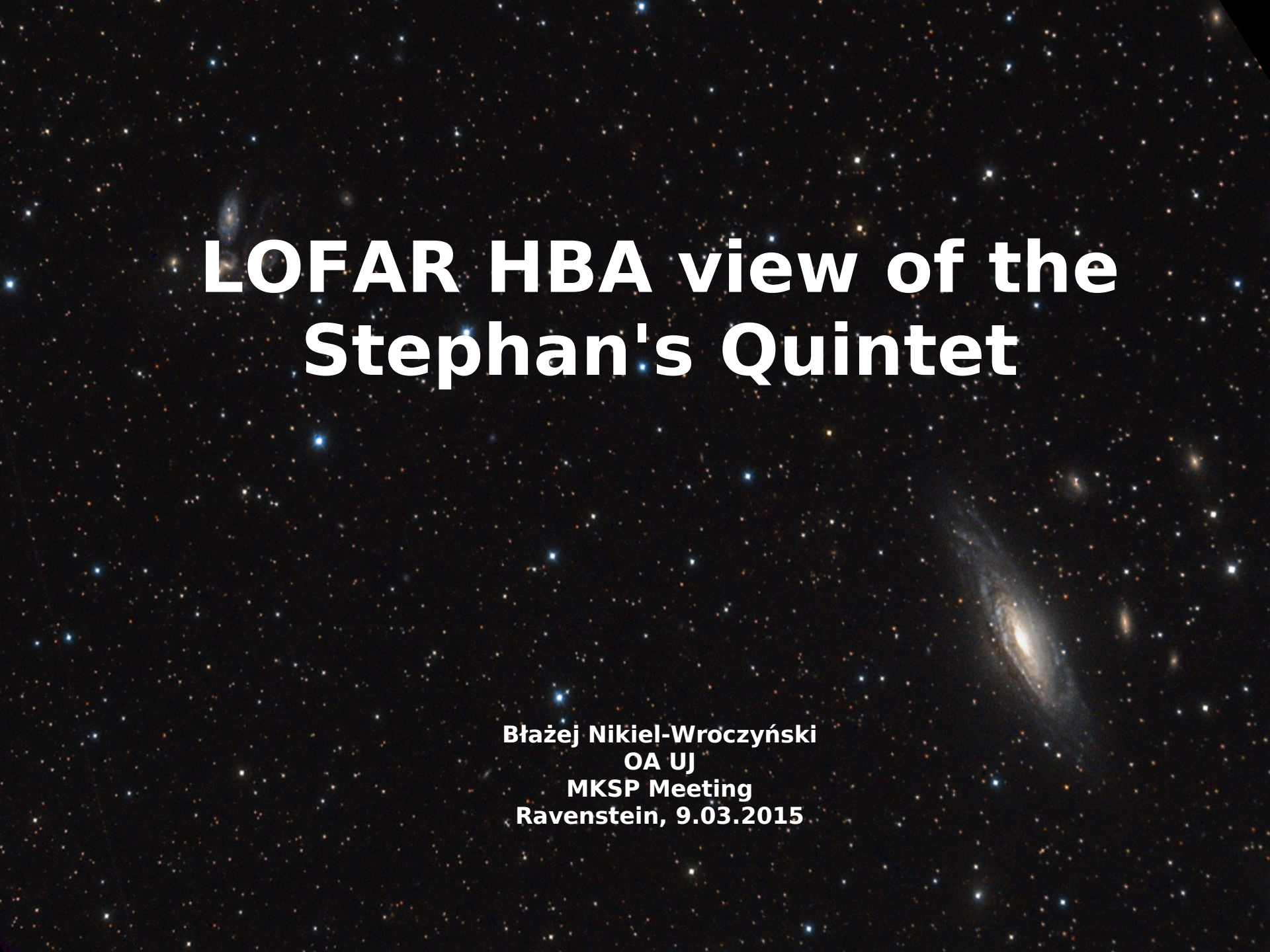


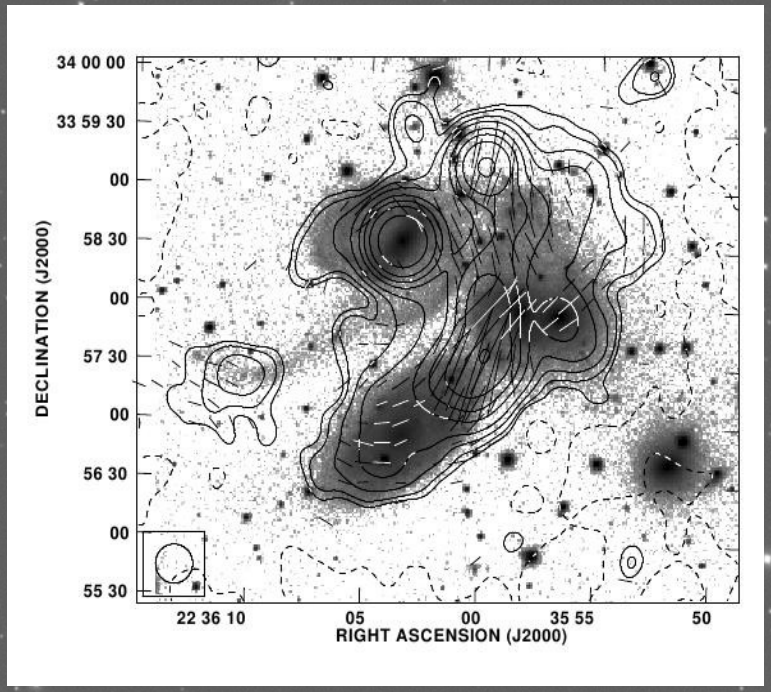
LOFAR HBA view of the Stephan's Quintet

Błażej Nikiel-Wroczyński
OA UJ
MKSP Meeting
Ravenstein, 9.03.2015

Basics of the Stephan's Quintet

- The best studied galaxy group
- Discovered in 1877
- Well known for an intergalactic shock
- Plentitude of other interesting entities: tidal tails, tidal dwarfs, starburst regions, neutral hydrogen halo
