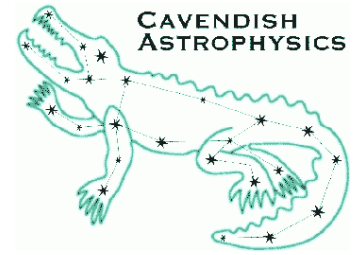


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610 MHz surveys using the GMRT

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Astrophysics in the LOFAR era
26th April 2007

 Galaxy
Evolution



Outline

- Introduction to the GMRT
- Current surveys
 - Spitzer extragalactic First Look Survey
 - Elais-N1
 - Elais-N2
 - Lockman Hole
- Scientific results so far
- Future GMRT surveys



Introduction to the GMRT

- Indian radio telescope
 - 30 dishes, 45 m diameter
 - Baselines up to 25 km
- One of the largest radio telescopes currently available
 - 153, 233, 325, **610**, 1420 MHz
 - 3x collecting area of VLA
 - ~ arcsec resolution
- Broad-band channels
 - up to 2 x 16 MHz
- Very good survey instrument

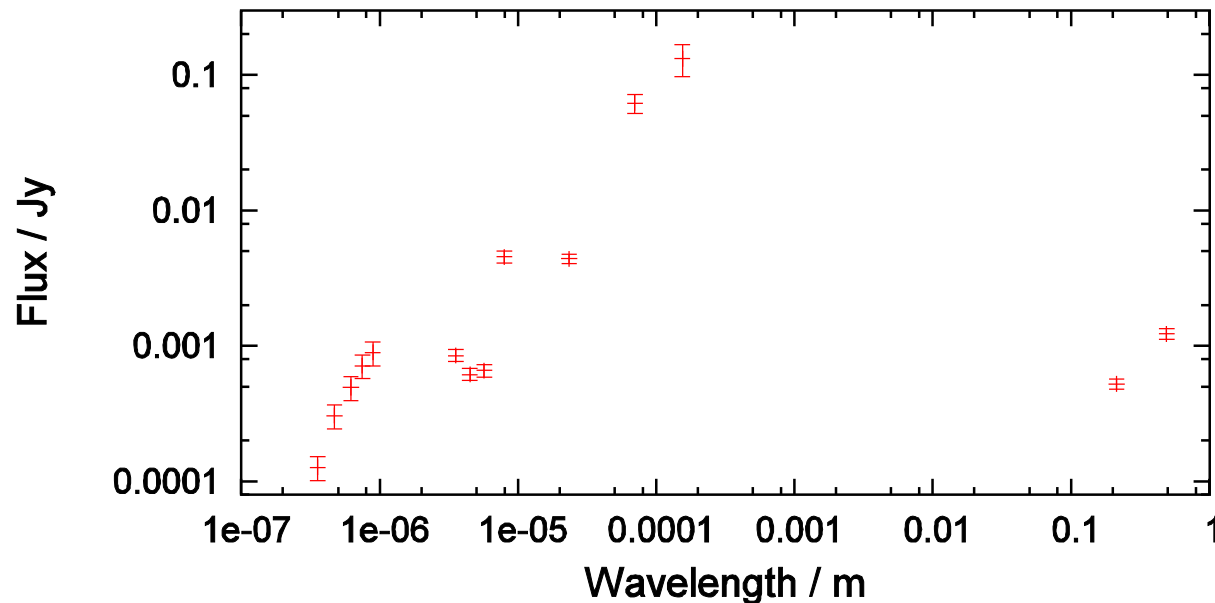


Current Surveys

- **Spitzer extragalactic First Look Survey**
 - Complete
- **ELAIS-N1**
 - Final imaging in progress
- **ELAIS-N2**
 - Initial calibration and imaging in progress
- **Lockman Hole**
 - Initial calibration and imaging in progress

