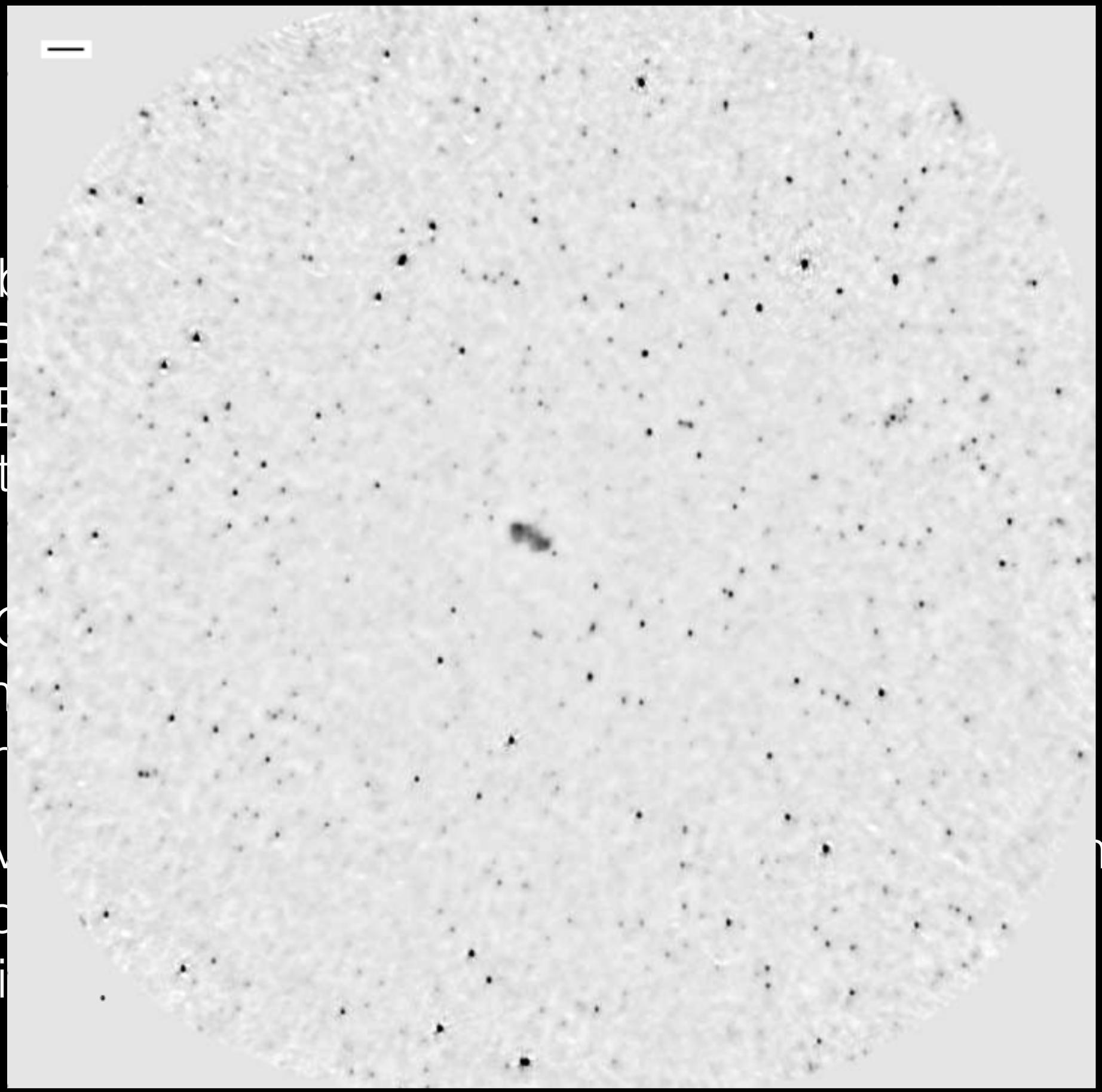
- Observed on 13.03.2014
- LBA+HBA
- HBA - 7.5 hrs.
- interleaved, 3C196 2 min., target 30 min.

- AO flagged, de-mixed
- amplitudes corrected - obs. pipeline
- phase calibration, imaging - selfcal.py

- Averaged 7 images, 20 SBs each, low and high res.
- Low res - 60” x 43”, 2 mJy/b
- High res - 22” x 22”, 2 mJy/b

- Ob
- LB
- HB
- int

- AC
- an
- ph
- Av
- Lo
- Hi



res.