- Scarcity of the radio data

Previous experiences

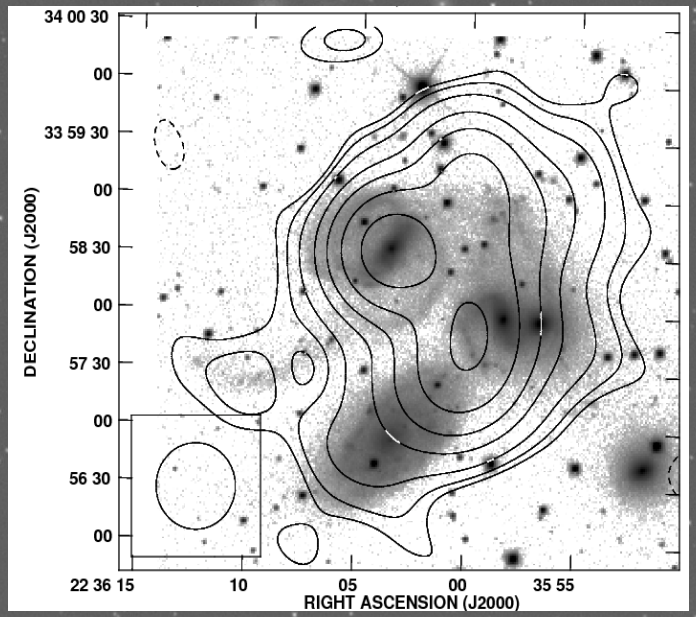


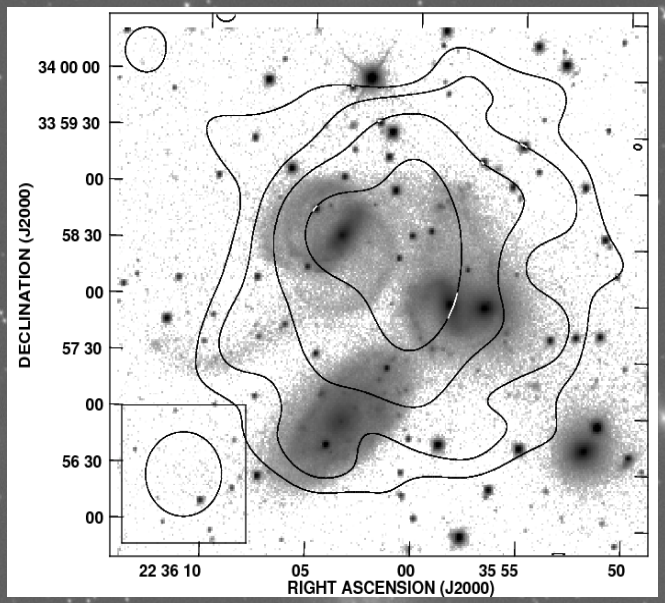
- **Joint studies by OA UJ, MPIfR and AI RUB – 2013**
- **Detection of a large envelope of continuum-emitting medium, the ridge, the tidal dwarf galaxy...**
- **Polarised Intensity also detected**
- **Significant magnetic fields**

