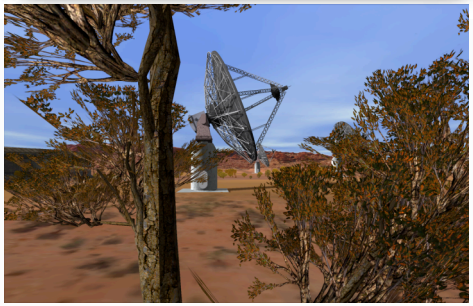
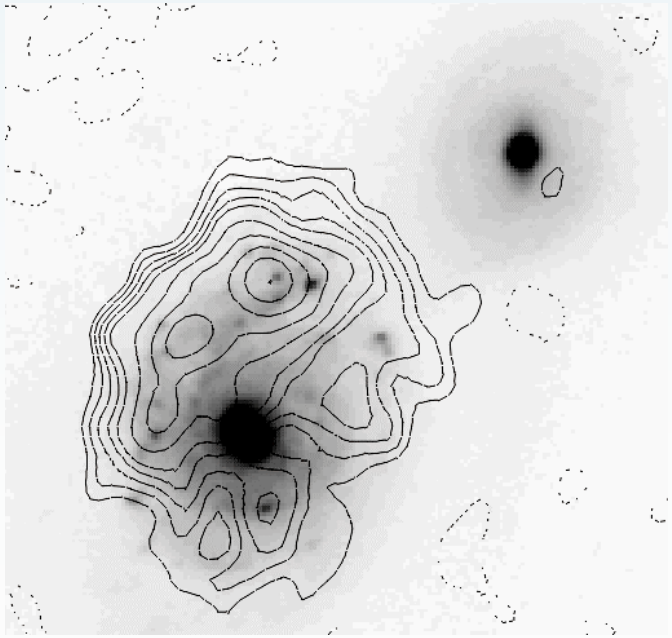
Tracing High Redshift Star Formation in the Current and Next Generation of Radio Surveys

Nick Seymour (MSSL/UCL)

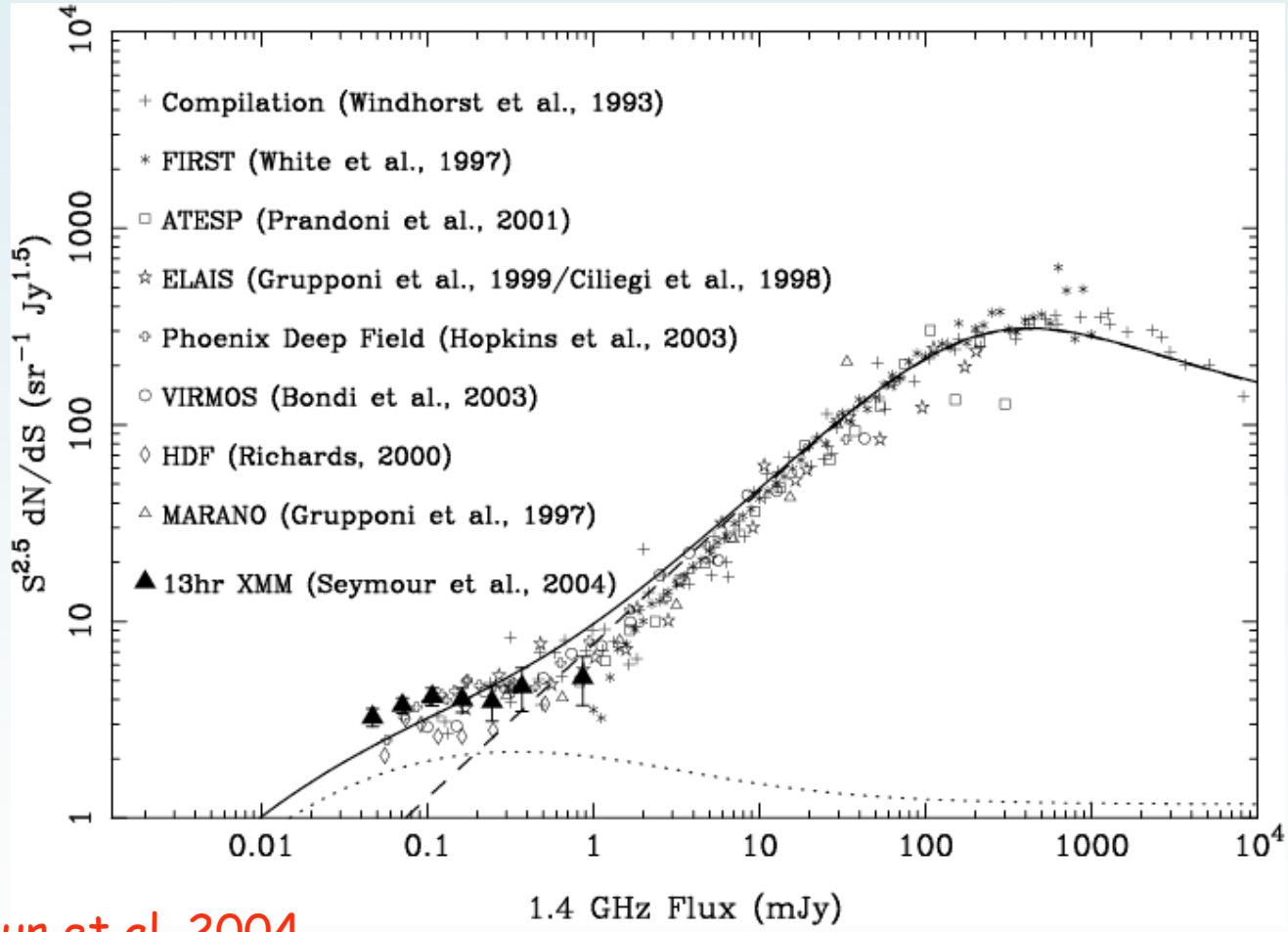
3rd June 2009 - Panoramic Radio Astronomy