- Ob
- LE
- HE
- int
- AG
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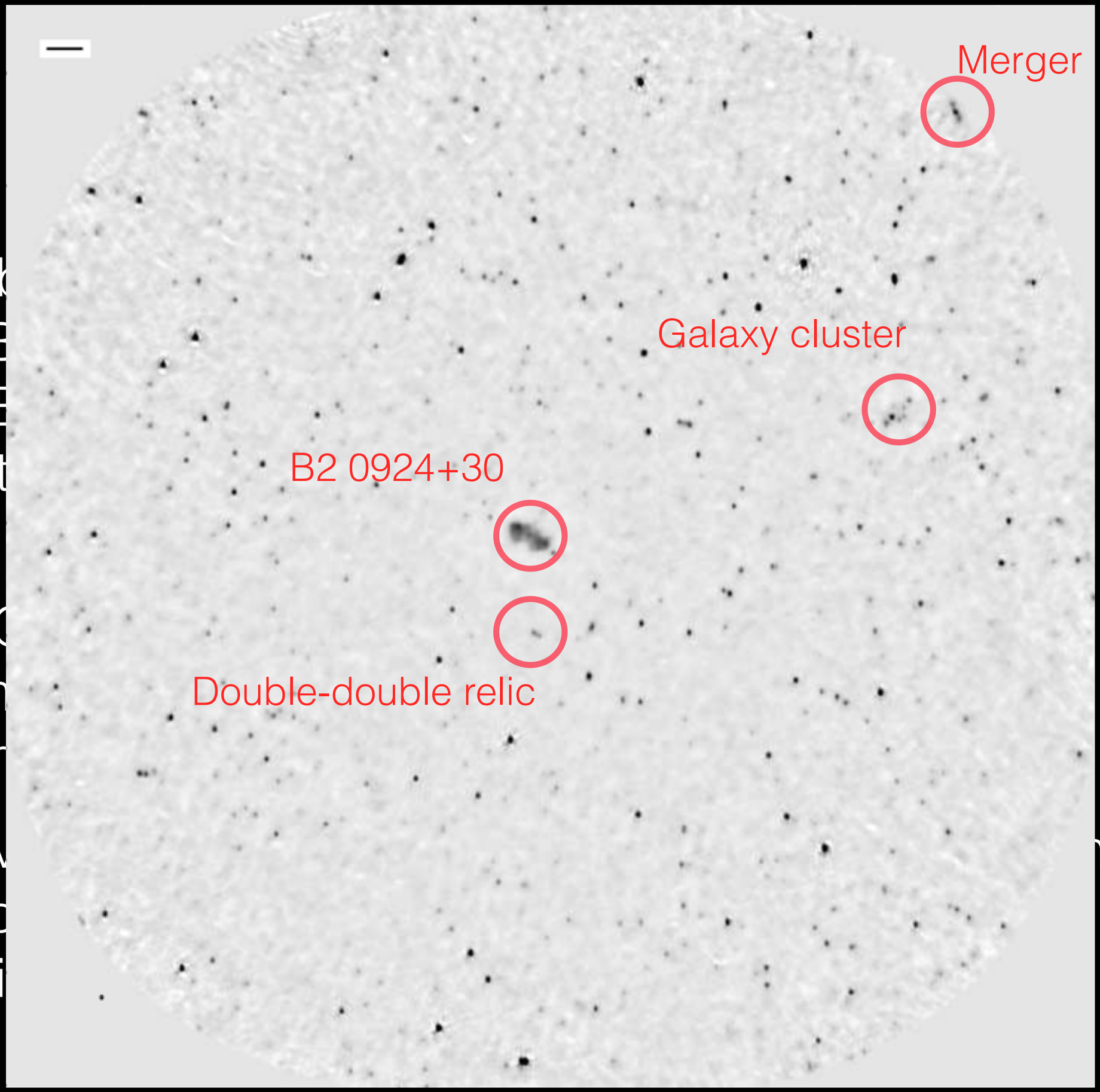
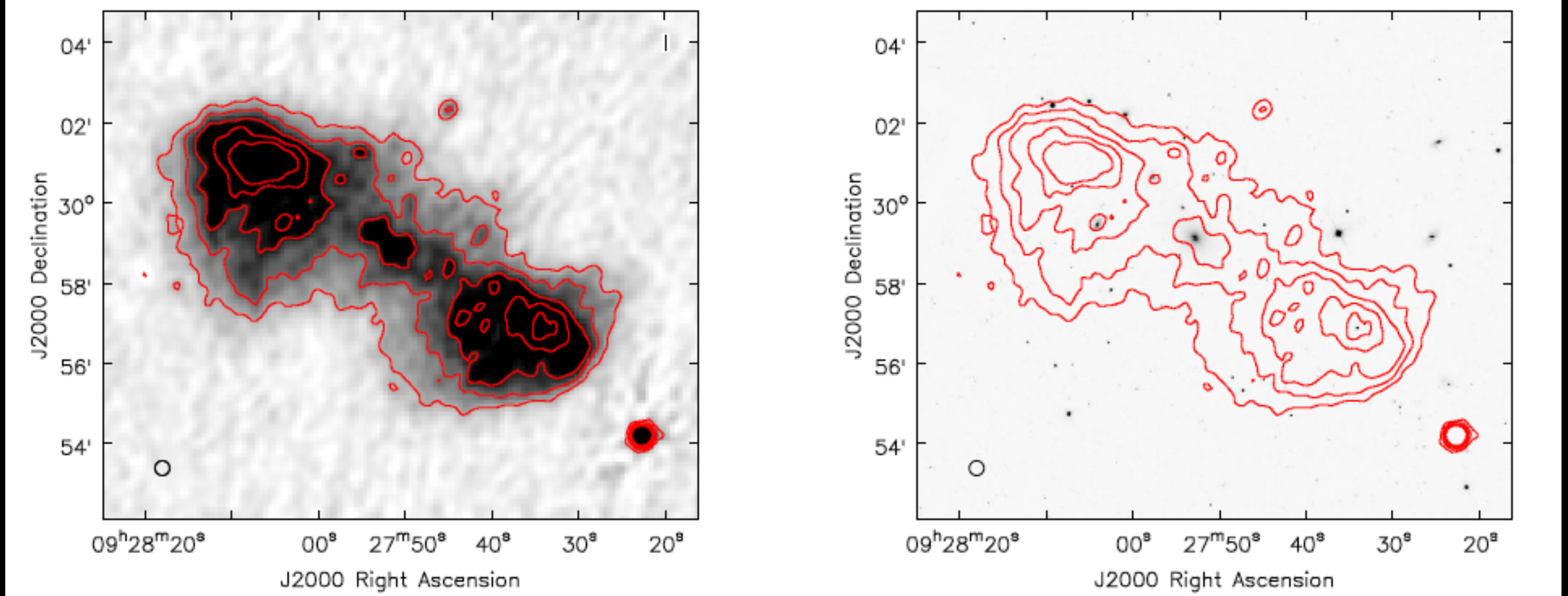
- ph
- Av
- Lo
- Hi