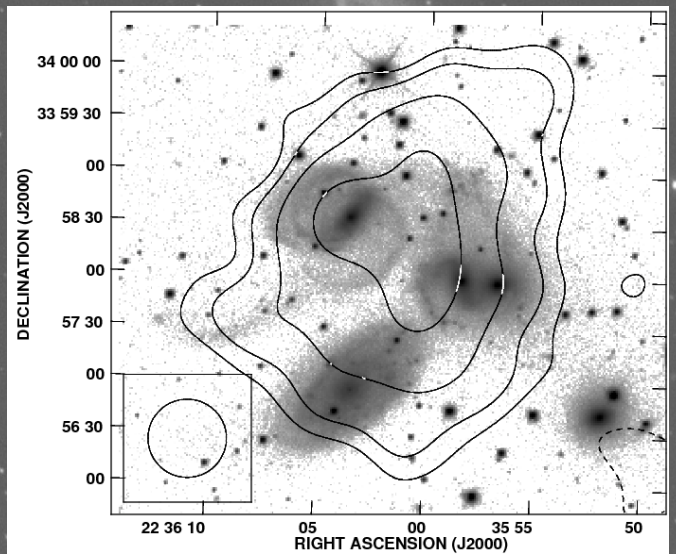
Table 3. Parameters used to estimate the magnetic field properties and resulting values

Region	D[kpc]	K_0	α	$S_{4.86}$ [mJy]	p [%]	$B_{\rm TOT}$ [μG]	$B_{\rm ORD}$ [μG]	$E_{\rm B}$ [erg cm^{-3}]
Ridge	12.5 ± 2.5	100 ± 50	1.1 ± 0.15	10.6 ± 0.6	5	11.0 ± 2.2	2.6 ± 0.8	$0.5 \pm 0.15 \times 10^{-11}$
SQ-A	6 ± 3	100	1.1 ± 0.1	0.32 ± 0.02	———	8.8 ± 2.3	———	$3.0 \pm 1.6 \times 10^{-12}$
SQ-B	6 ± 3	100	1.2 ± 0.2	0.16 ± 0.01	33	6.5 ± 1.9	3.5 ± 1.2	$1.8 \pm 0.9 \times 10^{-12}$
Group	32 ± 6	100	1.2 ± 0.2	4.6 ± 0.6	2	6.4 ± 1.1	1.1 ± 0.3	$1.8 \pm 0.5 \times 10^{-12}$