Deep 1.4GHz Source Counts

Euclidean normalised counts



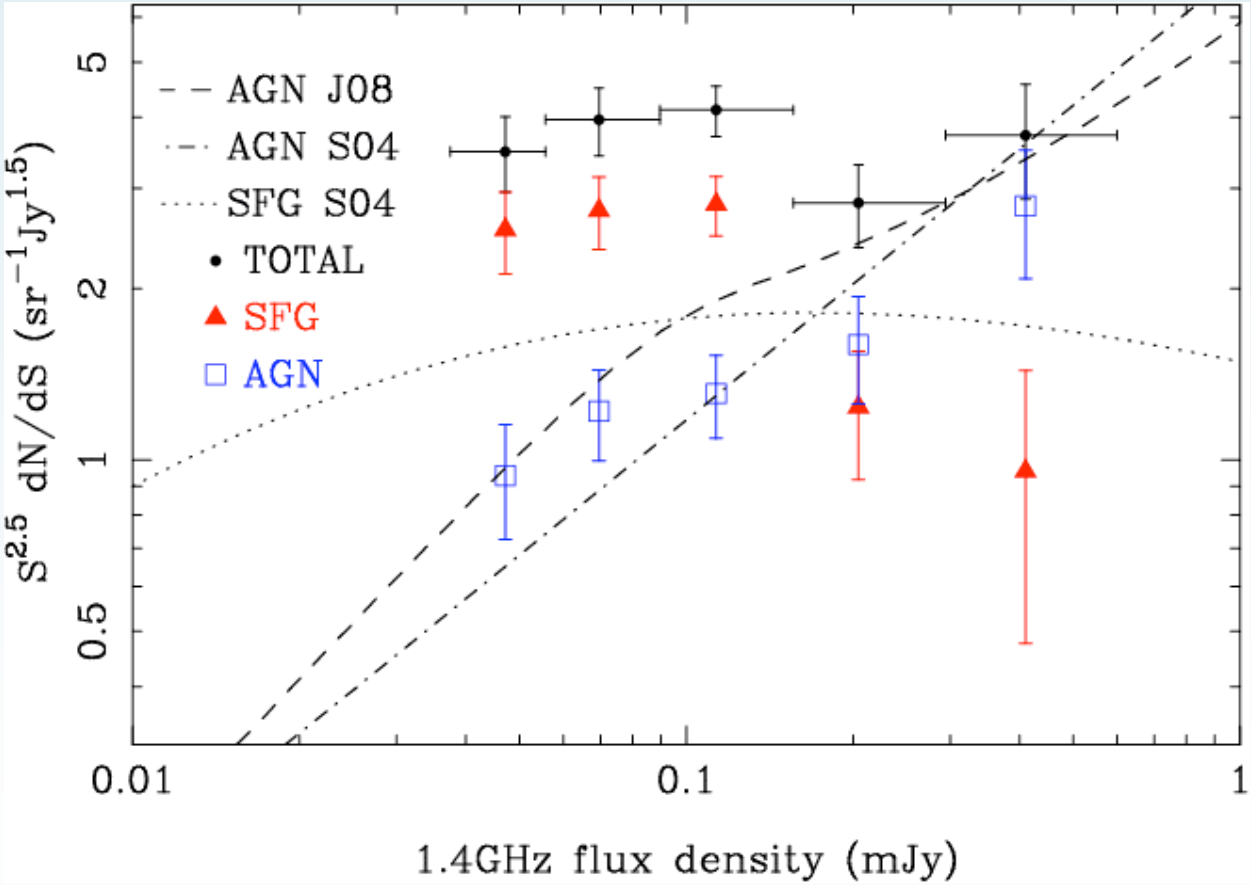
Seymour et al. 2004

1.4GHz flux density (mJy)

Methods to discriminate between AGN and star forming activity

- Radio morphology
- Radio spectral index/radio SED
- Radio variability
- Radio polarisation
- Flux density ratios/full SED modeling

Fraction of SFG at Faint Radio Flux Densities



Seymour et al. 2008

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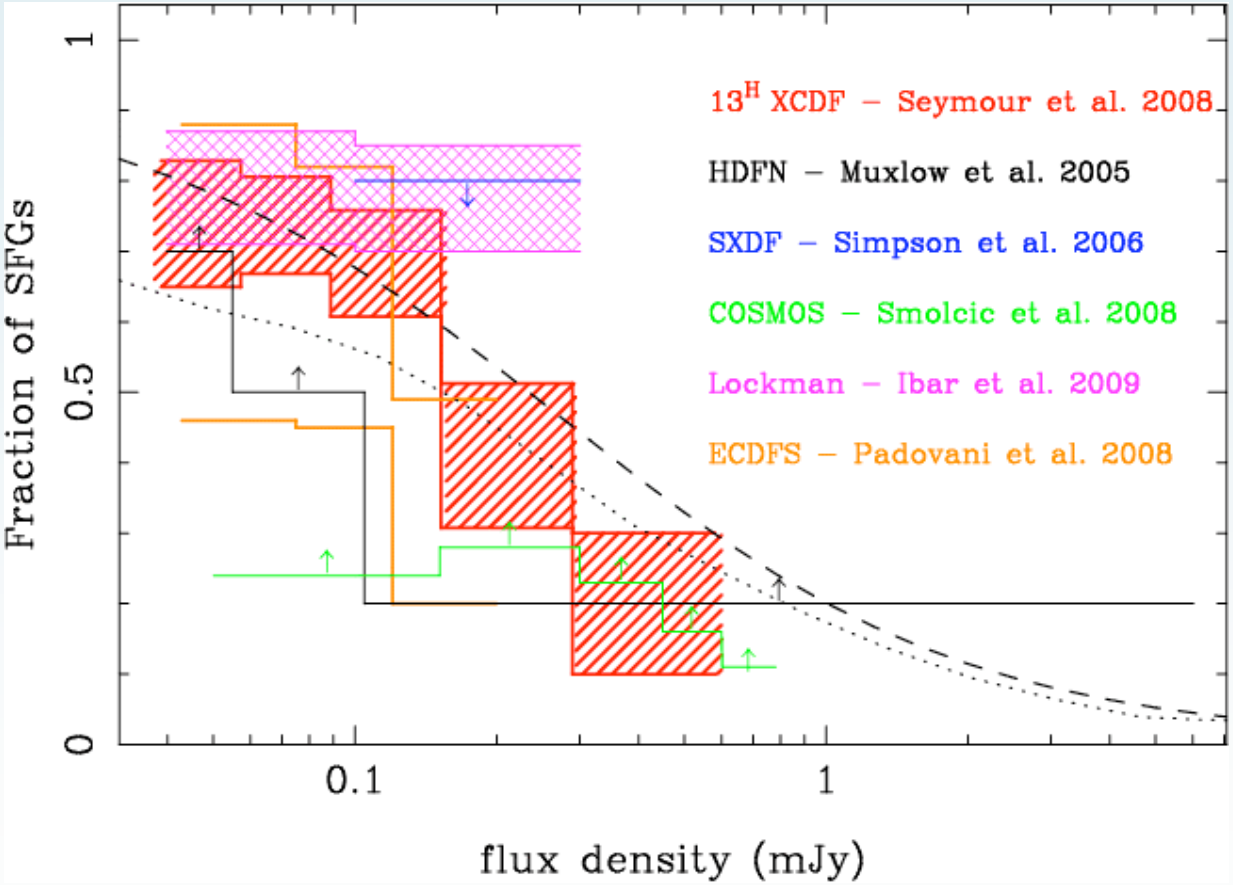
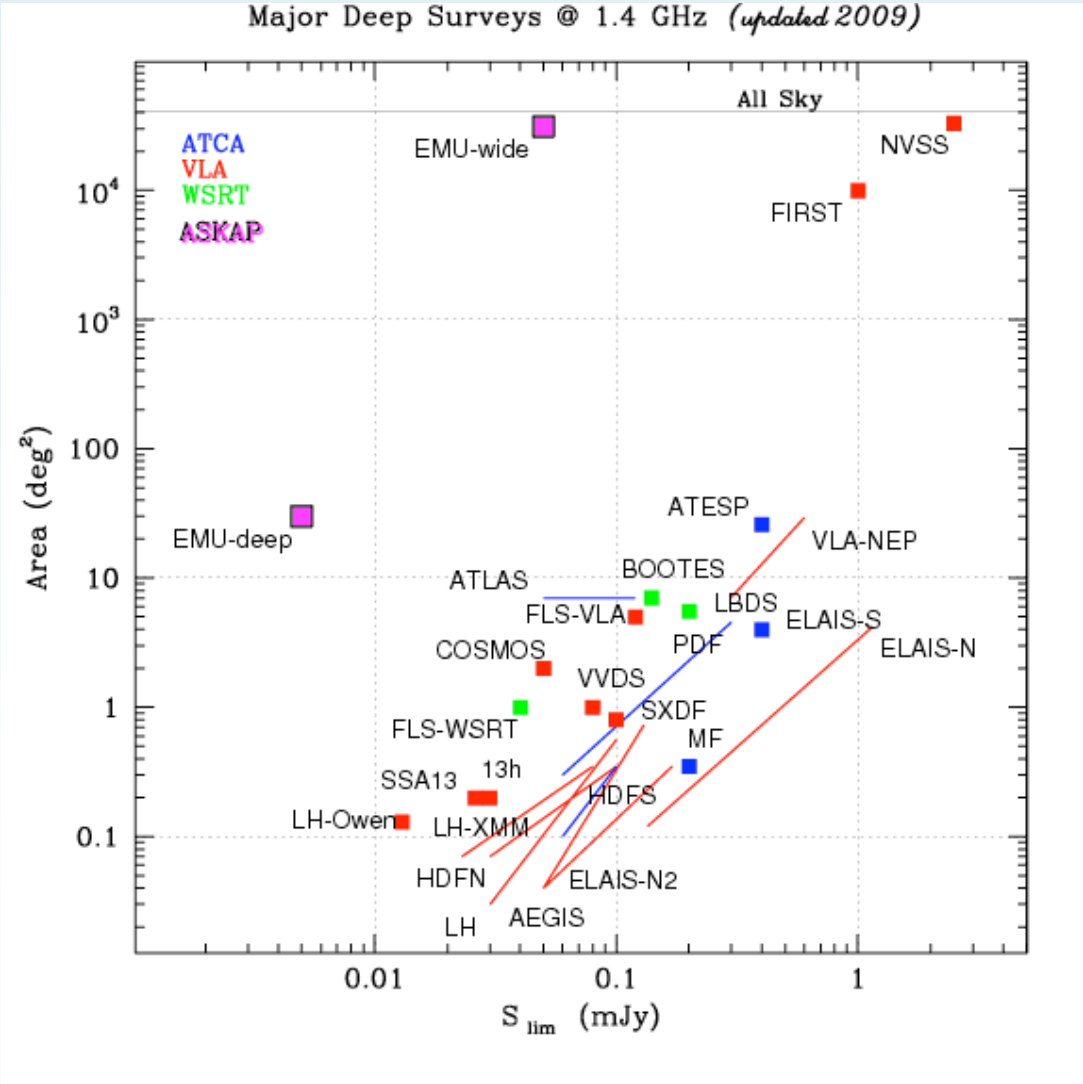


