Multifrequency analysis of the magnetic field in HCG 92 and Arp 143

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Based on the results from GMRT, EVLA and ILT observations
done by the OA UJ in cooperation with MPIfR and AIRUB

CMF Conference, 23.10.2014, Kraków

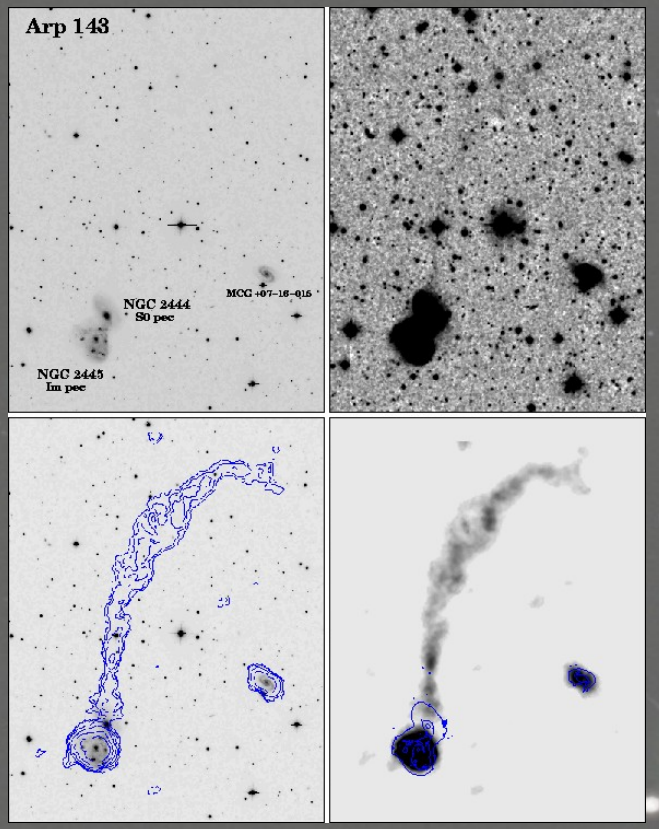
Multifrequency analysis of the magnetic field of HCG 92 and Arp 143

- Why do we want to study multiple galaxies?
- Why these two?
- What do we know about them?
- Why multifrequency?

Teamwork is overpowered!