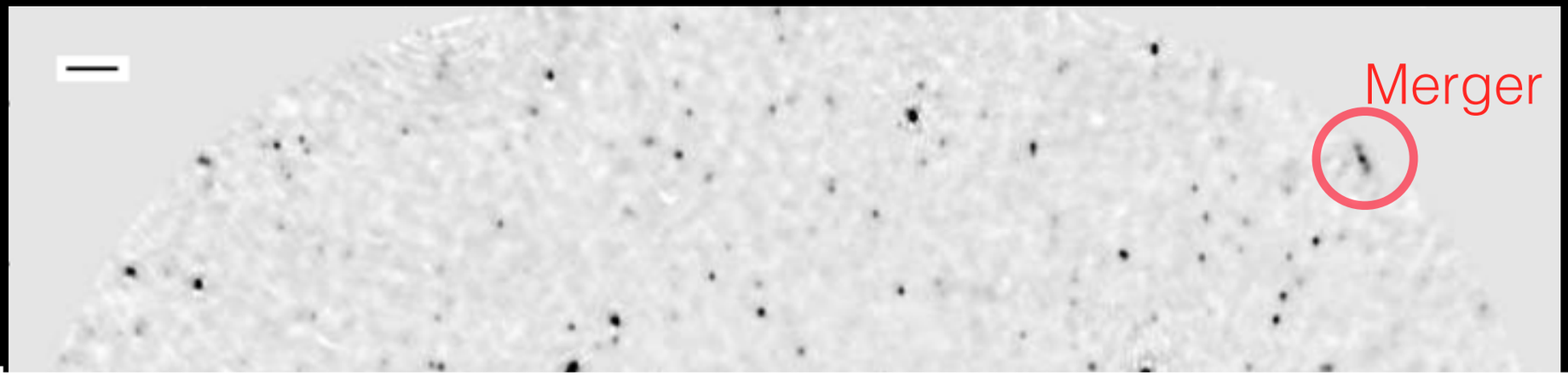


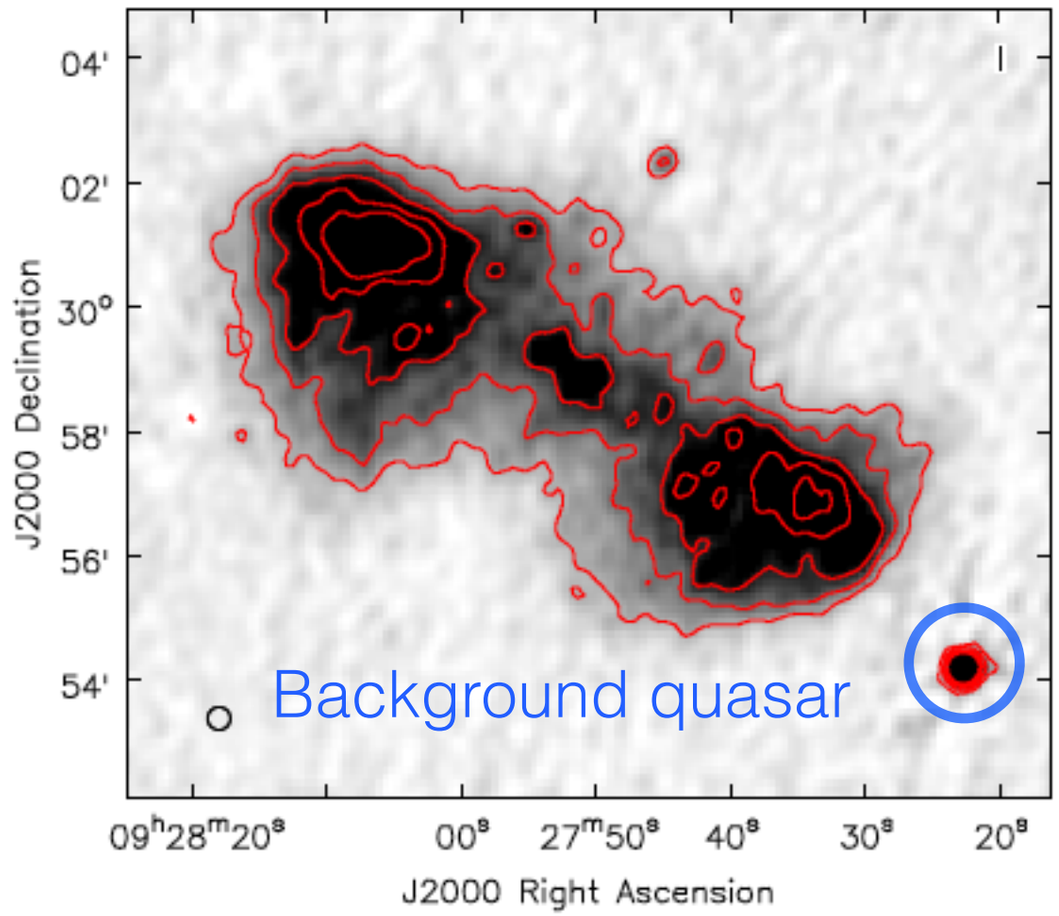
res.