The Current and Next Generation of Surveys

By Isabella Prandoni



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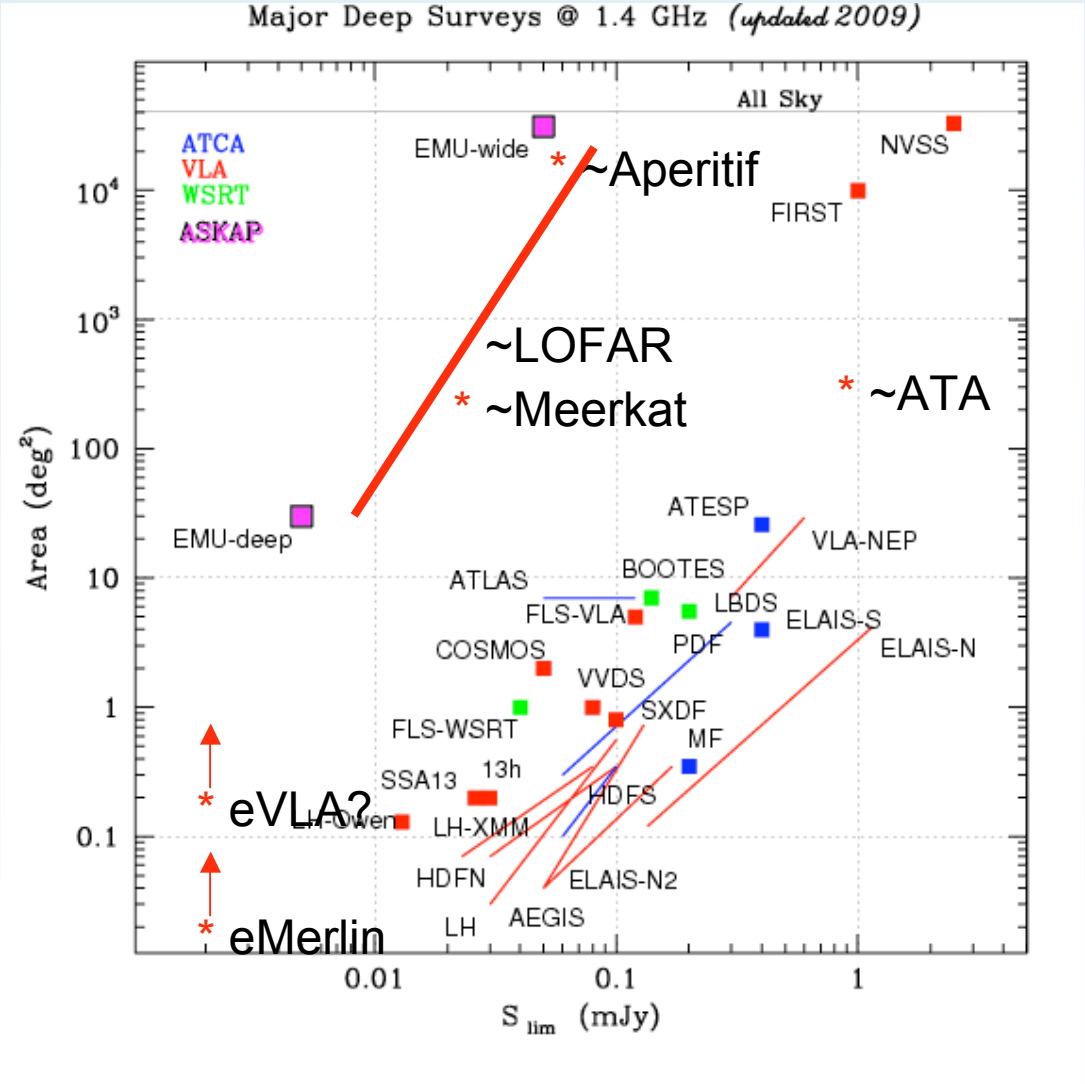