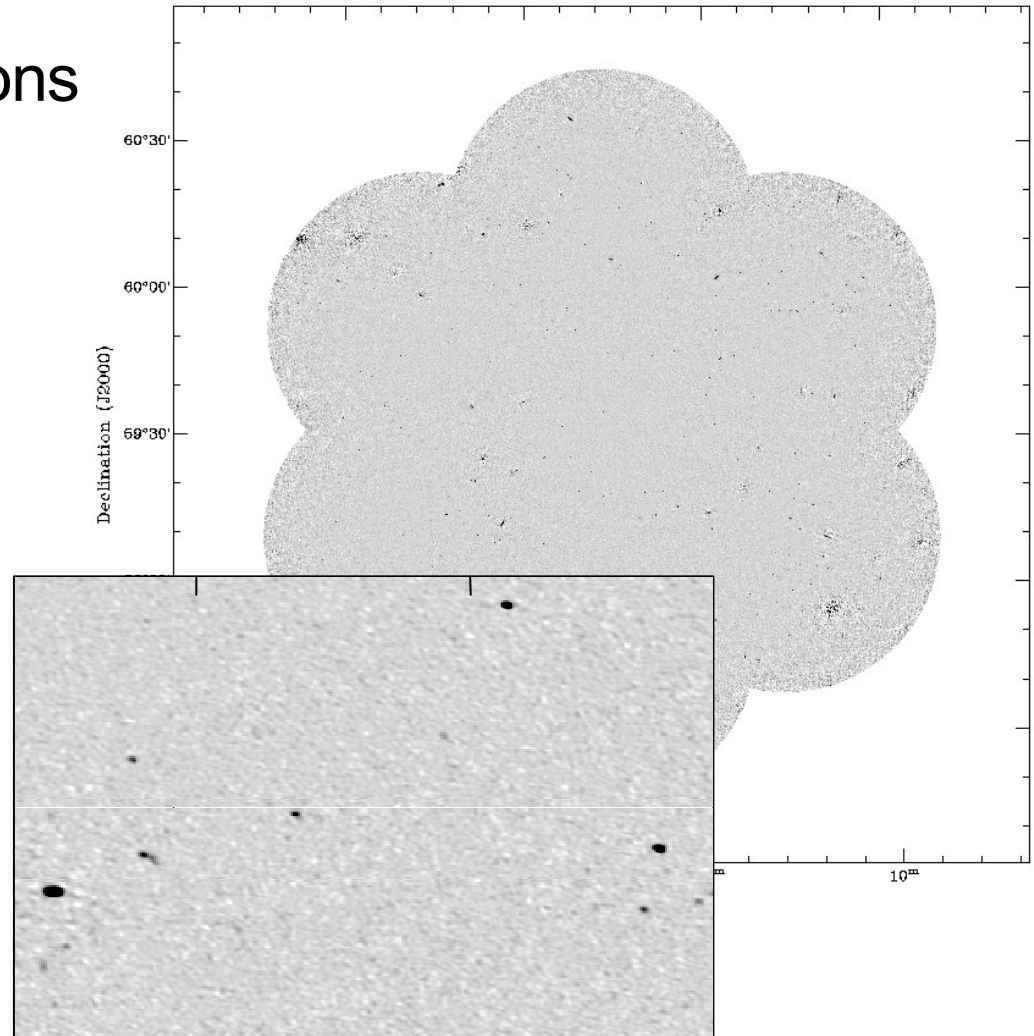
Choice of survey fields

- Complement existing multi-wavelength observations
 - Spitzer data on all regions
 - VLA 1.4 GHz survey
 - variety of optical surveys
 - spectroscopic / photometric redshifts

