Science potential from deep fields

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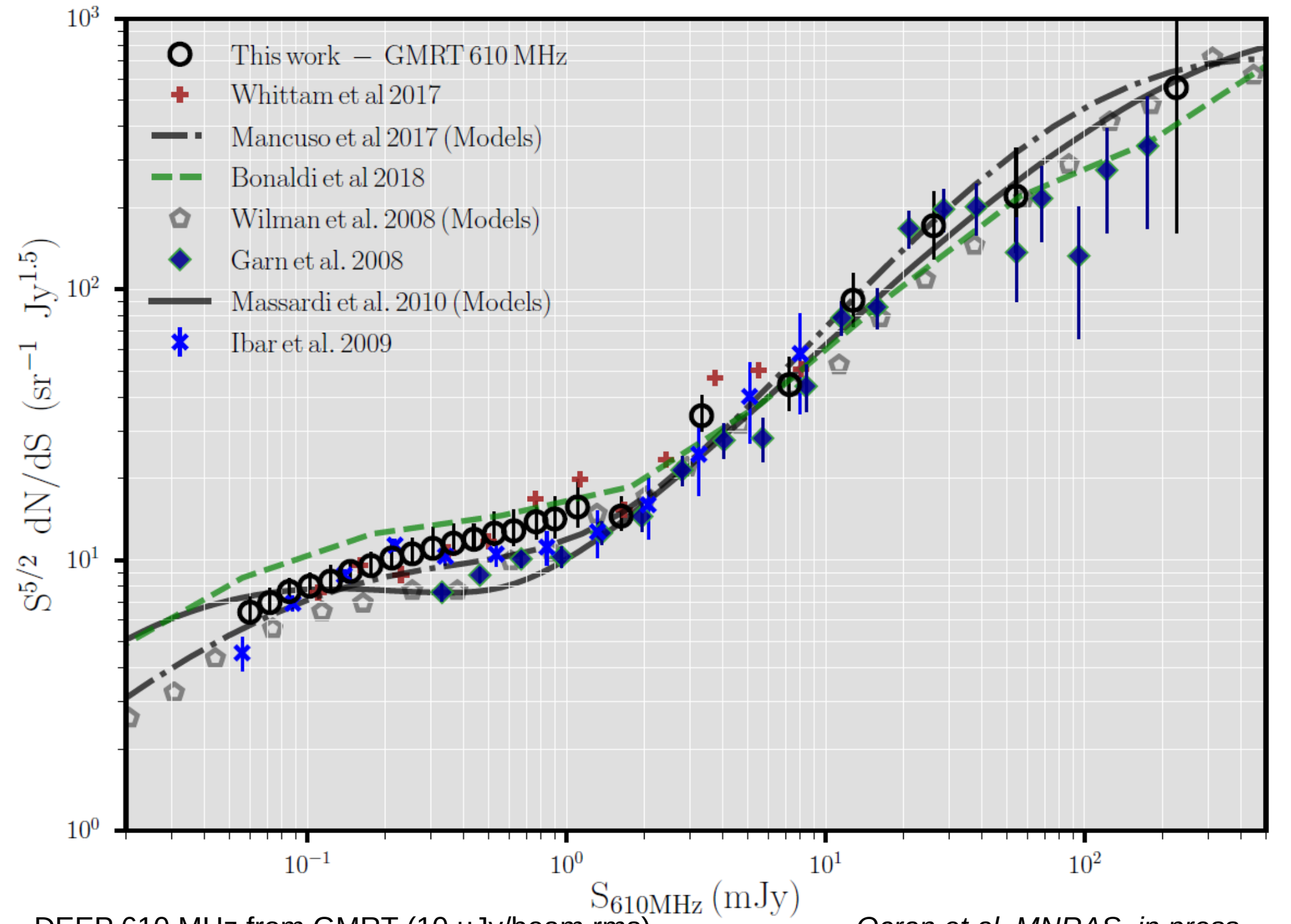
Why go “deep”?