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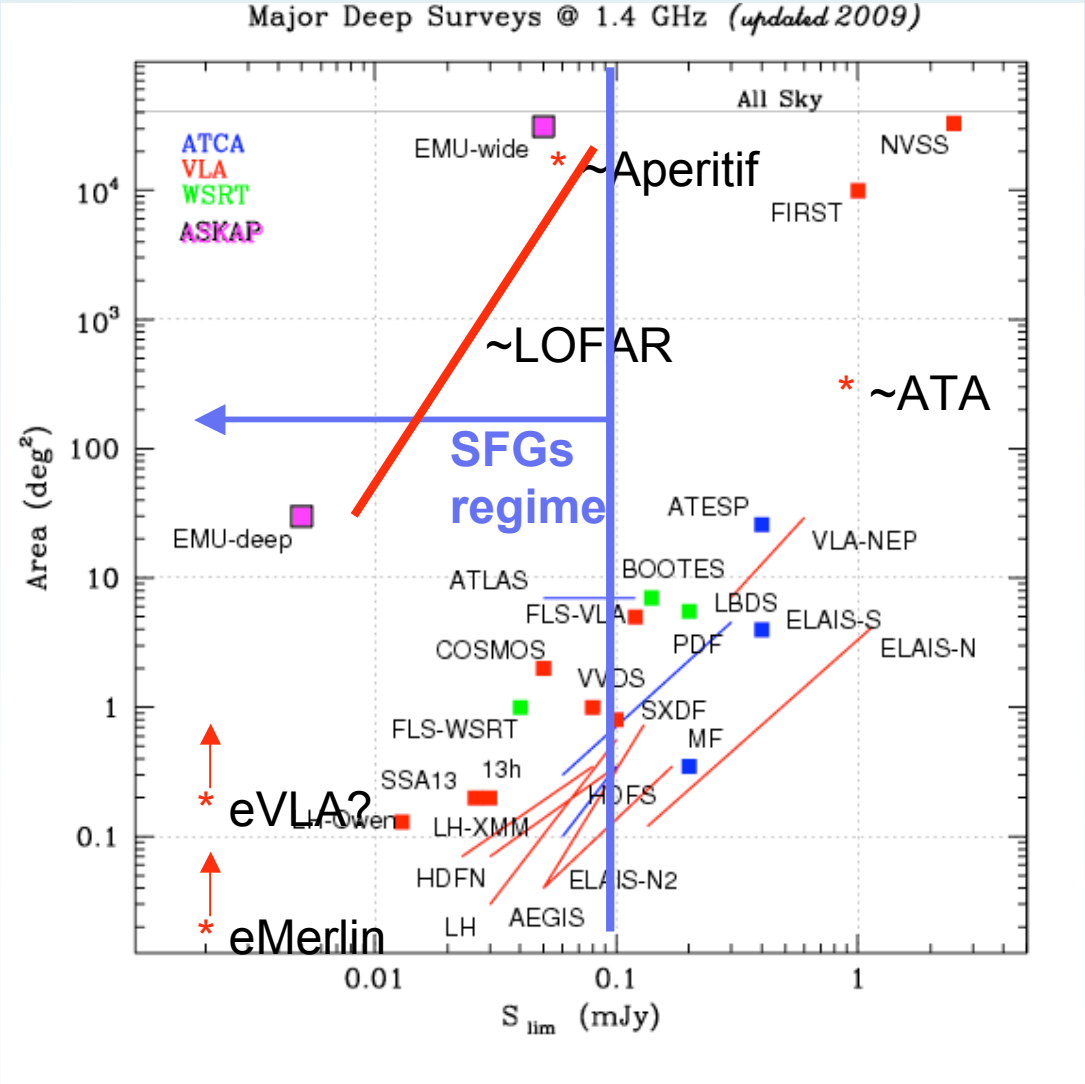

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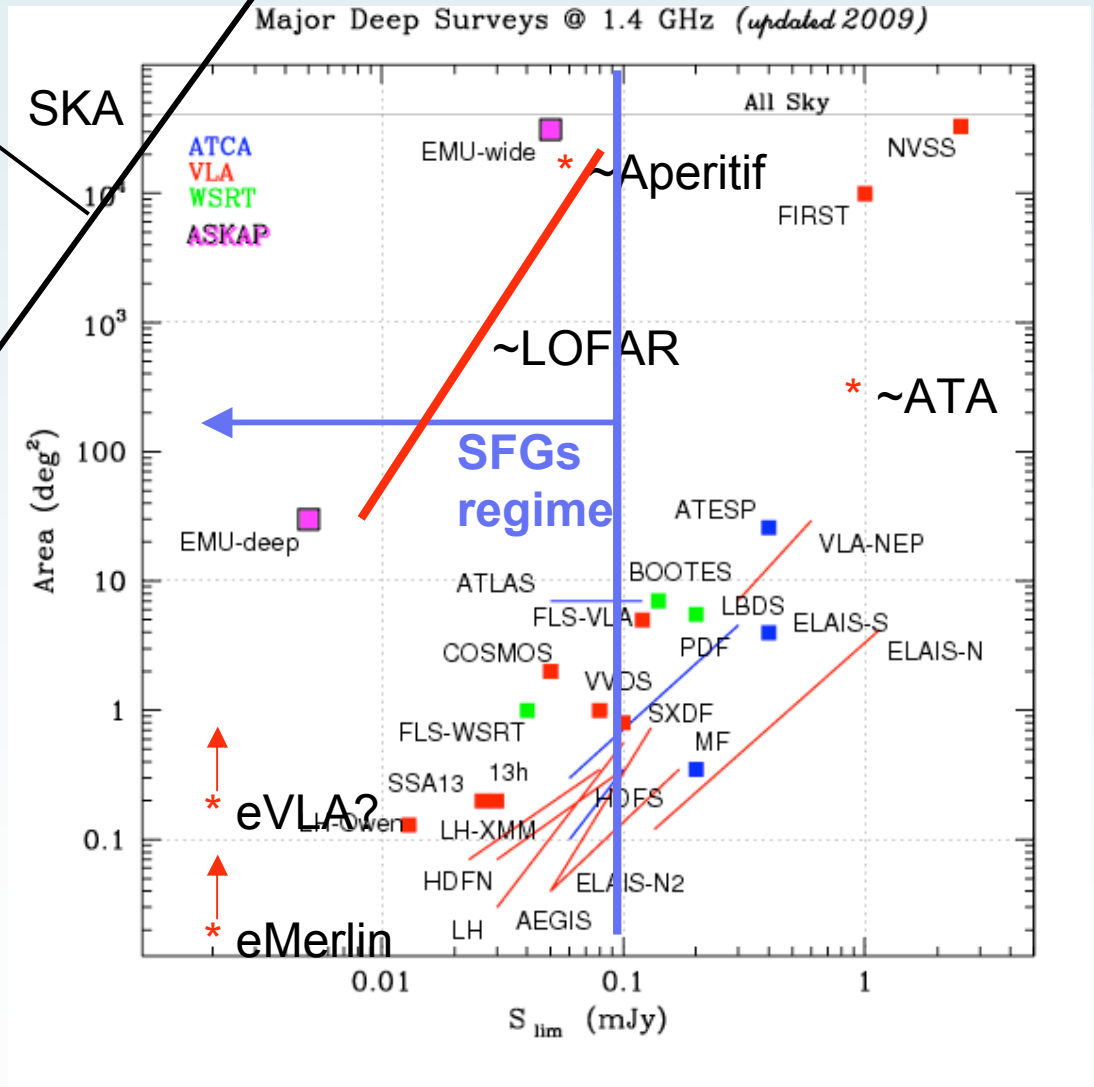