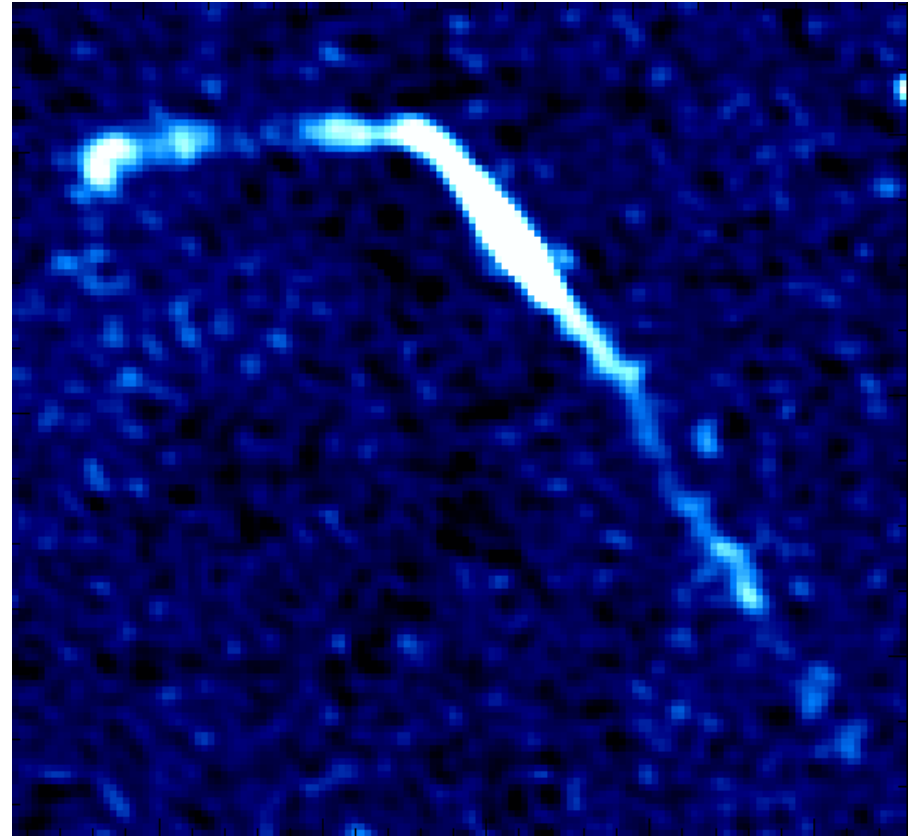
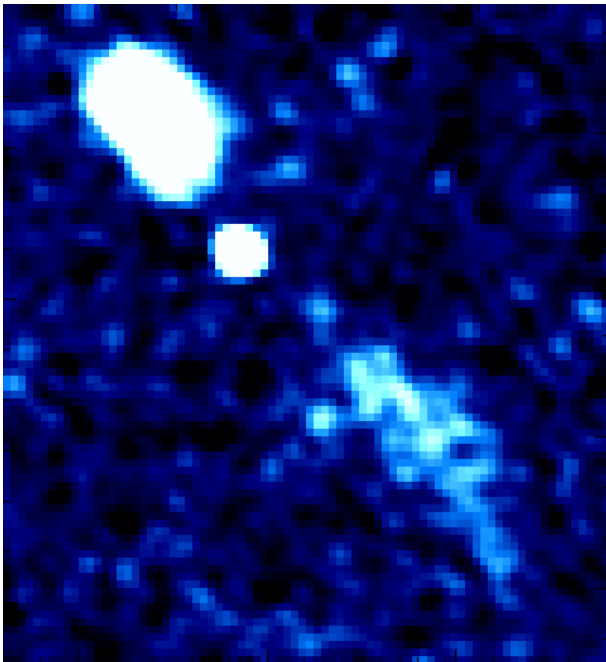
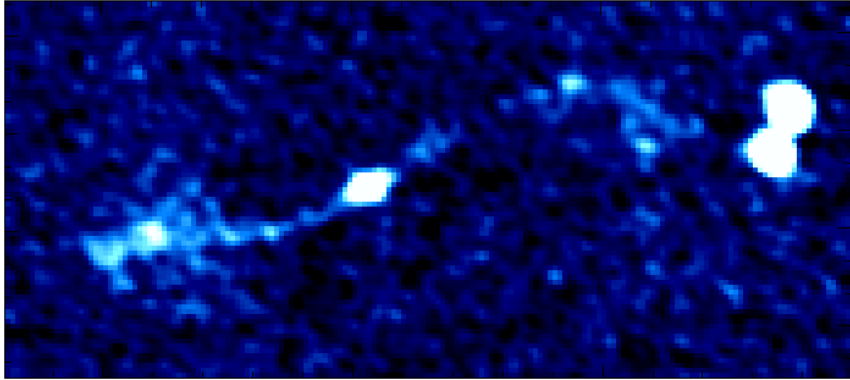