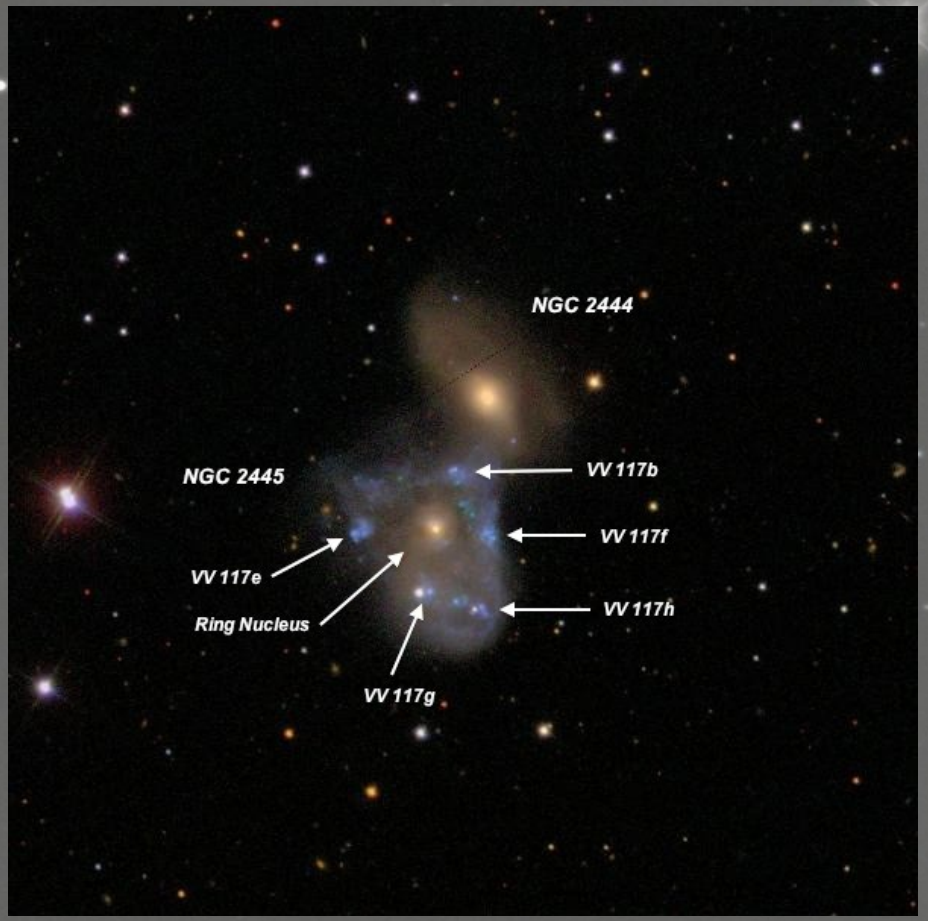
The universe's weirdest galaxy

- Arp 143, 60 Mpc away, NGC 2444/5
- Best known for a long neutral gas tail extending towards north from the ring
- Result of a collision that took place some 85 Myrs ago



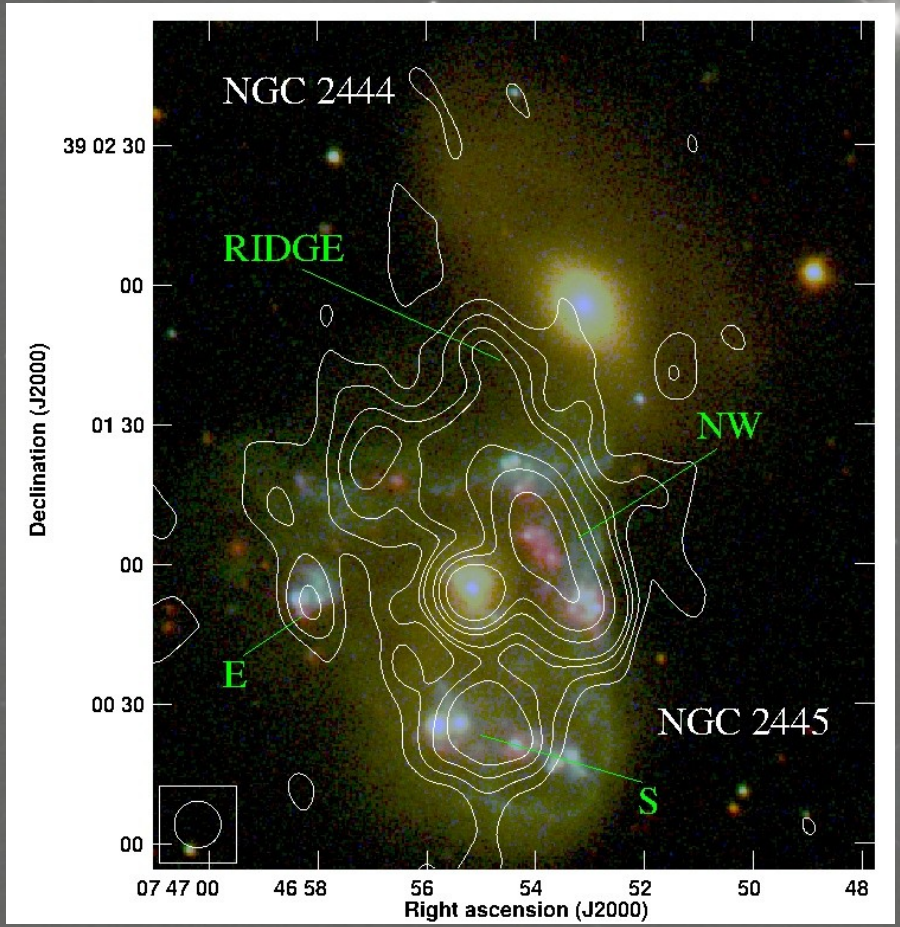
The universe's weirdest galaxy

- The ring hosts several young starforming regions
- Beirao et al. 2009: ages from 2.5 to 7.5 Myrs
- Nucleus might be undergoing some starburst activity
- No signs for an ongoing interaction with the companion galaxy



Radio emission of Arp 143

- Falsecolour RGB mosaic with H_a component from Romano et al. 2008
- The ring emits at radio frequencies!
- Maxima at the position of the nucleus and three star-forming regions
- An interesting feature not seen before – an intergalactic bridge?