1. $S=L/4\pi r^2$; farther sources are fainter for given L

2. Extremely faint sources, but nearby

3. Source count

4. Serendipitous discovery



DEEP 610 MHz from GMRT (10 μJy/beam rms)

Ocran et al, MNRAS, in press

Some early results

Windhorst (1985):

- Faint sources (< mJy) – largely star forming galaxies
- Bright sources (> a few mJy) mostly powerful AGNs

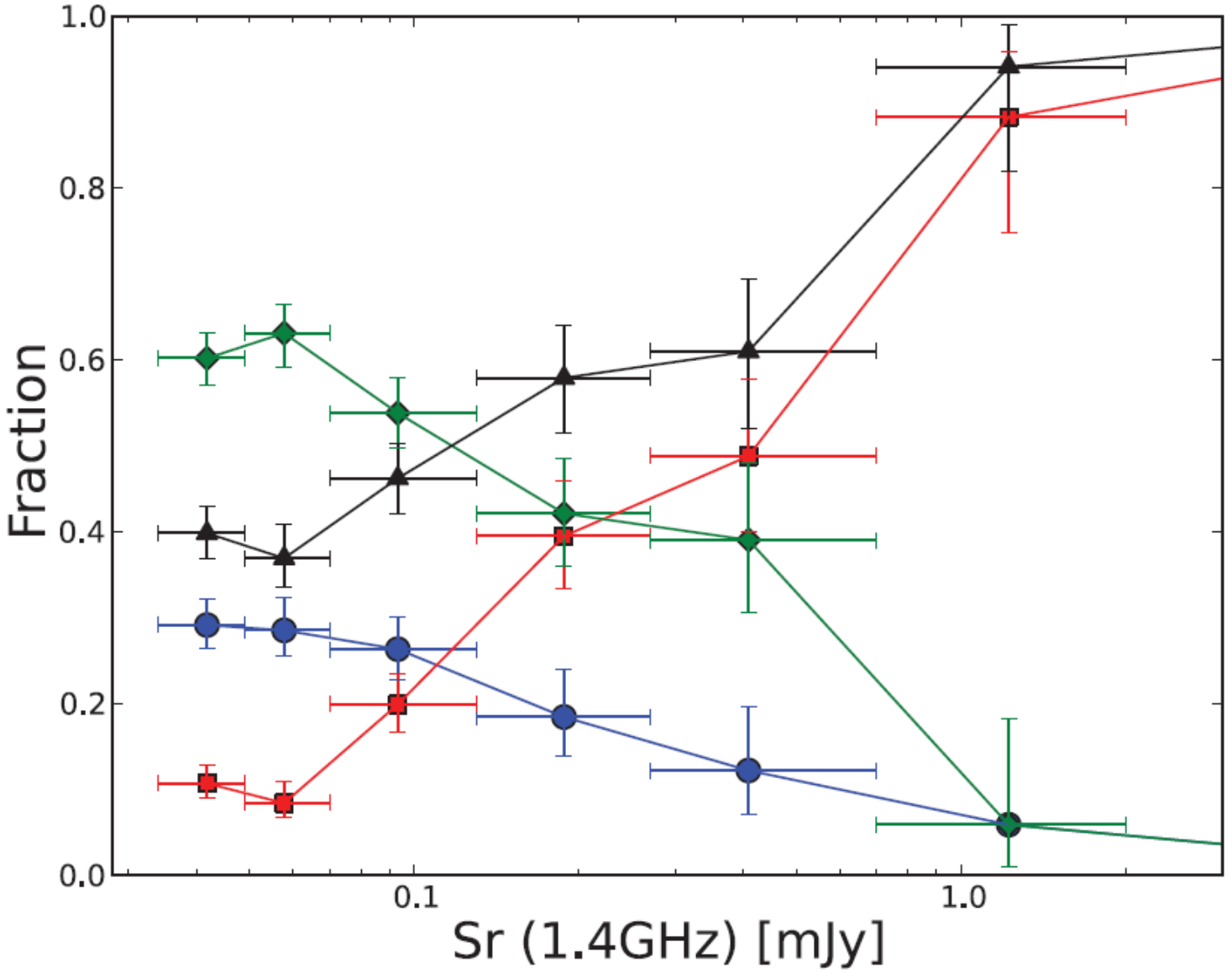
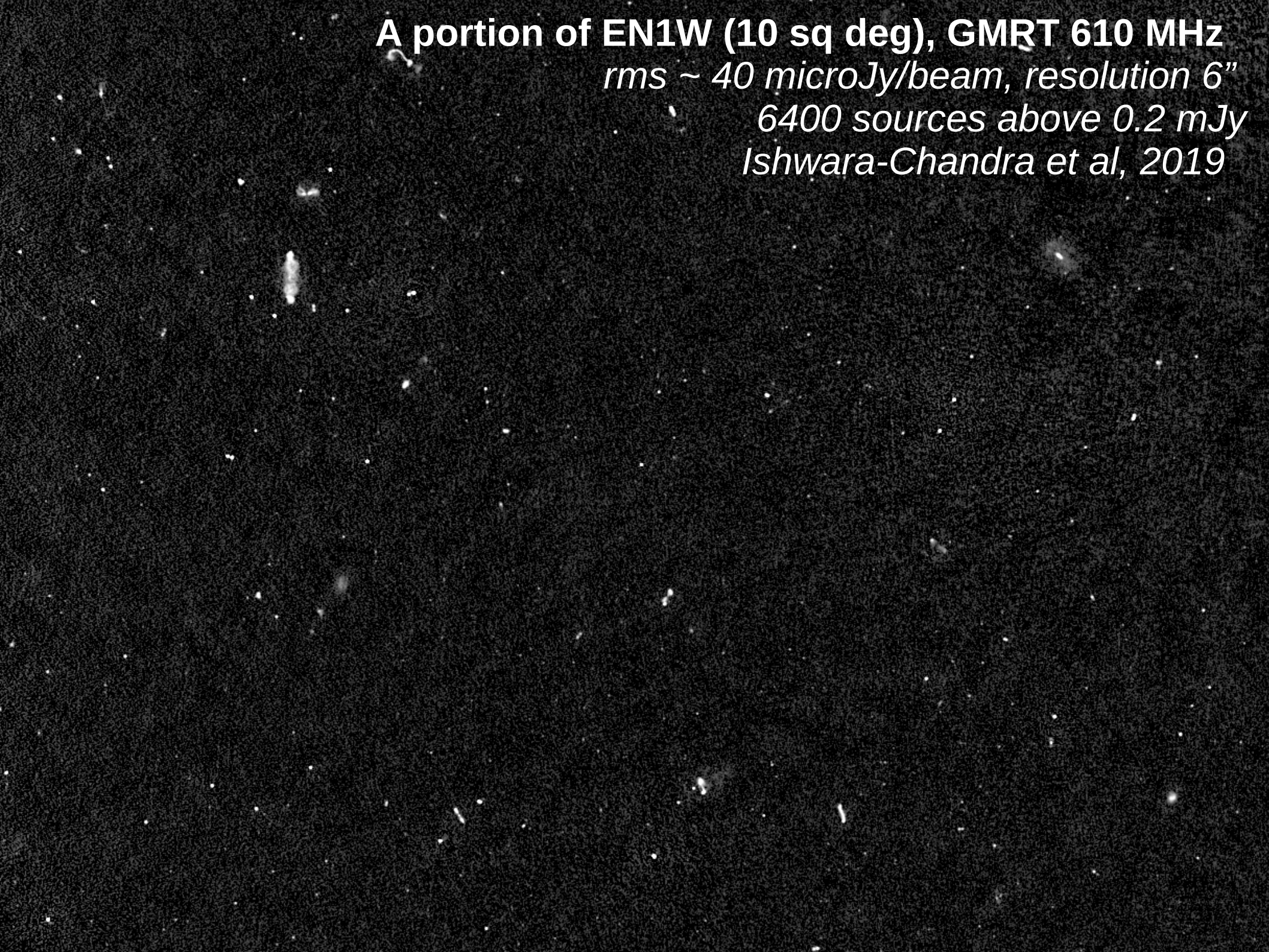