Merger

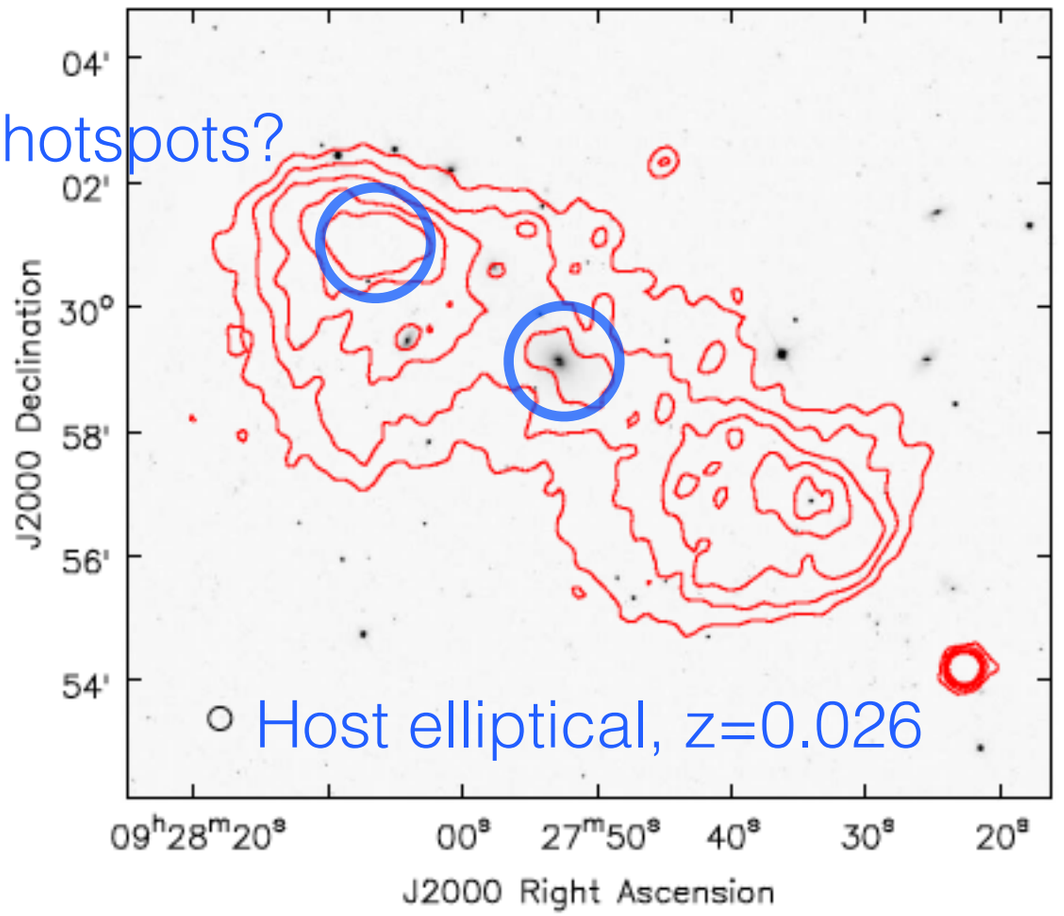


HBA high resolution image of B2 0924+30





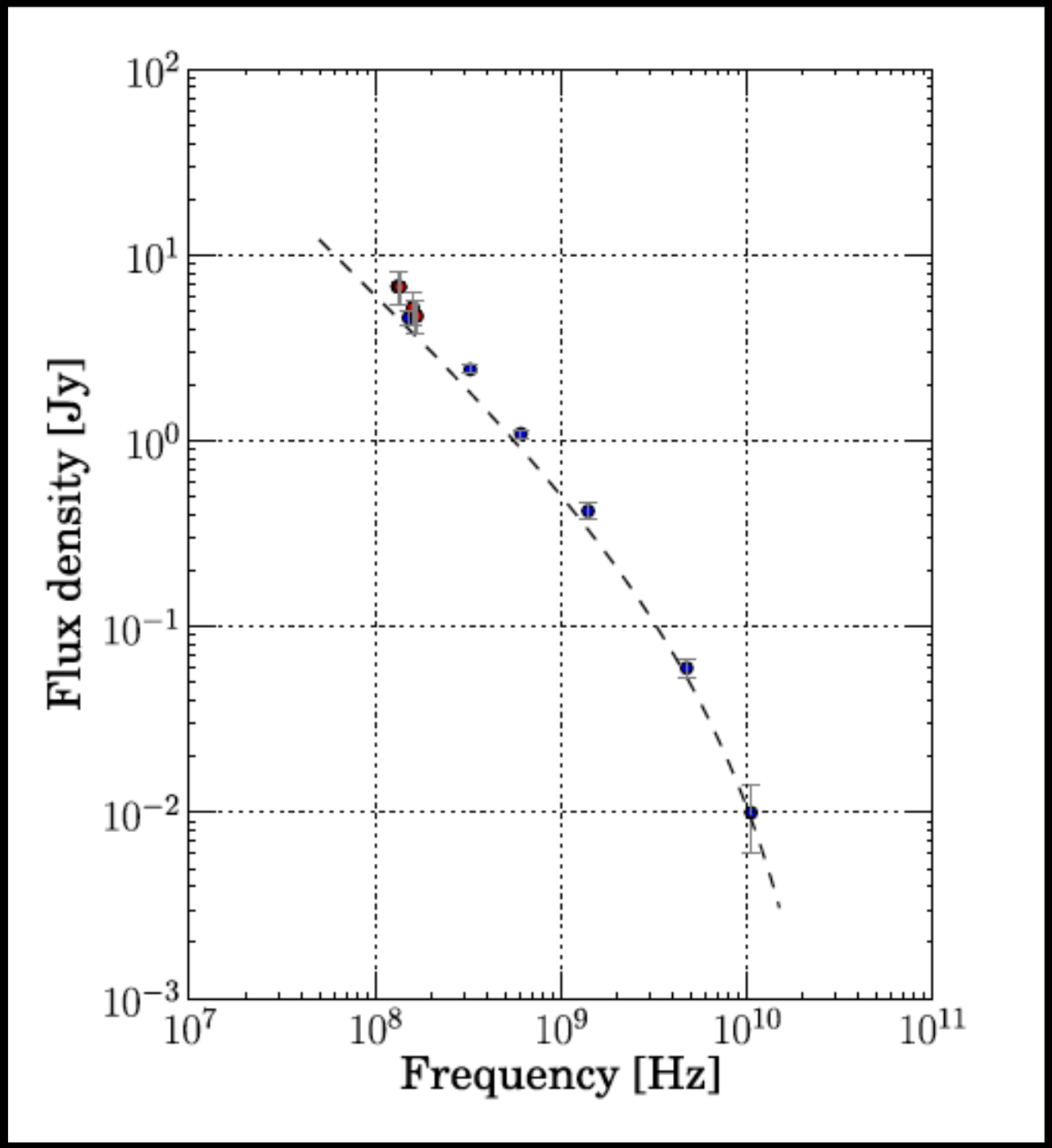
Relic hotspots?