Magnetic field of Arp 143

- Estimates derived using BFELD code (Beck&Krause 2005)
- Significant magnetic fields in all of the regions were detected
- Magnetic field in the bridge is comparable to that found in between the Taffies
- Lack of polarisation data – nothing can be said about the regular component and possible magnetic field dragging

Region	D [kpc]	α	$S_{4.86}$ [mJy]	$B_{\rm TOT}$ [μG]	$E_{\rm B}$ [erg cm^{-3}]
Core	0.65 ± 0.15	0.64 ± 0.08	3.24 ± 0.16	38.8 ± 1.7	$60 \pm 5 \times 10^{-12}$
NW	5.5 ± 0.5	0.81 ± 0.07	3.59 ± 0.13	12.0 ± 0.4	$5.8 \pm 0.5 \times 10^{-12}$
S	5.5 ± 0.5	0.89 ± 0.06	0.57 ± 0.04	9.9 ± 0.3	$3.9 \pm 0.3 \times 10^{-12}$
E	5.5 ± 0.5	1.03 ± 0.19	0.08 ± 0.02	8.7 ± 0.6	$3.0 \pm 0.4 \times 10^{-12}$
Ridge	5.5 ± 0.5	1.01 ± 0.12	0.16 ± 0.03	9.2 ± 0.6	$3.3 \pm 0.3 \times 10^{-12}$

Benefits from low frequency observations

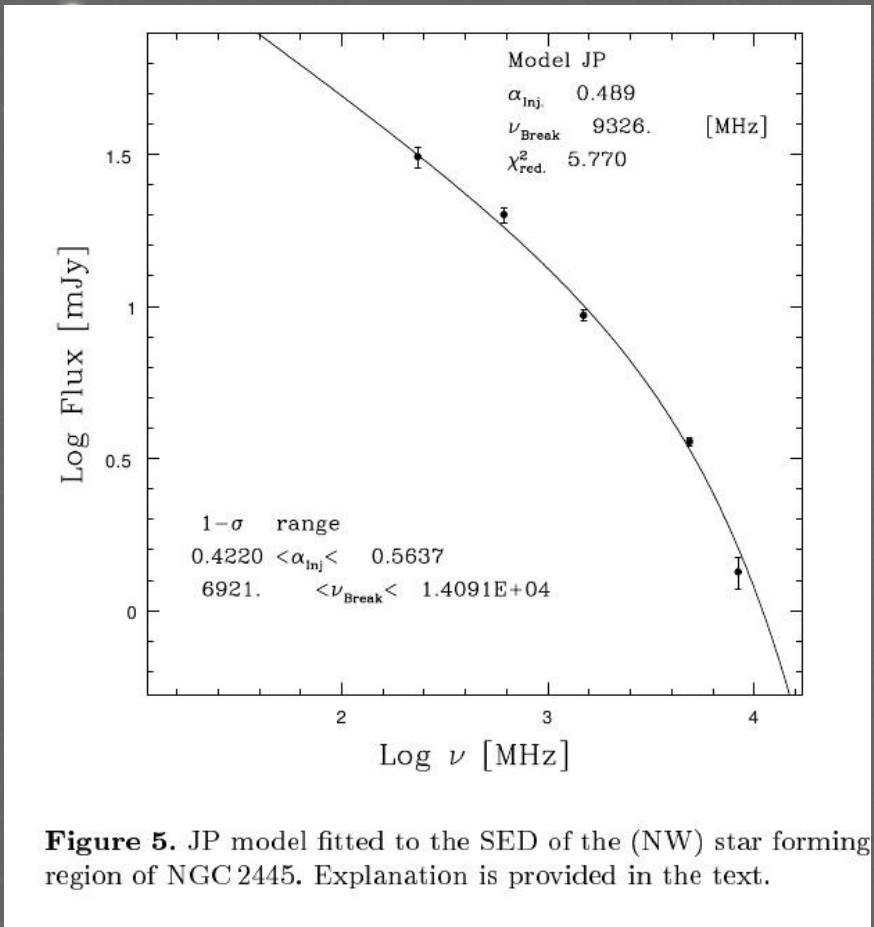
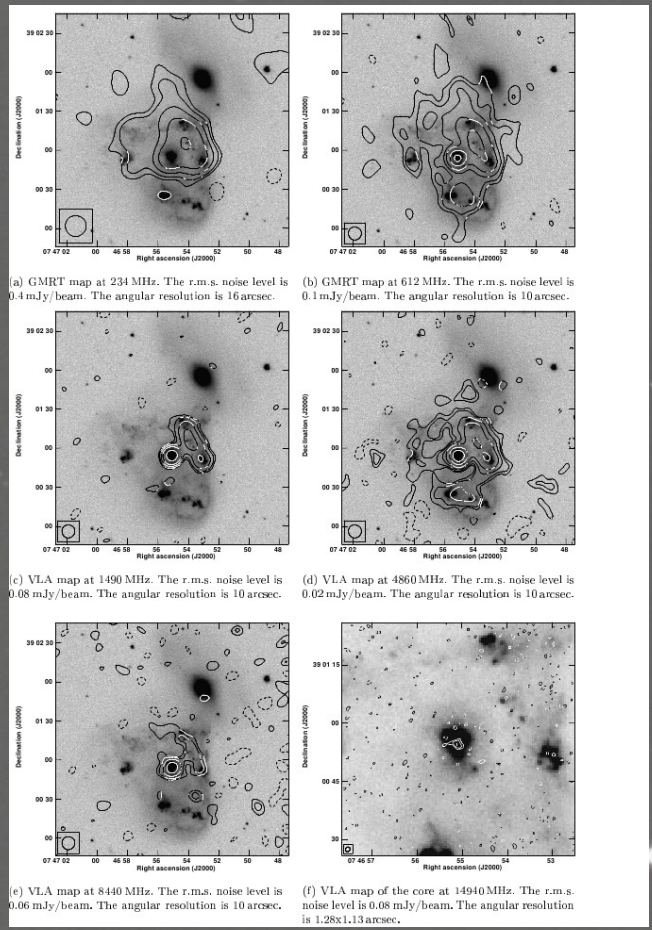