Spitzer First Look Survey field

- 40 hours of observations in 2004
- Imaging complete
 - Catalogue and paper released in January
 - astro-ph/0701534
- $\sim 4 \text{ deg}^2$
- r.m.s. noise $\sim 30 \mu\text{Jy}$
- Resolution $\sim 6''$
- 3944 sources

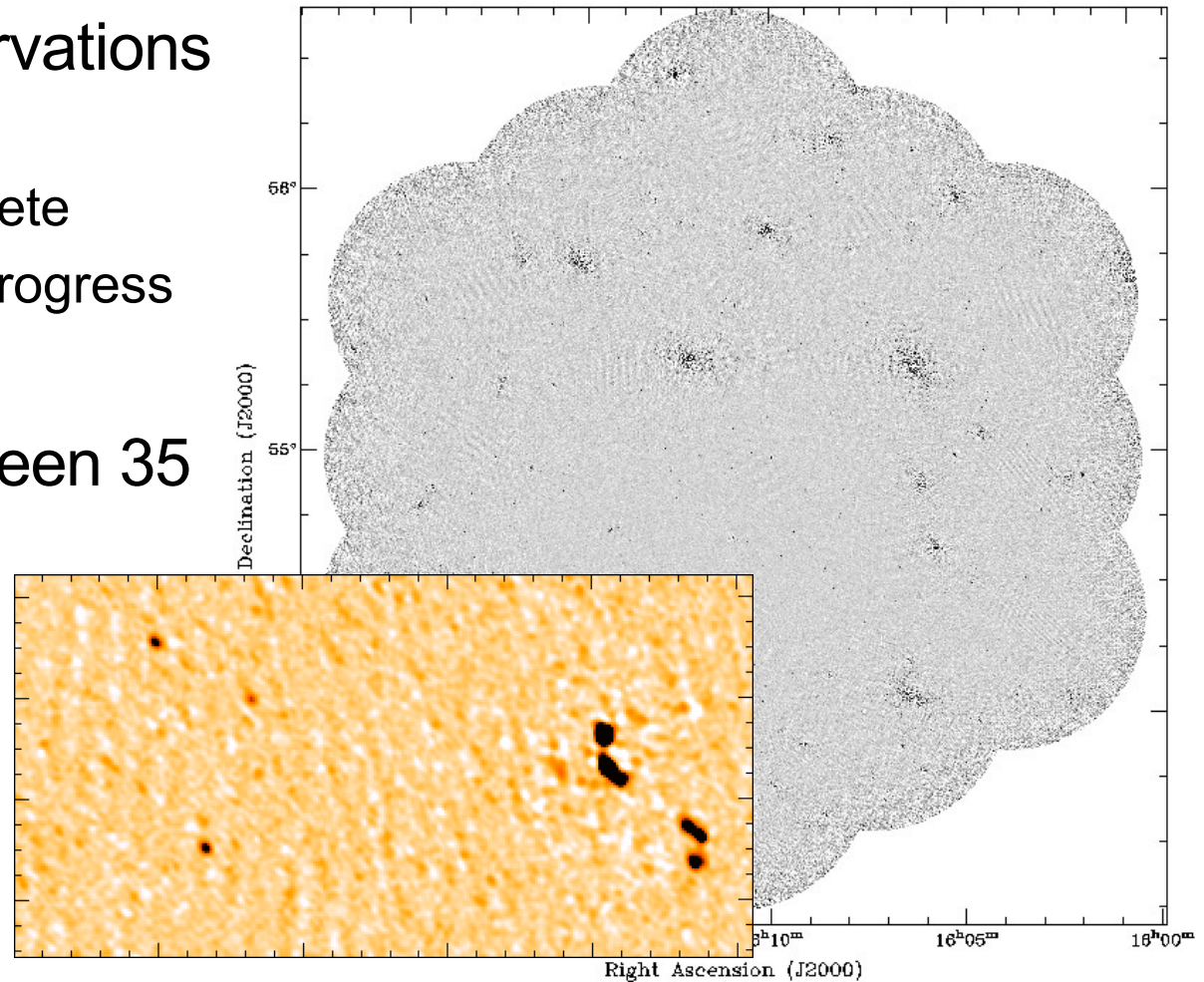