A

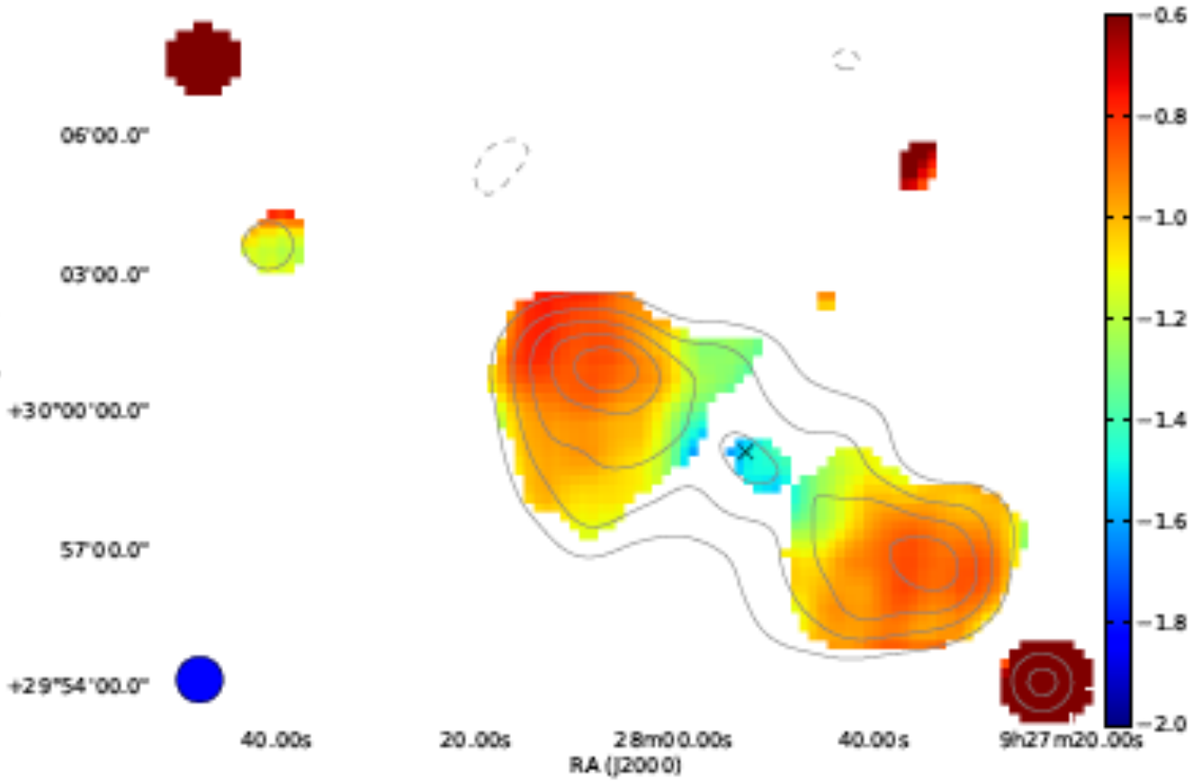
- Lo
- Hi

Results

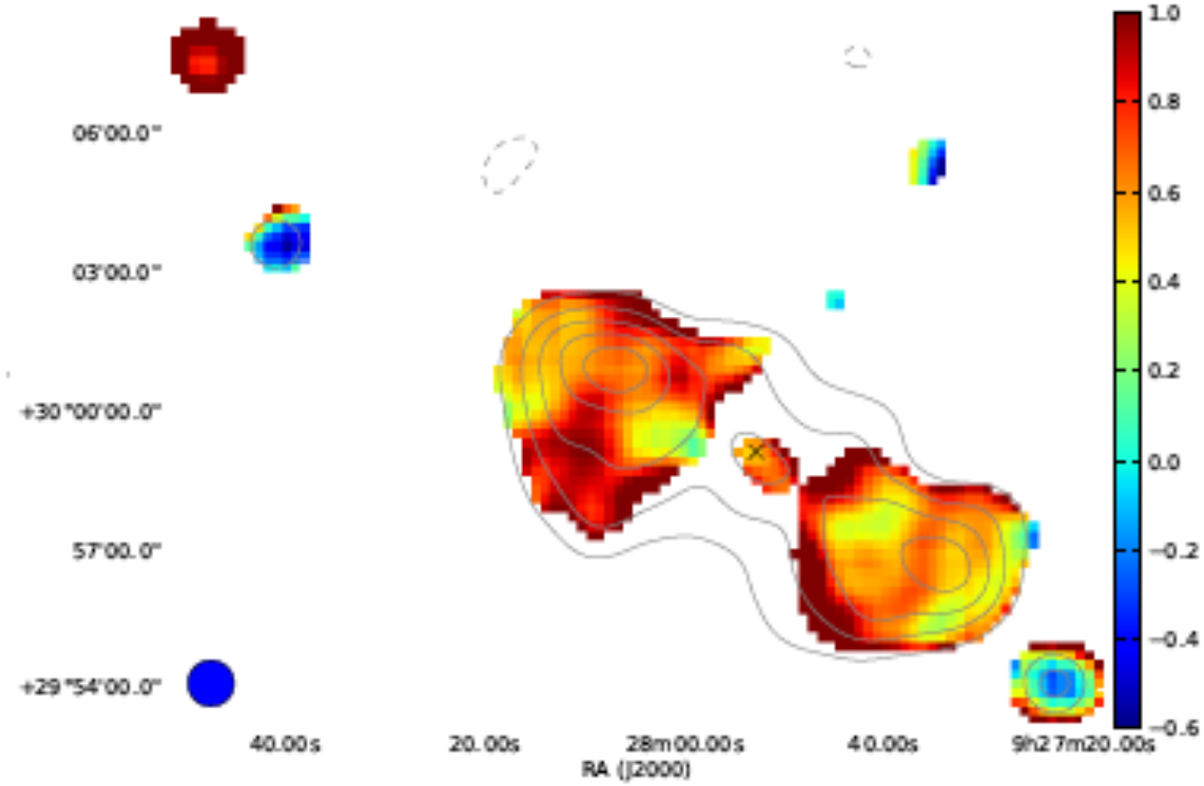


Integrated flux density ageing models (JP) suggest an age of 60 Myr

Results



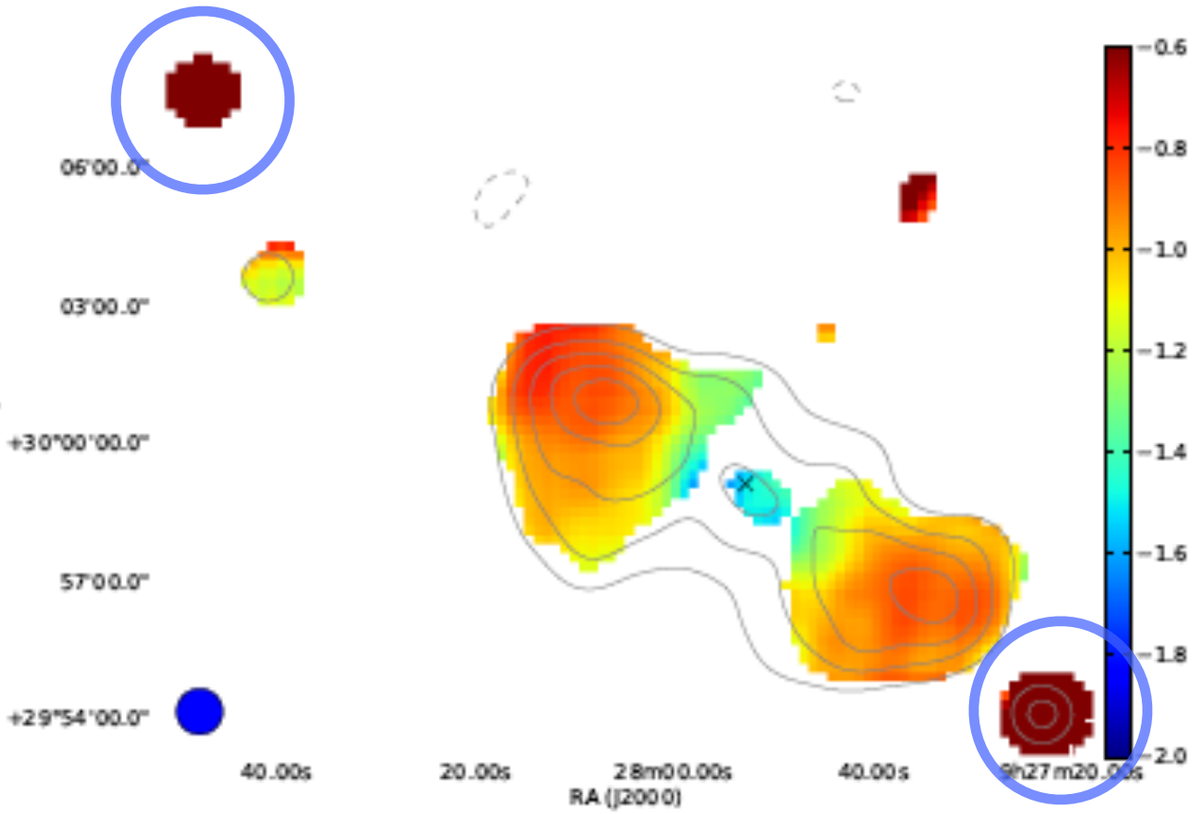
(a) α_{140}^{609} spectral index map.