Observational results

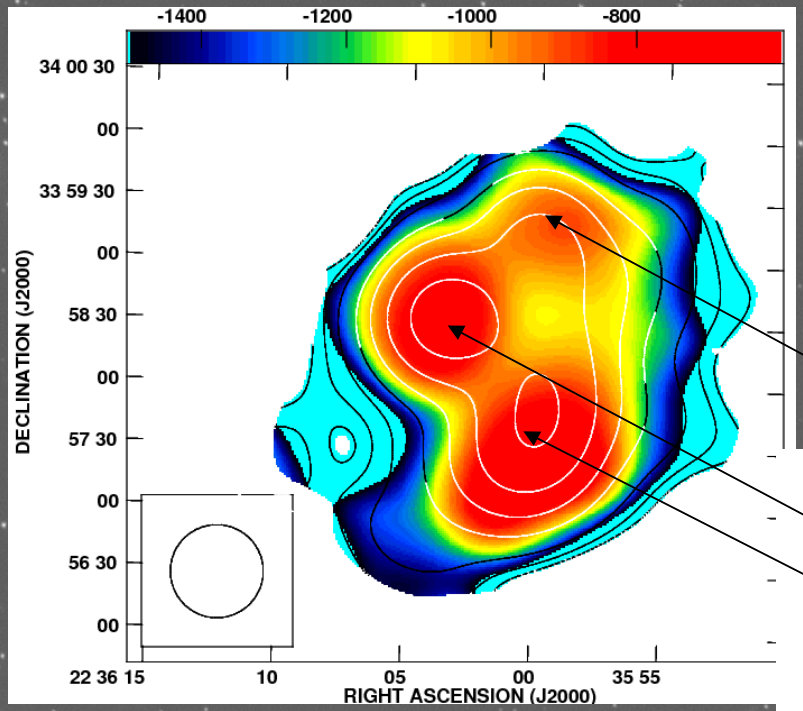




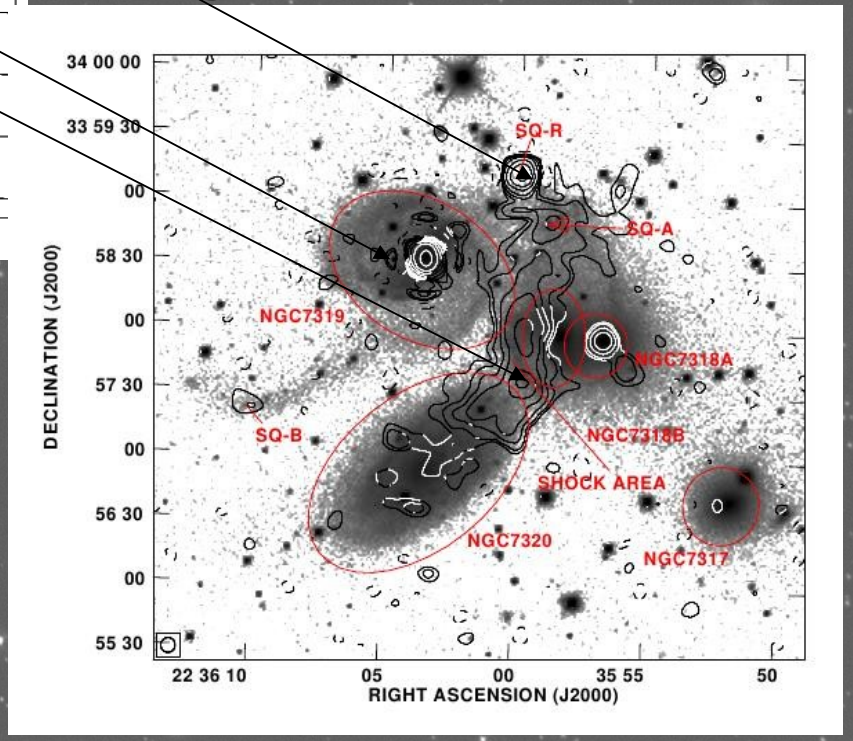


- **Preliminary results**
- **Two LOFAR maps, convolved to a common beam of 45 arcsec (to be compared with the VLA 20cm data)**

Observational results



- Spectral index map is limited by the size of the envelope at 1425 MHz
- Still, different entities are easily visible
- And the map is quite similar to that at the higher frequencies



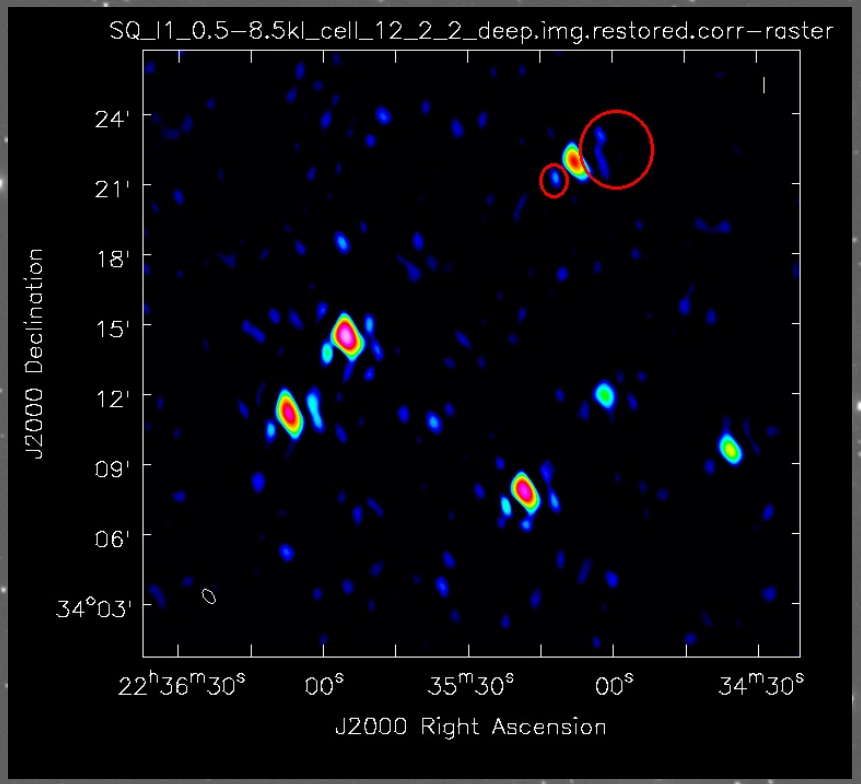
- Preliminary estimate for the magnetic field in the shock area (near the emission maximum):