Figure 5. JP model fitted to the SED of the (NW) star forming region of NGC 2445. Explanation is provided in the text.



(a) GMRT map at 234 MHz. The r.m.s. noise level is 0.4 mJy/beam. The angular resolution is 16 arcsec.

(b) GMRT map at 612 MHz. The r.m.s. noise level is 0.1 mJy/beam. The angular resolution is 10 arcsec.

(c) VLA map at 1490 MHz. The r.m.s. noise level is 0.08 mJy/beam. The angular resolution is 10 arcsec.

(d) VLA map at 4860 MHz. The r.m.s. noise level is 0.02 mJy/beam. The angular resolution is 10 arcsec.

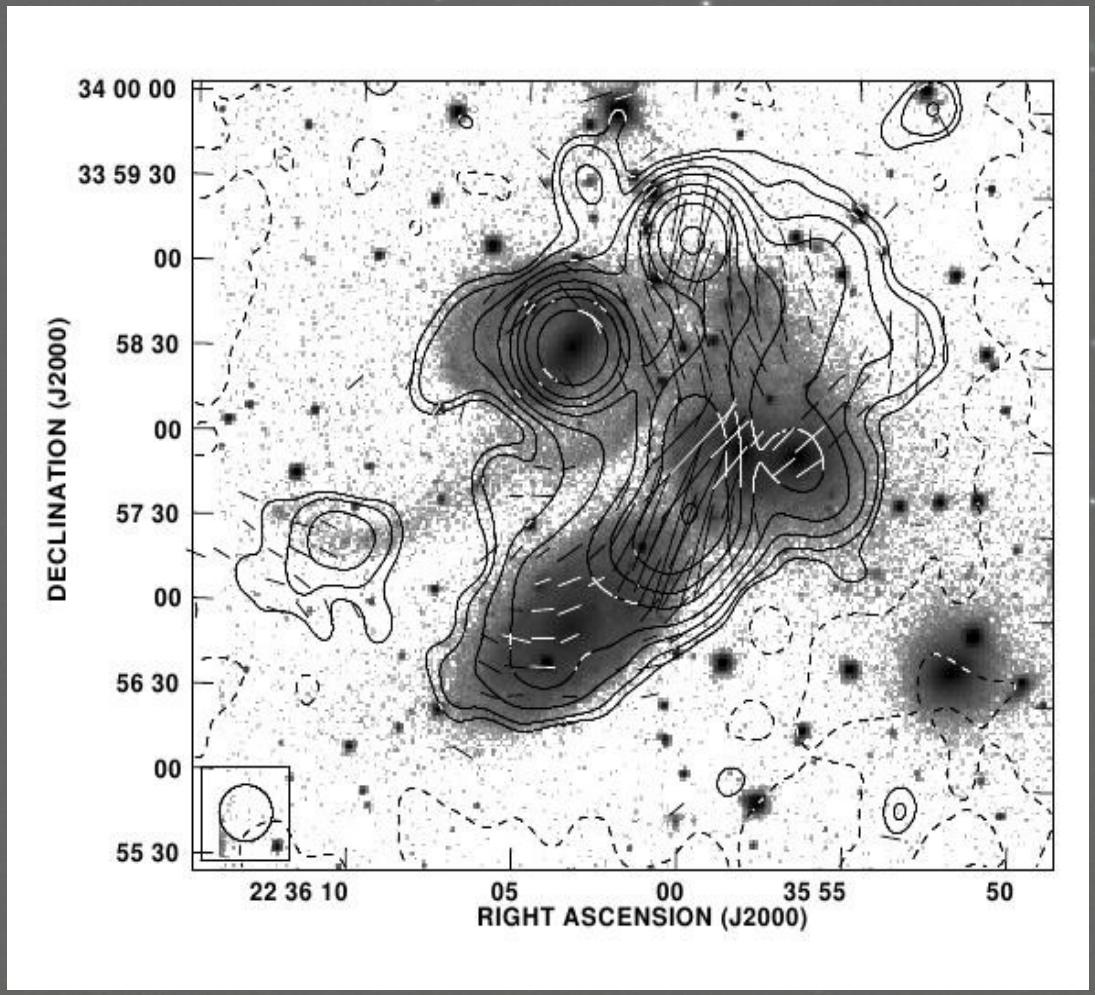
(e) VLA map at 8440 MHz. The r.m.s. noise level is 0.06 mJy/beam. The angular resolution is 10 arcsec.

(f) VLA map of the core at 14940 MHz. The r.m.s. noise level is 0.08 mJy/beam. The angular resolution is 1.28x1.13 arcsec.

The Stephan's Quintet

- The most well known galaxy group
- Xu et al. 2002: detection of the radio emission
- Nikiel-Wroczynski et al. 2014: deep radio imaging, polarisation detected

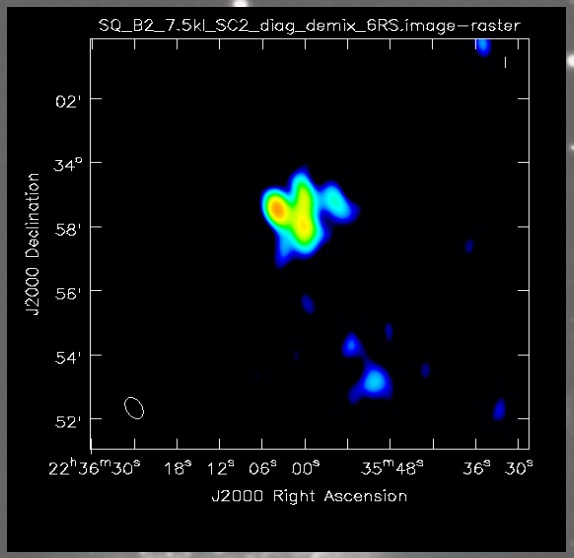
What do we lack?