(b) $\alpha_{140}^{609} - \alpha_{609}^{1400}$ spectral curvature map.

Spectral index mapping reveals distribution of ages

Results



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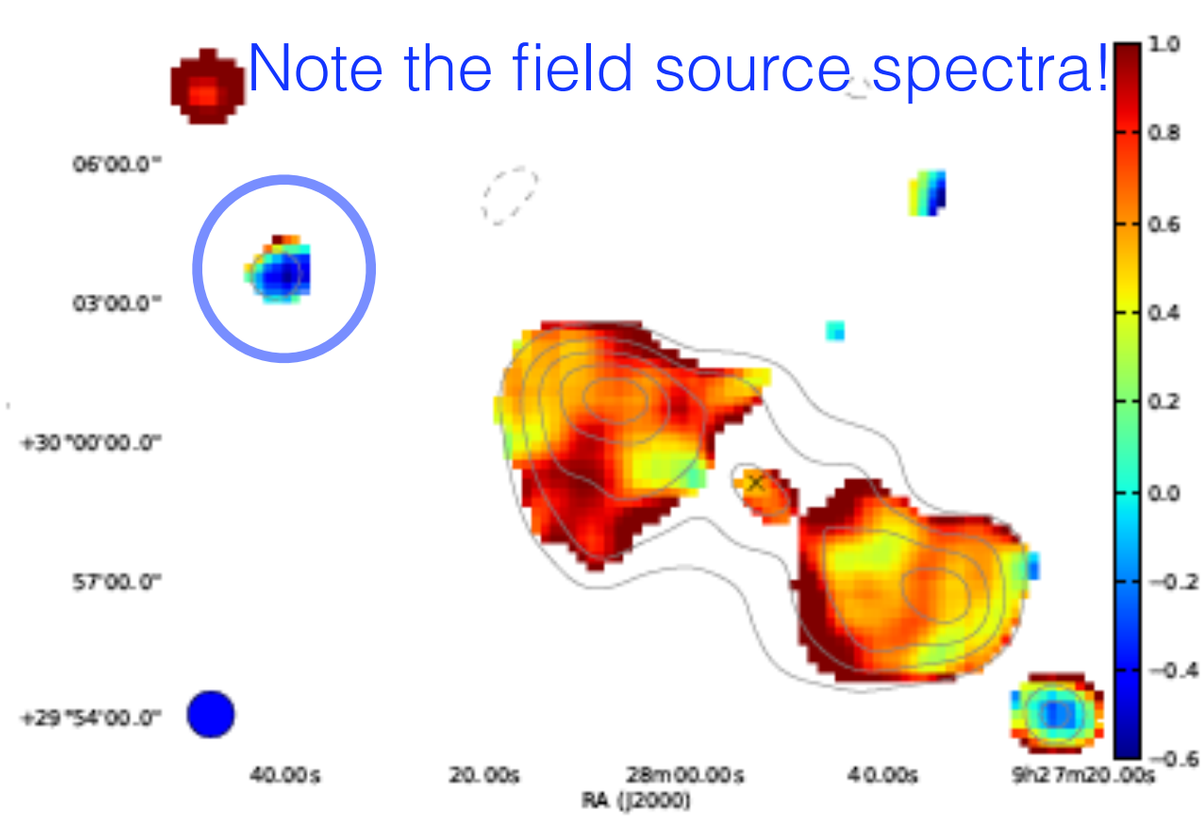