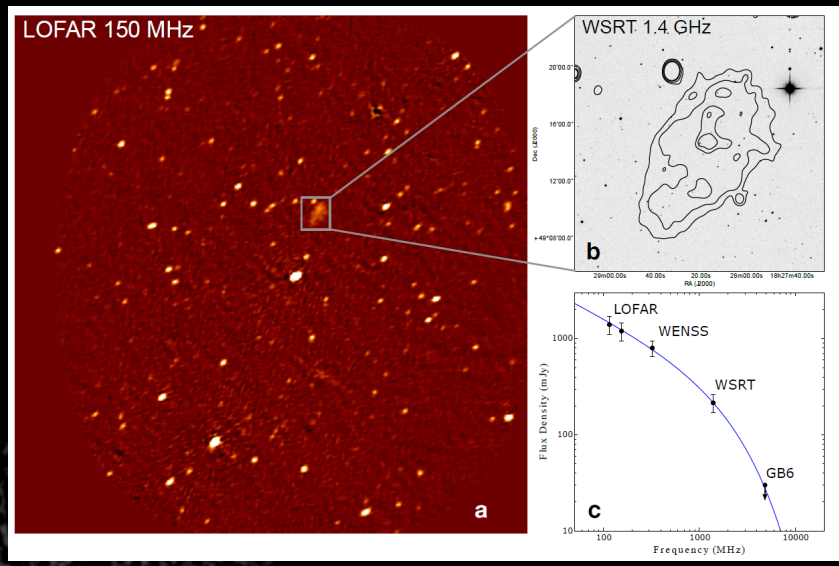
Figure 6. Relative fraction of the various classes of radio sources: SFGs (green diamonds), all AGNs (black triangles), RQ AGNs (blue circles) and RL AGNs (red squares). The error bars correspond to 1σ Poisson errors