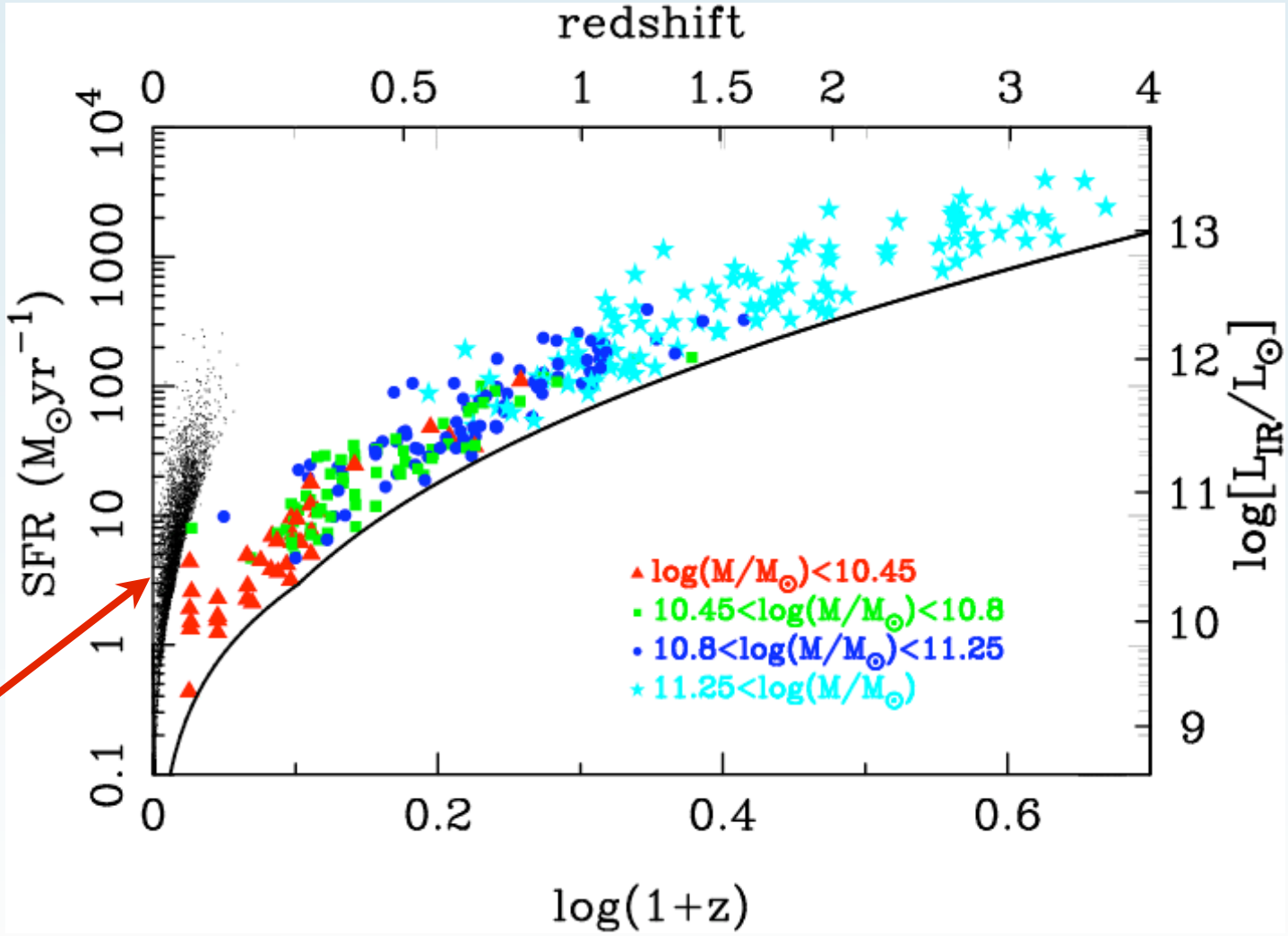
What science can we do with radio-selected star forming galaxies?

SFR v Redshift for radio-selected SFGs

Seymour et al. (2008)