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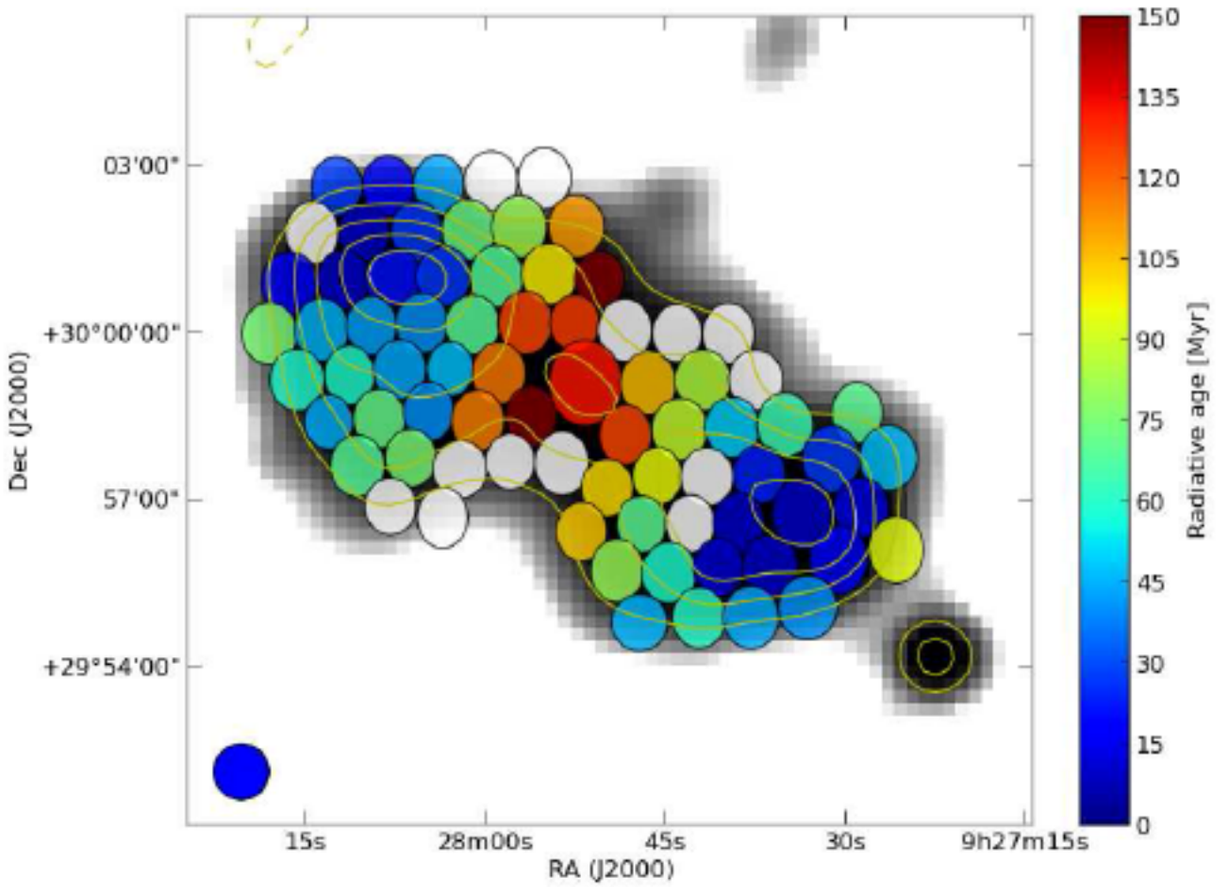
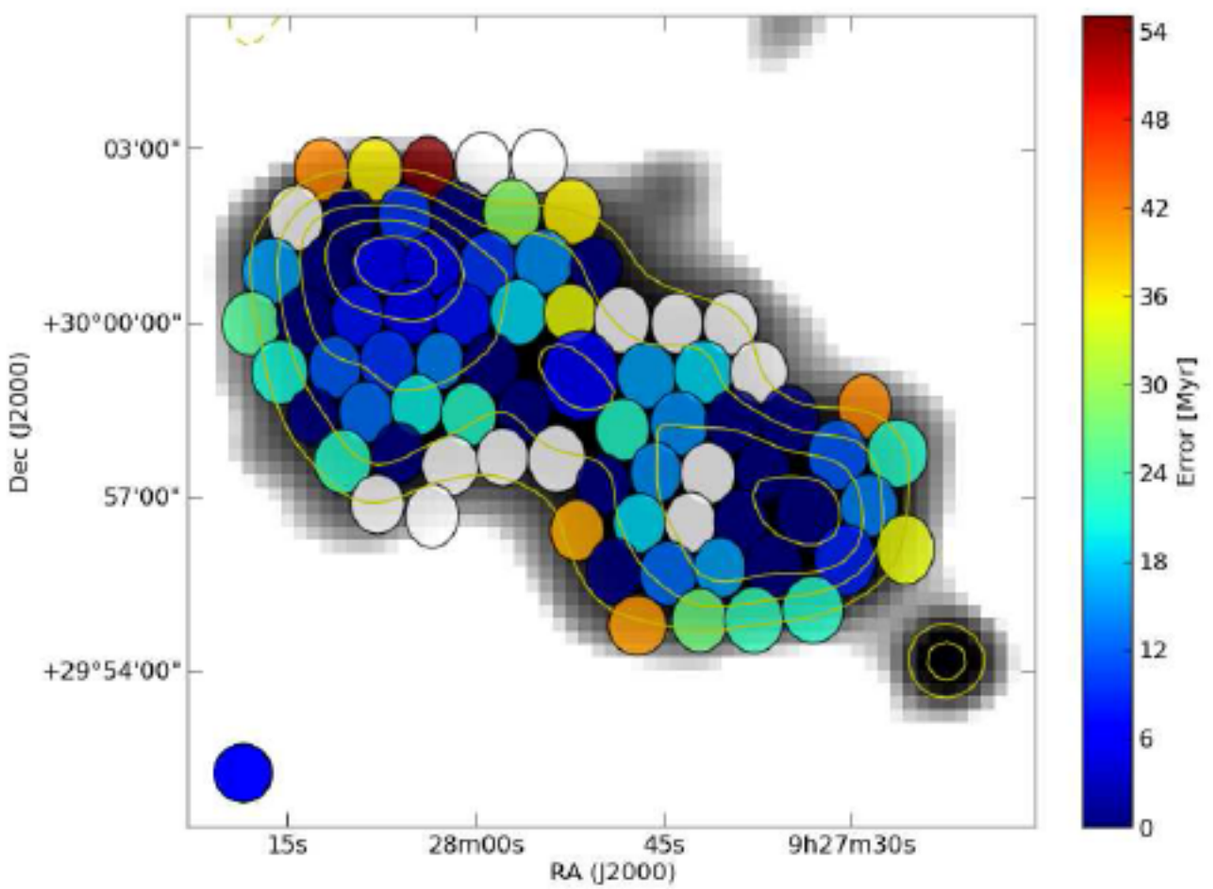