A few deep fields

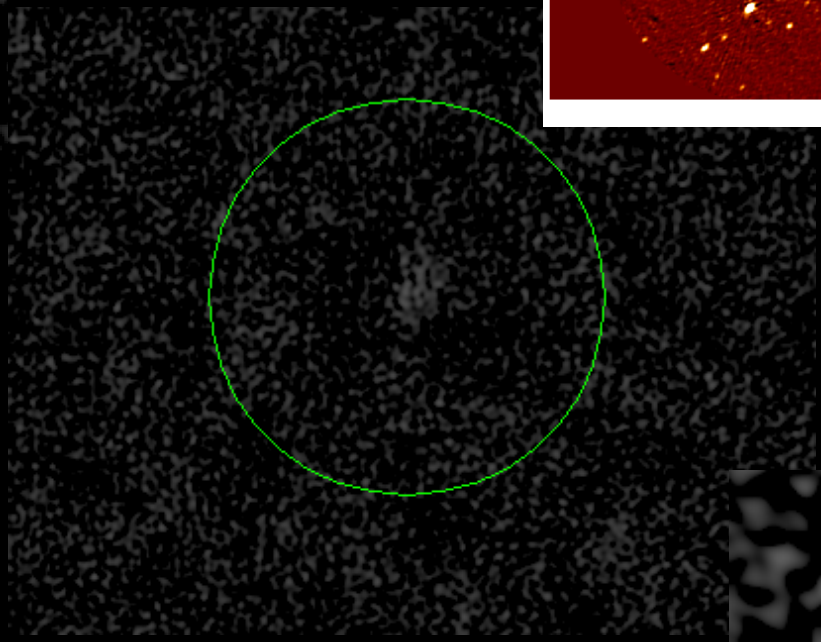

A portion of EN1W (10 sq deg), GMRT 610 MHz
rms ~ 40 microJy/beam, resolution 6”
6400 sources above 0.2 mJy
Ishwara-Chandra et al, 2019