Star Formation Rate

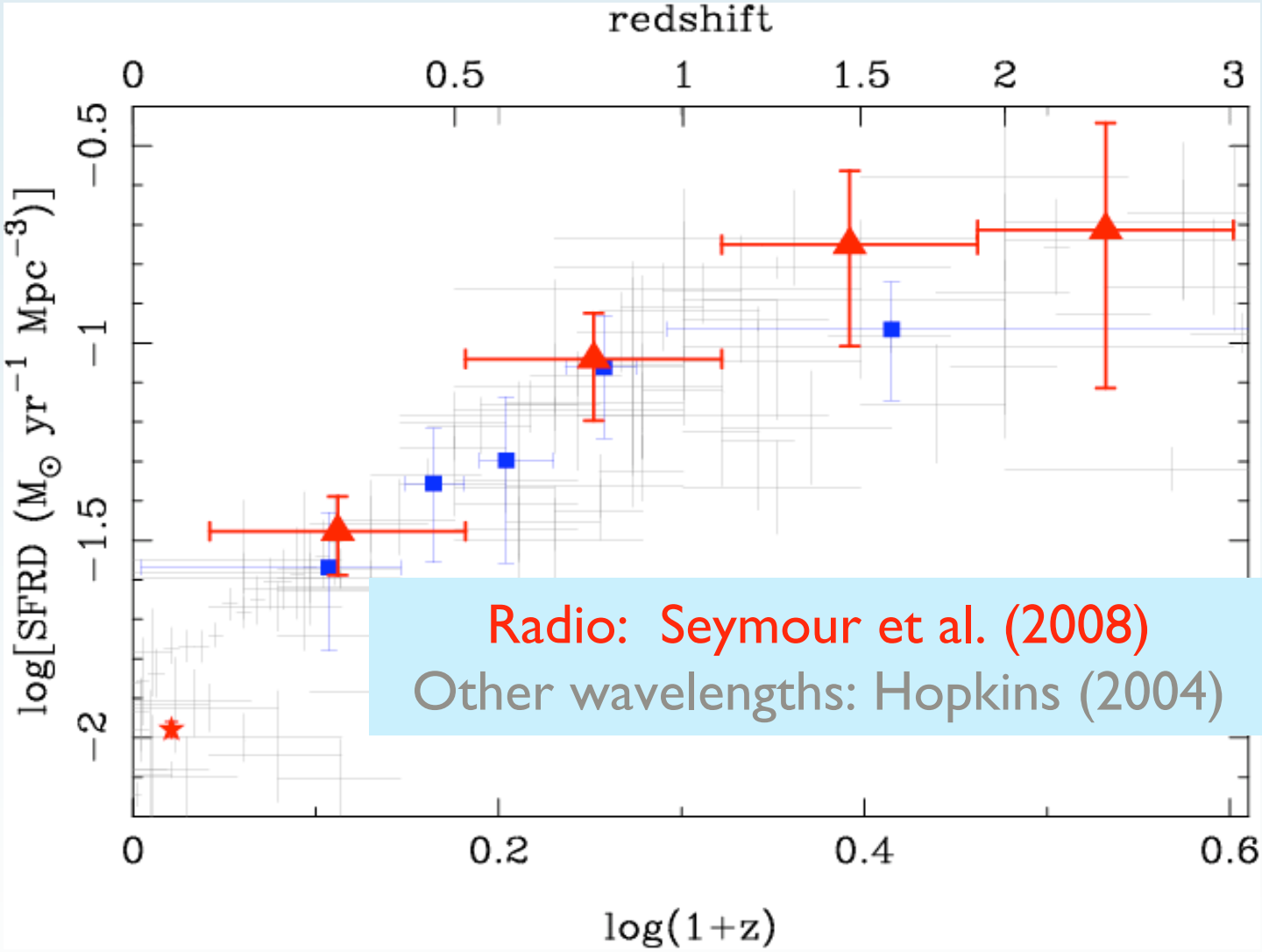
2df local starbursts



At high redshift we discover extreme starbursts in massive galaxies which we don't see locally!

Lilly-Madua Plot

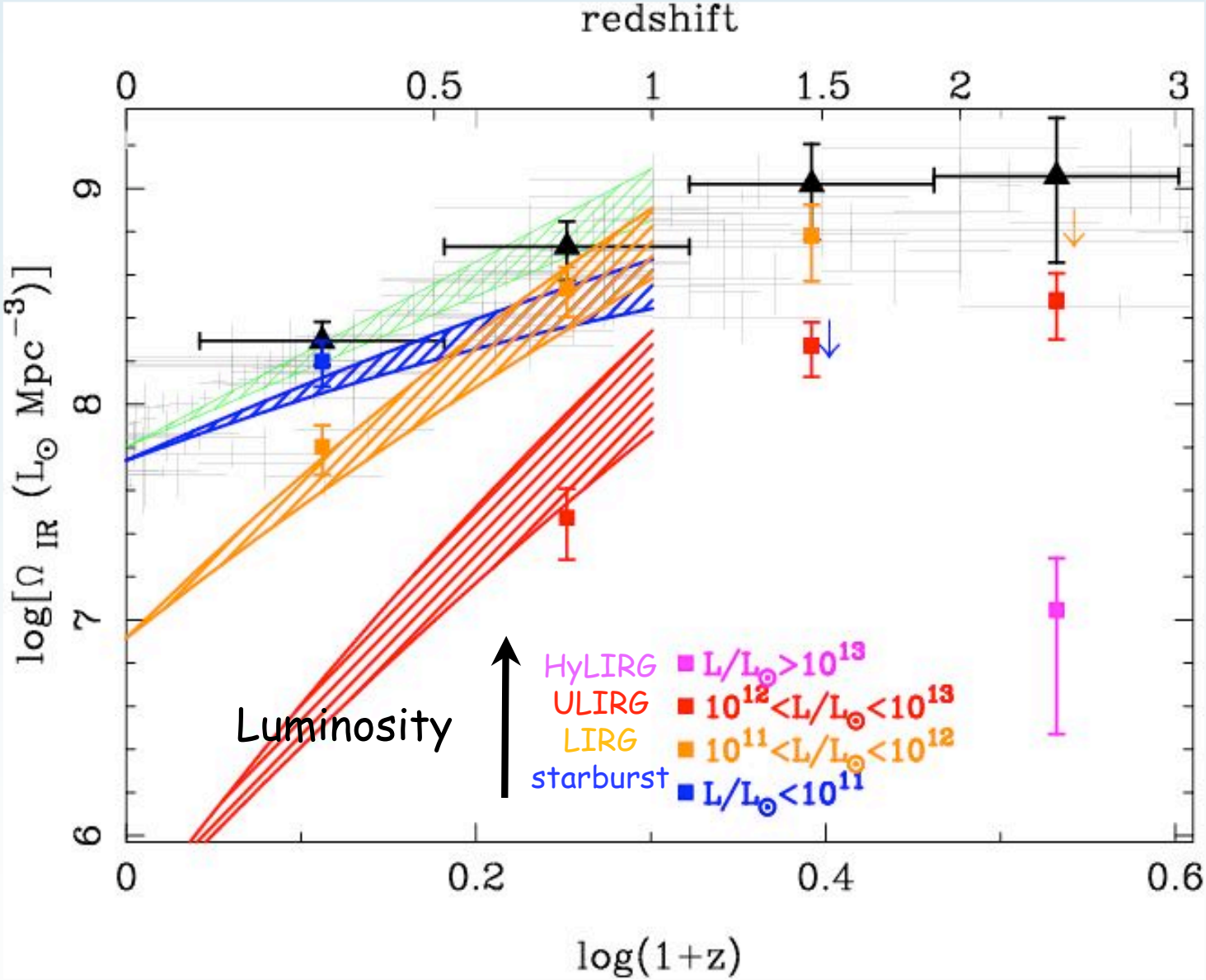
Star Formation Rate Density



Radio results also show the rapid rise to z=1-2

Seymour et al. 2008b

IR/Luminosity Desnity = Star Formation Rate Density



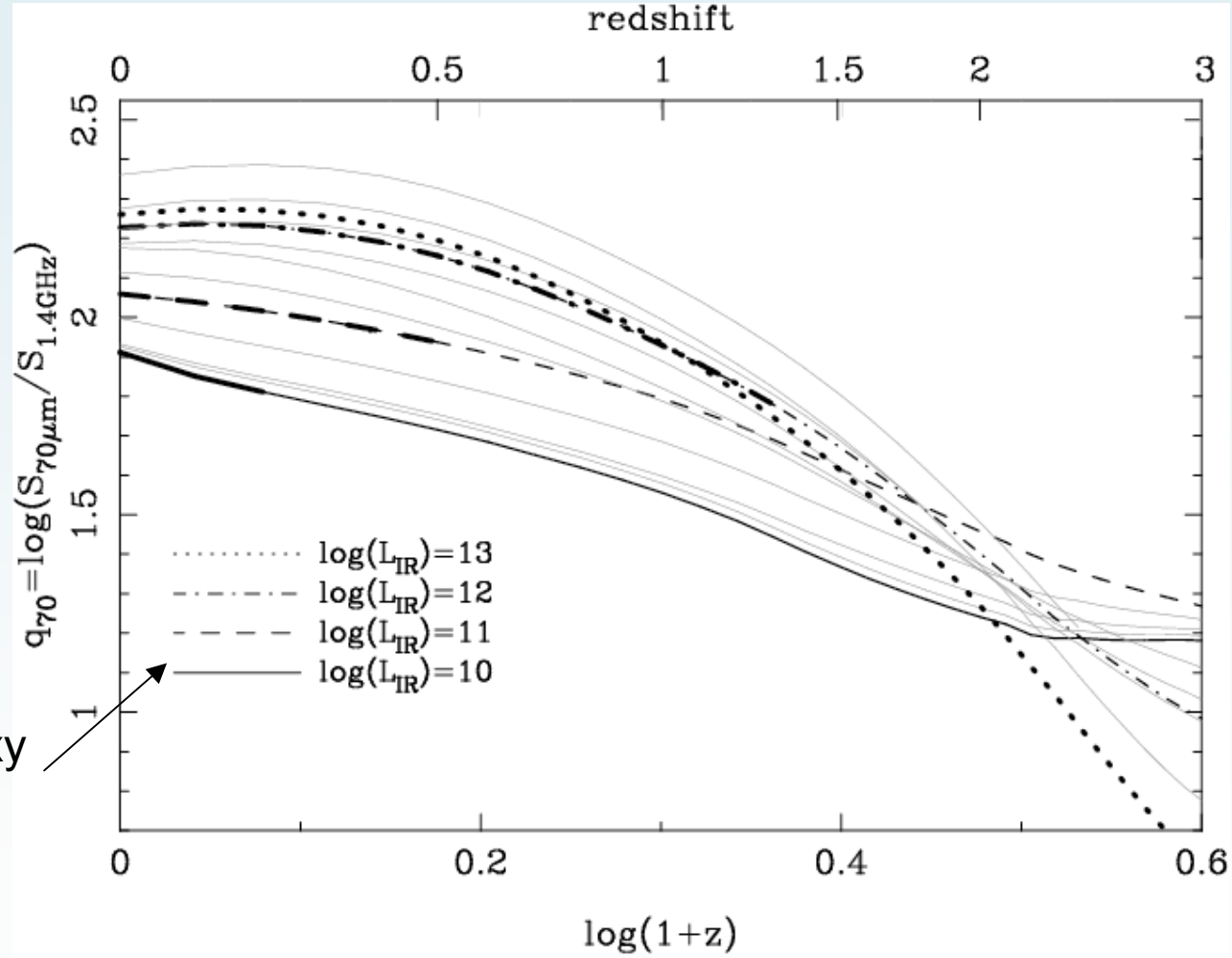
Shaded region from Le Floc'h et al. (2005)