Example sources



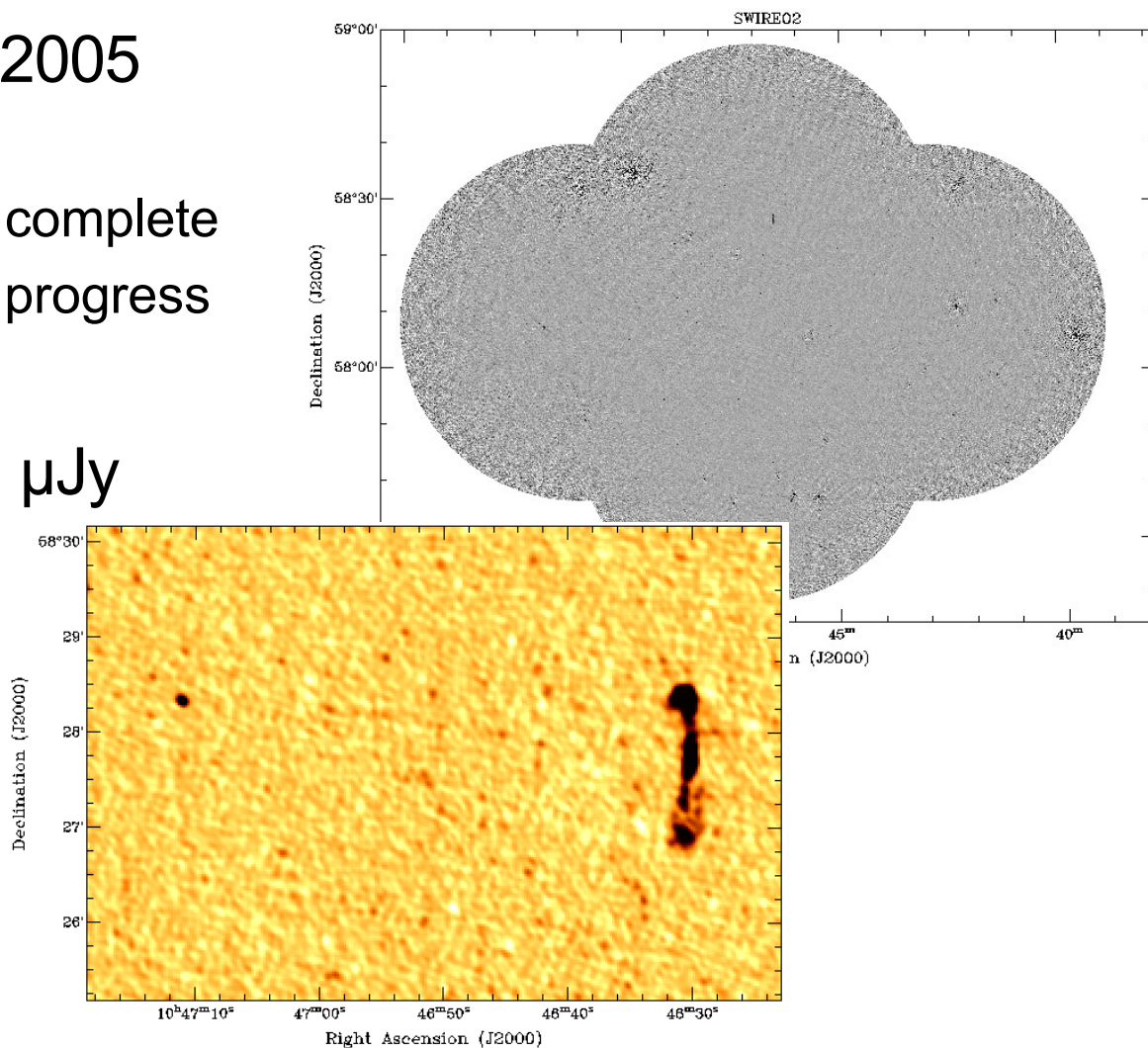
ELAIS-N1

- 25 hours of observations in 2005
 - calibration complete
 - final imaging in progress
- $\sim 9 \text{ deg}^2$
- r.m.s. noise between 35 and $70 \mu\text{Jy}$
- Resolution $\sim 6''$