Individual objects from EN1W

GMRT 610 MHz: *Looks different*
Total flux density ~ 22 mJy

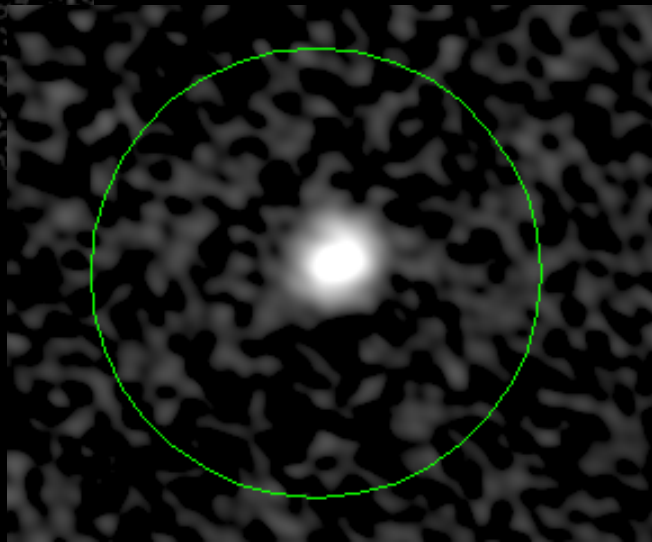


Brienza et al 2016



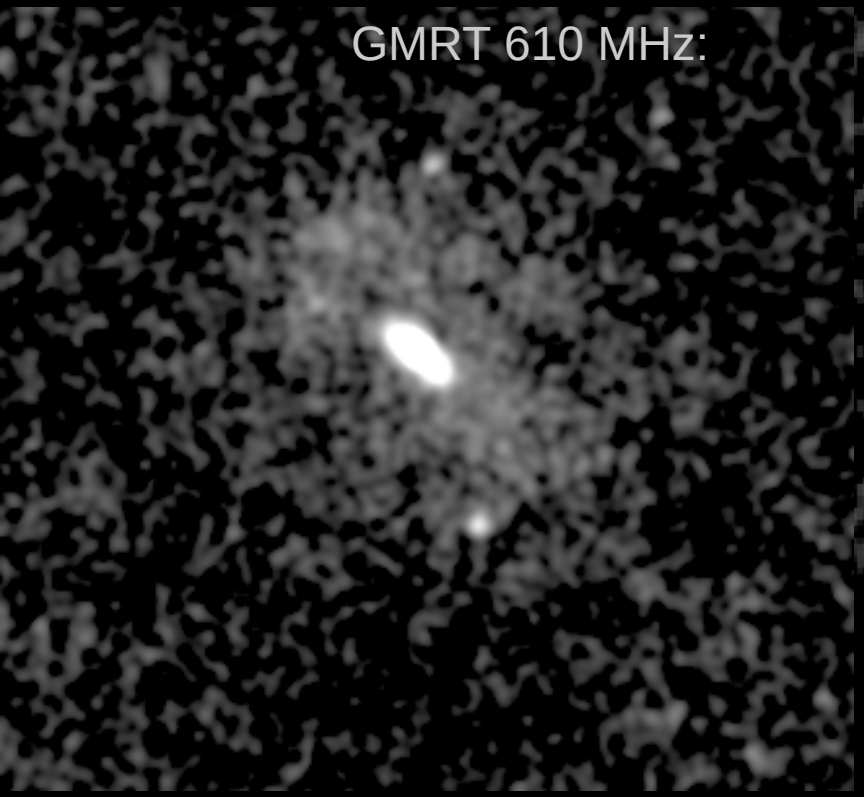
VLA 1.4 GHz – empty?
Barely detected in NVSS
Total flux density ~ 6 mJy

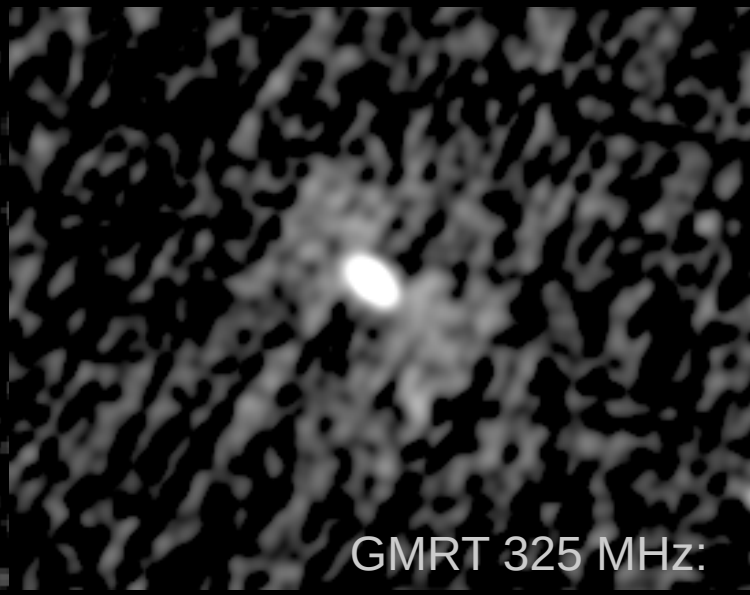
Zara et al, in preparation.