Does the radio luminosity/star formation rate density relation hold at high redshifts/luminosities?

This primarily depends on the IR-radio correlation

Far-IR/Radio Correlation

Observed Flux Density Ratio



Local galaxy templates

Seymour et al. 2009

Far-IR/Radio Correlation

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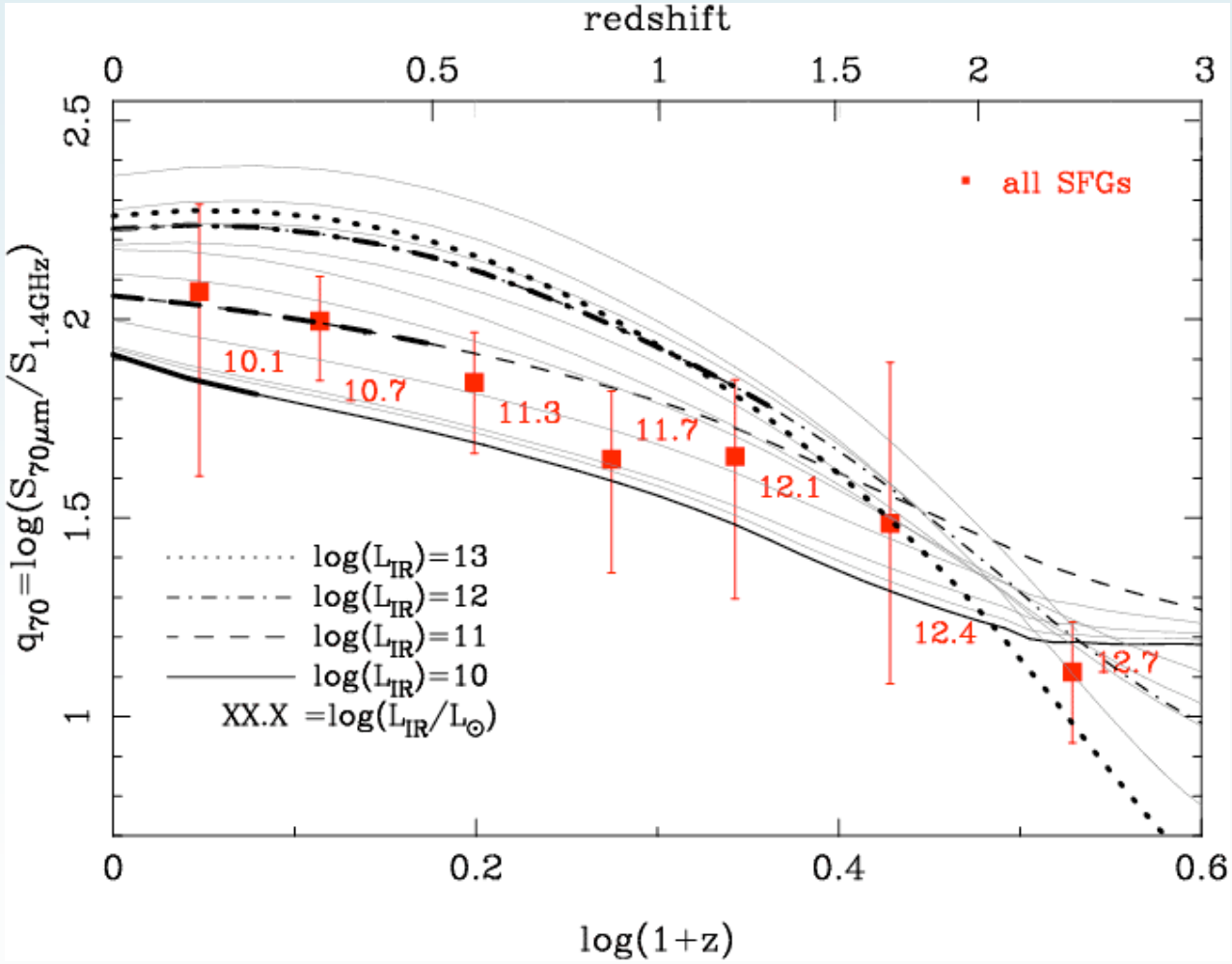


Seymour et al. 2009

Why might the 70um/radio correlation change at high redshift?