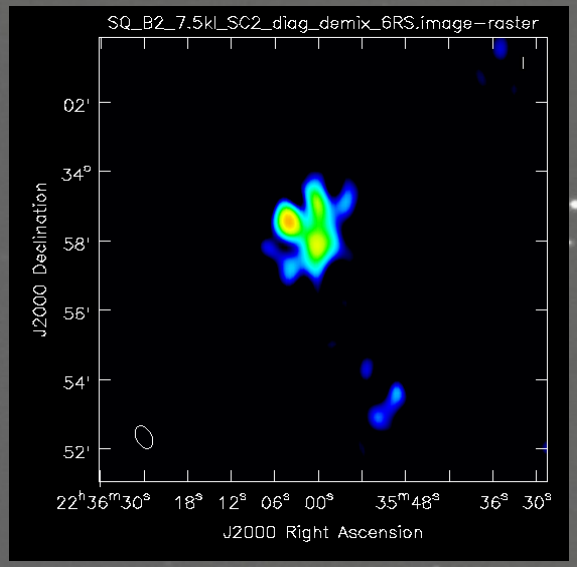


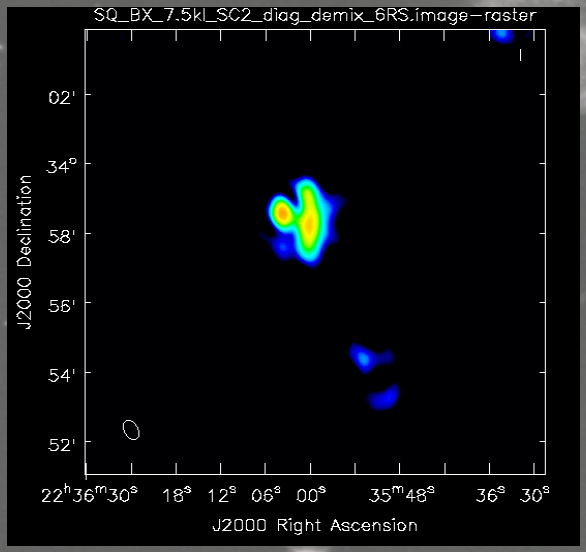
Nikiel-Wroczynski et al. 2013

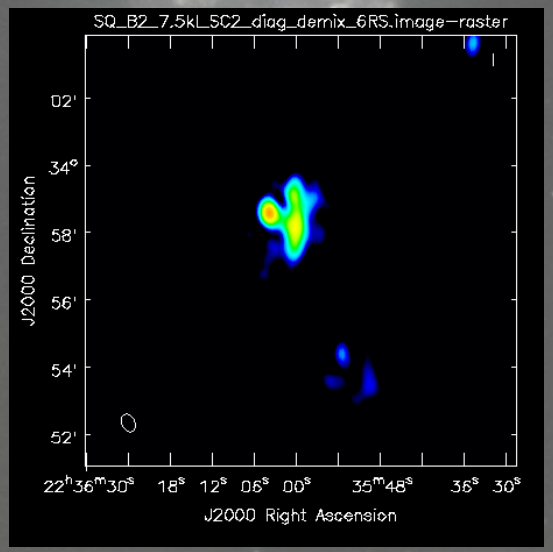
- How large part of the halo is already unseenable due to the ageing?
- Is there a bridge connecting the TDG and the halo?
- Is the magnetic field of the ridge regular, or just ordered (by compression)?
- If we want to answer all these questions at once, we should use ILT.