(a) Radiative ages

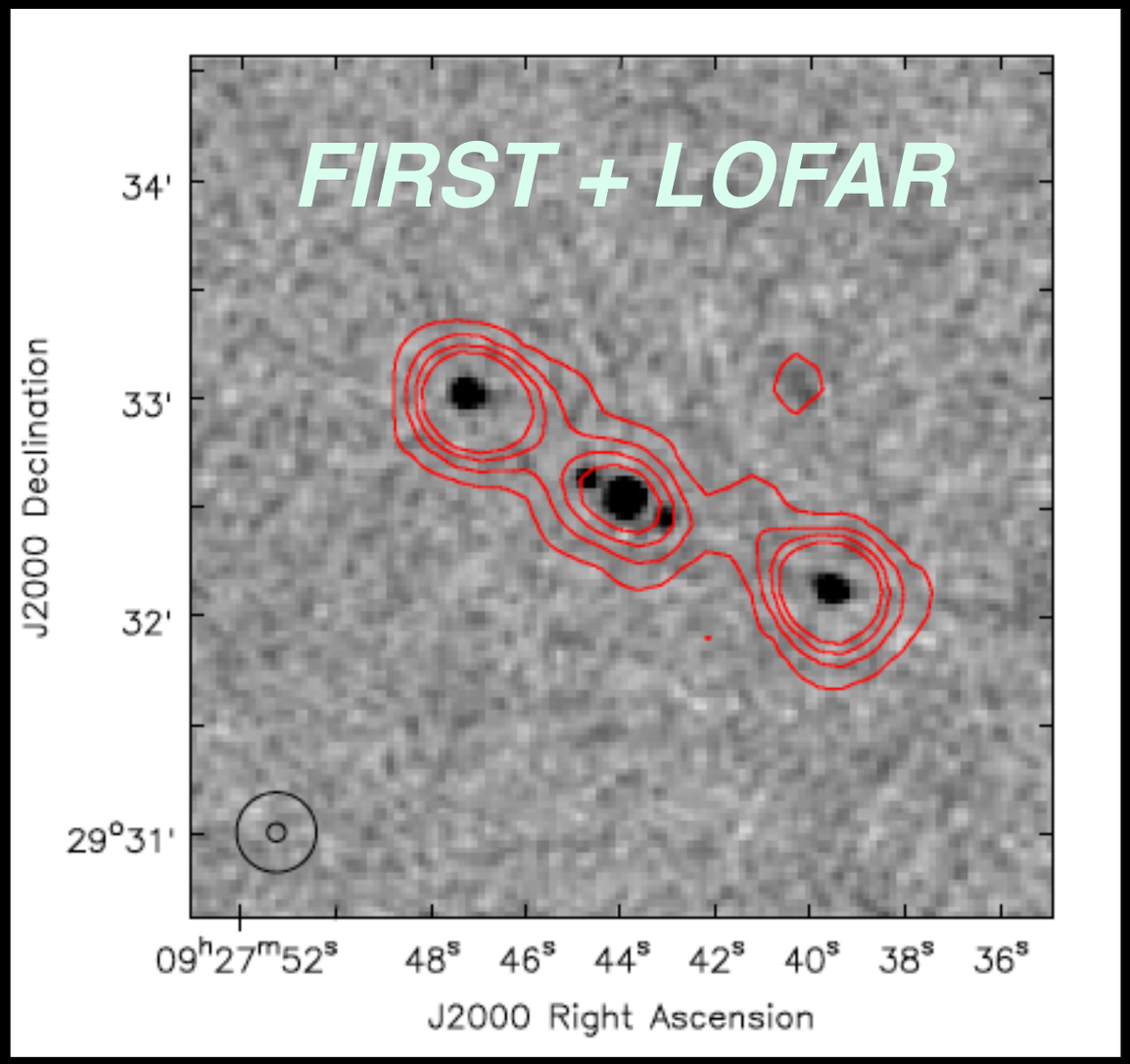


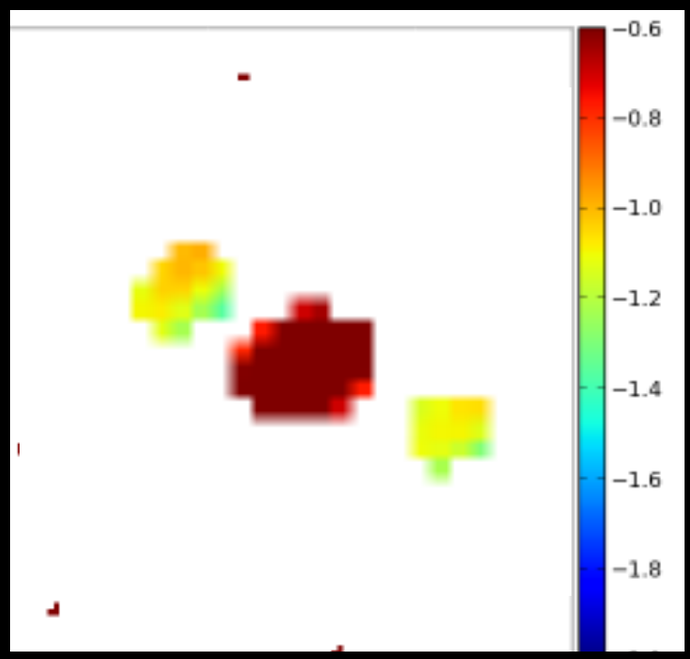
(b) Fitting errors

Spatially resolved age mapping reveals the core region to be the oldest

Results

DDRG with relic outer lobes
possibly high redshift (z > 2)





Publications

Radiative age mapping of the relic radio source B2 0924+30: the LOFAR perspective

Aleksandar Shulevski[1,2], Raffaella Morganti[1,2], and Peter Barthel[1]

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e-mail: morganti@astron.nl

ABSTRACT

Context. B2 0924+30 represents a prototypical FRII radio relic. Hosted by a nearby elliptical galaxy, its extent of 30′ allows us to make detailed studies of its structure and map its spectral index and age.
Aims. Our goal is to perform detailed aging analysis, using our LOFAR data to extend it to lower frequencies than ever before.
Methods. We construct low frequency spectral index maps and use synchrotron aging models as constraints to the data to derive source ages.
Results. We find that the integrated spectral index is consistent with previous studies. Spectral index maps reveal relic hotspot structures in the lobes, and age mapping shows that AGN activity has ceased around 100 Myr ago. We also elaborate on a discovery of a double-double radio galaxy with relic outer lobes in the field, as well as the lowest frequency detection of a radio halo connected to the galaxy cluster Abell 781.
Conclusions. The spectral index properties as well as the derived ages of B2 0924+30 are consistent with it being a FRII relic. LOFAR data are proving to be instrumental in extending such analysis to lower frequencies enabling modelling of the oldest source regions.

Key words. galaxies: active - radio continuum: galaxies - galaxies: individual: B2 0924+30

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