ELAIS-N2 / Lockman Hole

- 40 hours total in 2005 and 2006
 - initial calibration complete
 - initial imaging in progress
- $\sim 15 \text{ deg}^2$ total
- r.m.s. noise $\sim 70 \mu\text{Jy}$
- Resolution $\sim 6''$

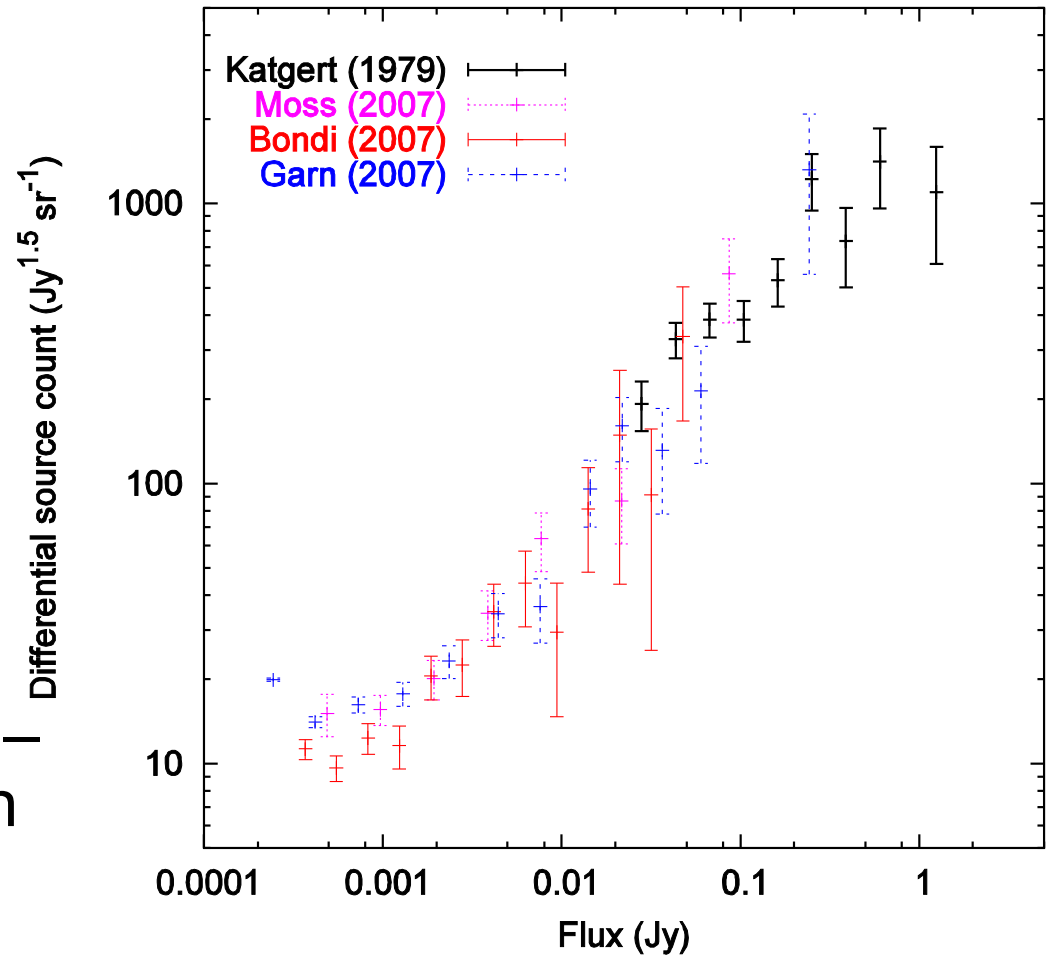


Scientific results so far

- Low flux density source counts
 - Deepest observations at 610 MHz
 - New population of sources found
- Spectral index distribution
 - Variation between high / low flux sources
 - Evidence that star-forming galaxies begin to dominate source counts at low flux densities
- Radio properties of Type-II AGN