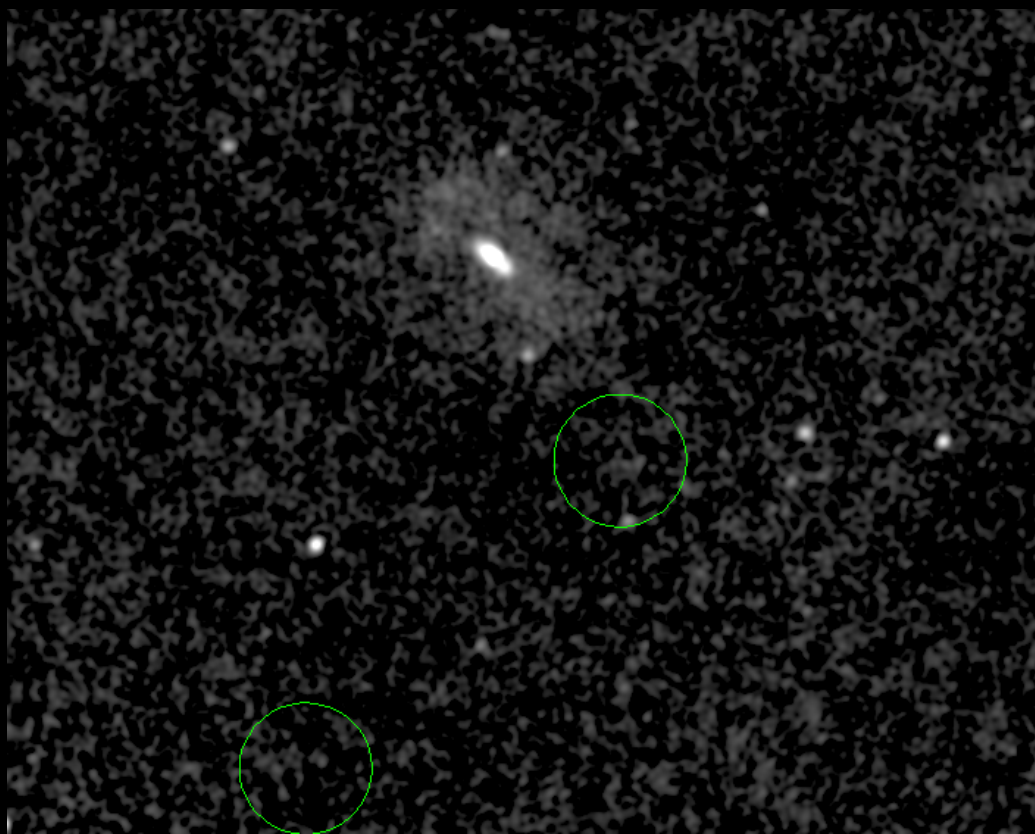


GMRT 325 MHz: very bright
Total flux density ~ 50 mJy

Individual objects from EN1W





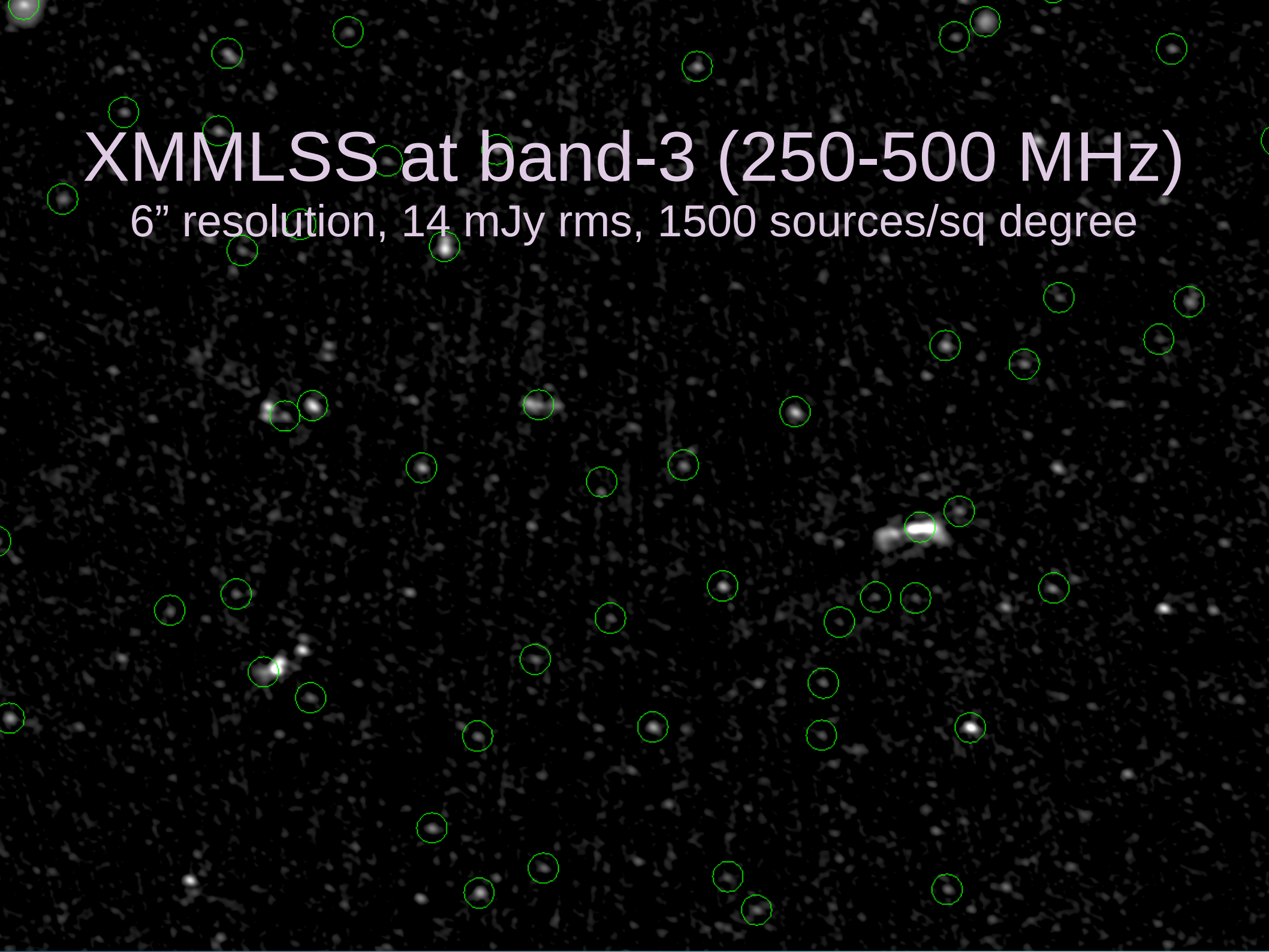


- No “standard AGN morphology”
- Bit large for synchrotron halo.
- A cluster halo? X-Ray data?
- Nearest cluster(s) a few arcmin away
- 3 hours each at uGMRT band 3, 4 and 5 required for better imaging of halo

Knowels et al, in preparation.

Other projects (=papers) from this field

1. Main data paper (*Ishwara-Chandra et al, 2019*)
2. Discovery of a relic source (*Zara et al, 2019*)
3. Giant Synchrotron Halo (*Kenda Knowels* ++)
4. Atypical sources (*Biny Sebastian* ++)
5. Clusters of Galaxies (*Ruta, Satish* ++)
6. Infrared Faint Radio Sources (*Veeresh Singh* ++)
7. Alignment of radio sources (*Russ Taylor* ++)
8. Spectroscopic Sample: LERGs vs HERGs (*Imogen Whittam*++)
9. Stacking in total intensity (*Yogesh Wadadekar* ++)
10. Stacking in HI (*Catherine* ++)
11. Several machine learning and technical projects (*total ~20*)


XMMLSS at band-3 (250-500 MHz)
6” resolution, 14 mJy rms, 1500 sources/sq degree

Concluding remarks

Deep fields are becoming the trend because

- Provides statistically complete data set
- More productive to gather multi-wavelength data
- Wide range of science possible from single field

Several ongoing programs with uGMRT to get deep data for several legacy fields.