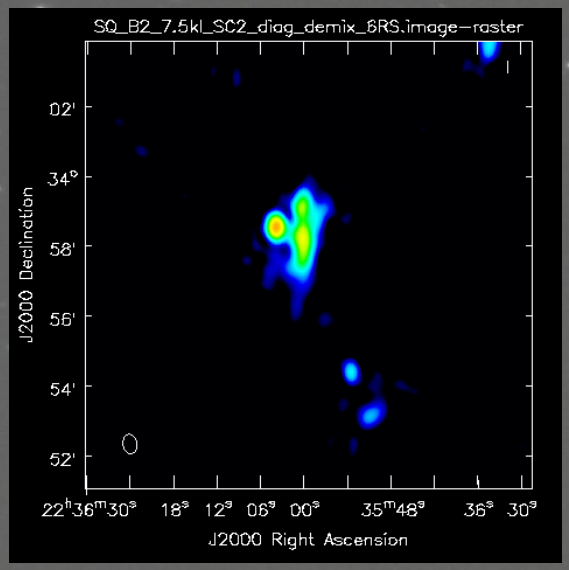
SQ at 5 LOFAR bands and VLA 6cm

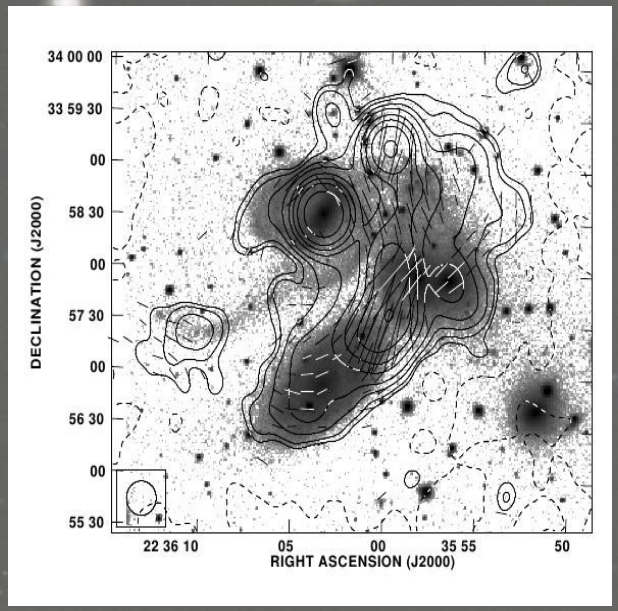






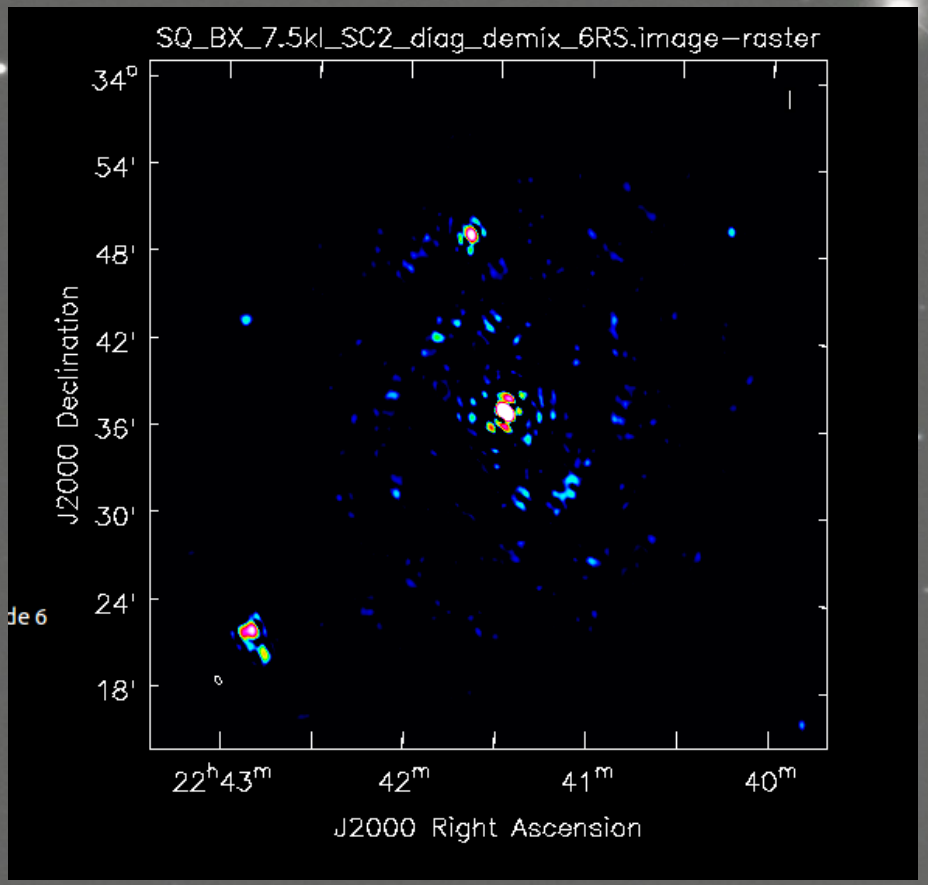






SQ – main issues and goals

- Getting some 20" resolution
- Three moderately strong sources in field – need for peeling
- They all have non-point structures, but they are quite well imaged by LOFAR
- Additional flagging will be surely needed
- Polarisation – the ubergoal



Nearby galaxy detected in the field

- NGC 7331 – total flux of ~1.9 Jy
- a between Condon et al. 2002 and LOFAR: -0.82 +/- 0.4