  10.0 +/- 1.5 μG

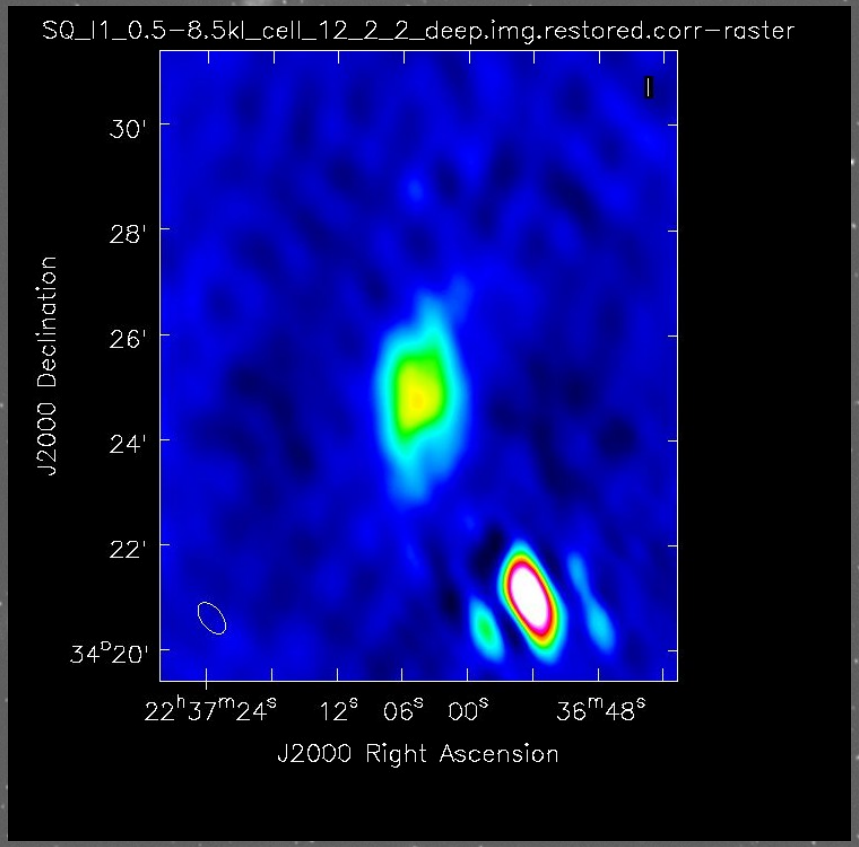
- MF+CR energy density: ~10^{-11} erg cm^{-3}
- Similar to the value derived at the higher frequencies, and still significant!