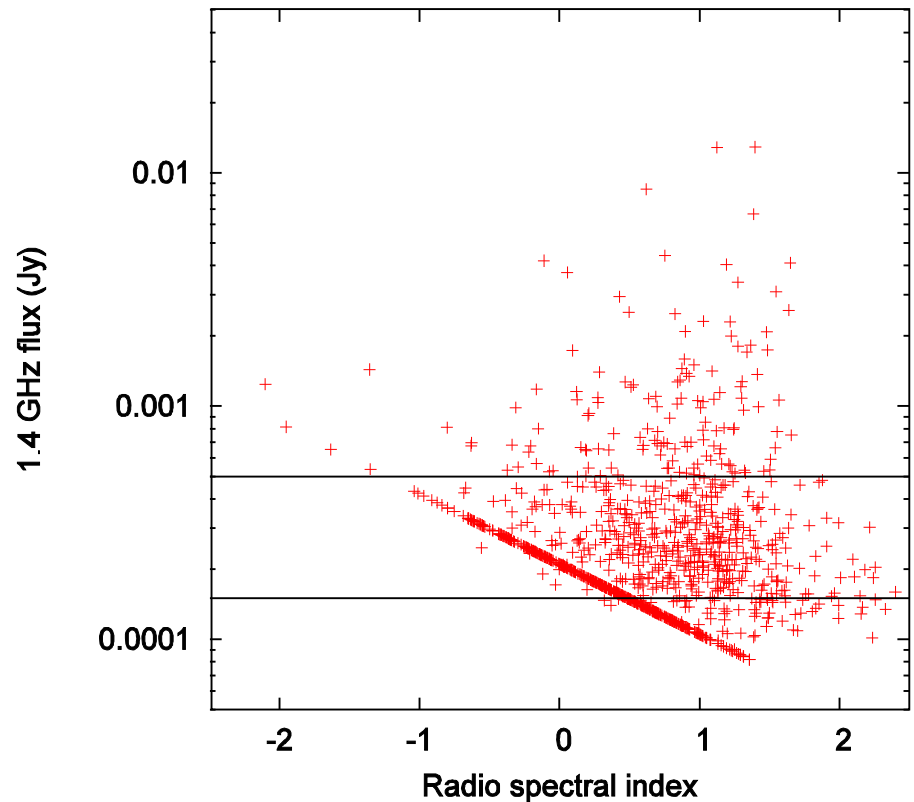
Differential source counts

- Deepest 610-MHz surveys to date
- Flattening of source counts at low flux density
 - Star-forming galaxies begin to dominate
- Some discrepancy still – should be resolved with future surveys



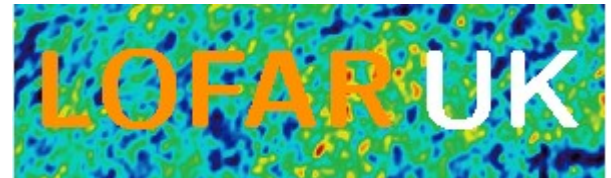
Spectral index distribution

- Spitzer First Look Survey designed to match similar survey at 1.4 GHz
- Change in dominant spectral index for faint objects
 - $\alpha \sim 0.8, S_{1.4} > 0.5 \text{ mJy}$
 - $\alpha \sim 0.45, S_{1.4} < 0.5 \text{ mJy}$



Future proposed GMRT surveys

- Recent proposal
 - 200+ square degrees over several years
 - will complement LOFAR 200 MHz survey
 - PanSTARRS optical survey region (g, r, i, z, y bands)
 - near-IR observations planned
- Proposed depth of 70 – 100 μJy
 - Techniques for reaching this now well understood
- International collaboration
 - LOFAR-UK consortium
 - Netherlands
 - India



Initial proposal

- 28 deg² over two semesters – covering the four PanSTARRS regions with no 610 MHz data
 - IFA / Lynx
 - VISTA-VIDEO1
 - Hubble Deep Field North
 - DEEP2
- Development of automated pipeline needed to deal with large quantities of data
 - Expected to detect ~ 13,000 sources

Summary

- The GMRT is a good survey instrument
- Four wide area surveys complete / in progress – 28 deg²
- Four more surveys planned – 28 deg²
- Future – much larger coverage – 200 deg²
- Lots of complementary data – good scientific potential

Any questions?