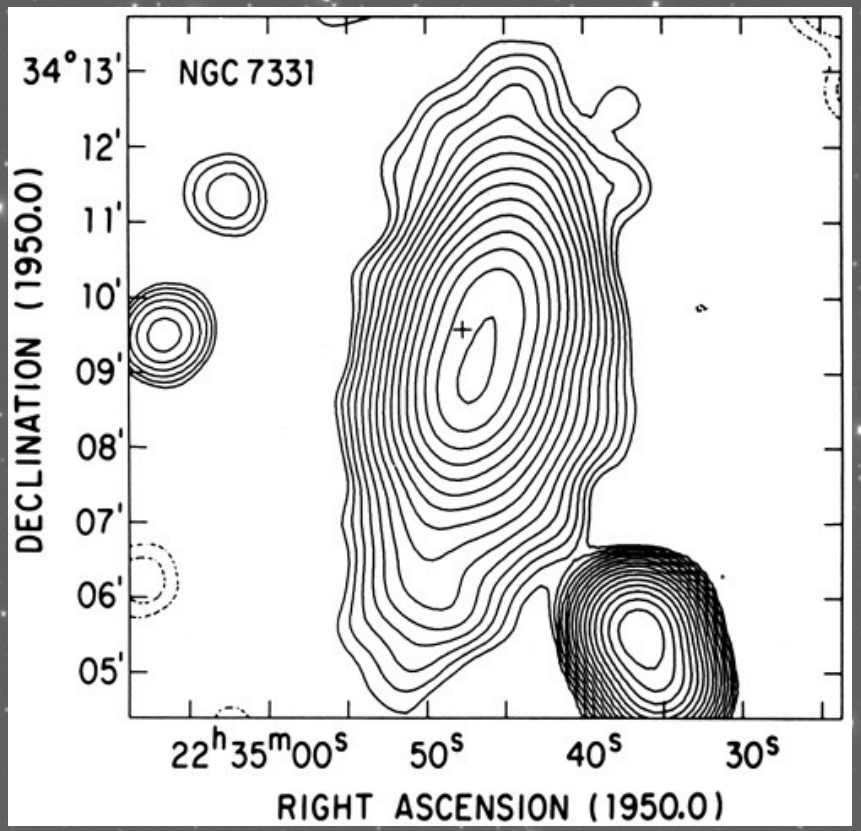
Problem with the artefacts

- If we stay at a resolution of some ~45 arcseconds, the maps are fine
- Problems arise if we increase the resolution: artefacts around brighter sources
- These artefacts for sure affect also the SQ itself
- The reasons for them is not entirely clear; several attempts to get rid of them have been tested
- Current activities supressed by the lack of sufficient computing power



NGC 7331: a nearby galaxy in the field

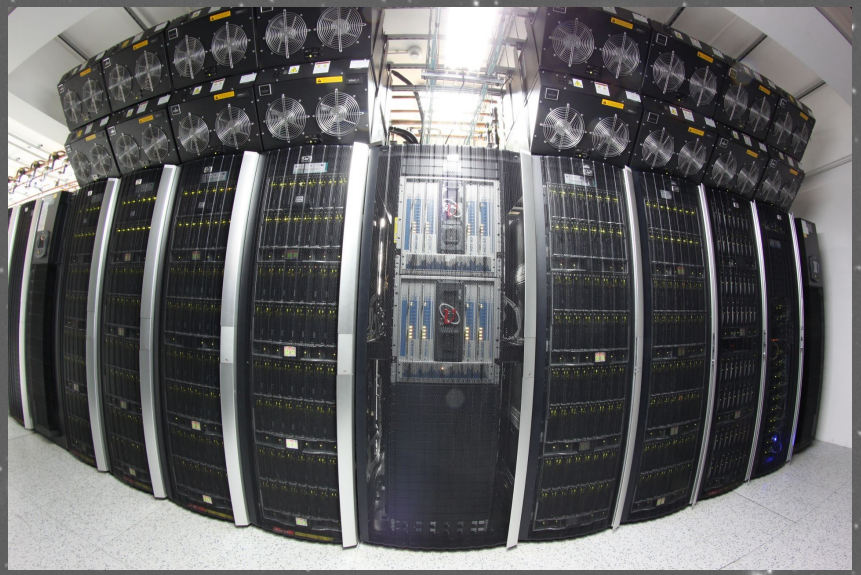




The new computing power: local

- Three new local, standalone computers ordered
- Expected delivery: Two units in the beginning of April, the third one in May (hopefully)
- Similiar in performance to single CEP3 nodes

The new computing power: clusters



- Zeus supercomputer will become the basic POLFAR computing cluster
- Preliminary tests of the LOFAR software ended with success
- Not available at the moment: new hardware is being installed (mostly storage units)

The new computing power: clusters

- The Krakow observations are part of the German Long Wavelenght Consortium Proposal for the JURECA supercomputer
- Computations will start right after the time is allocated
- First Krakow galaxy to be processed: NGC 6946