- Locally the IR SED is luminosity dependant?
- If high-z star forming regions in ULIRGs are more extended and hence be:
  - More optically thin and have less free-free absorption and therefore have a higher radio flux
  - Characterised by cooler IR dust SEDs and therefore have a lower 70um flux

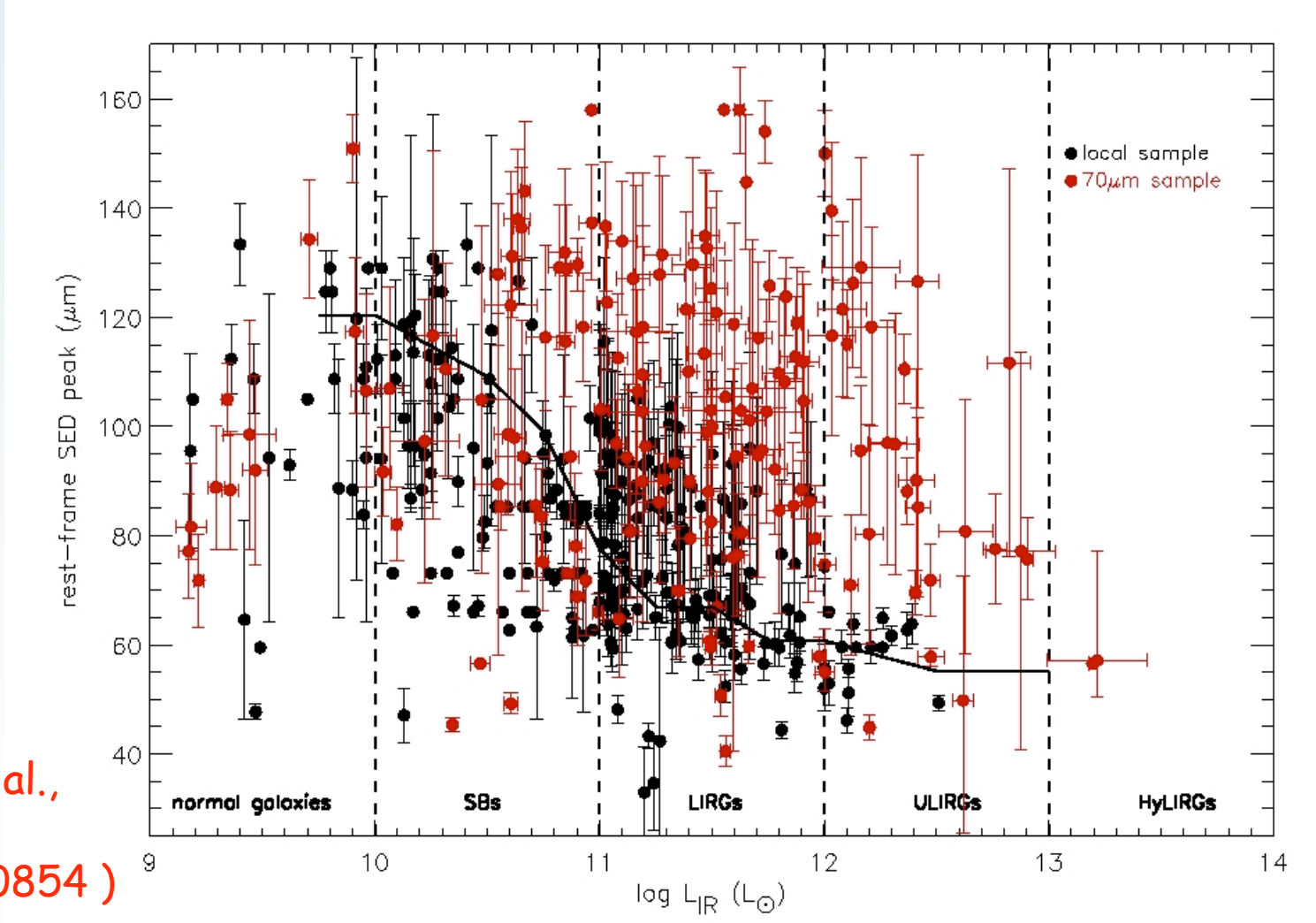
The Link Between SCUBA, *Spitzer* and *Herschel: Cold Galaxies at z≤1*

Track from Rieke et al. (2008) templates

IRAS Bright Galaxy Sample

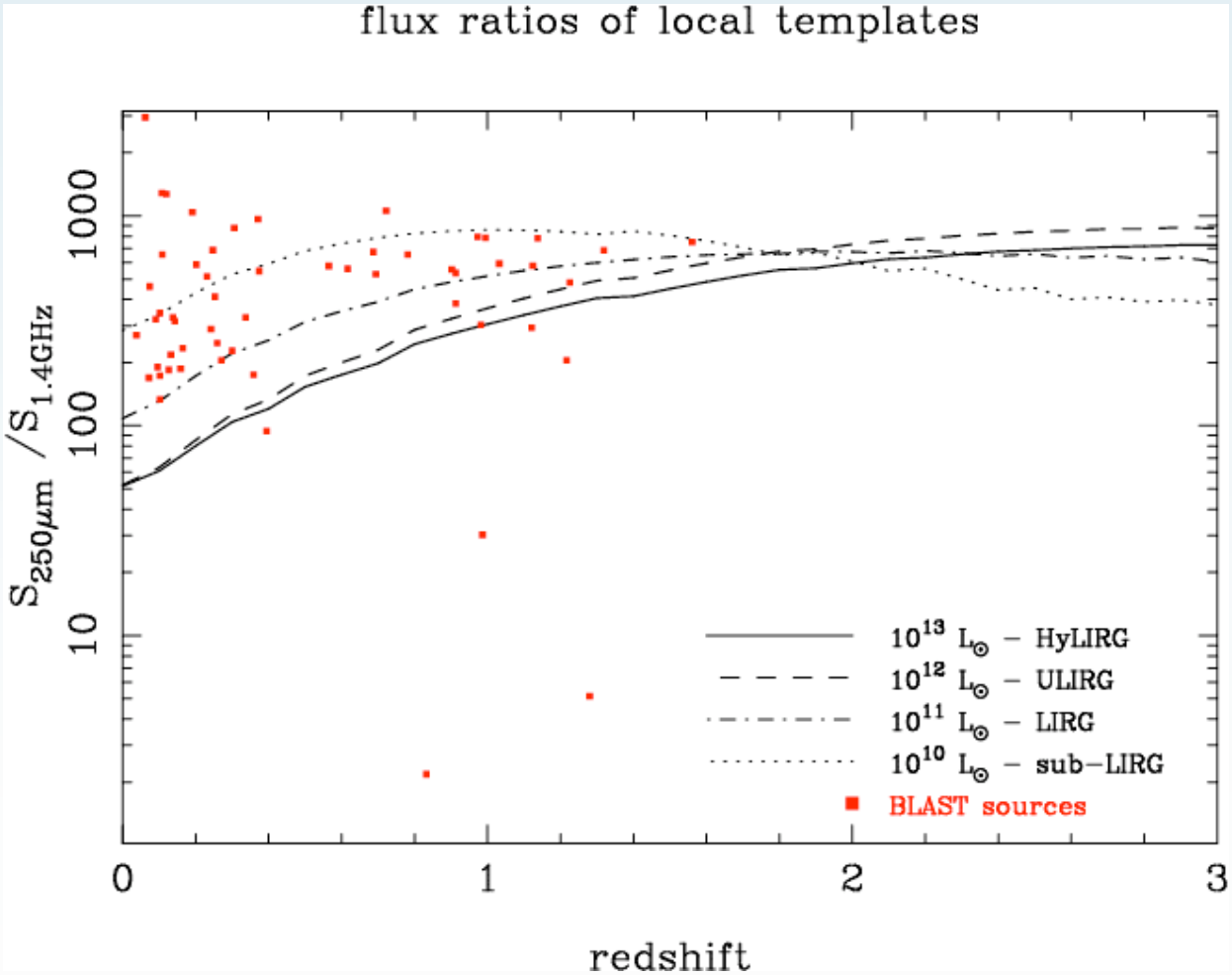
70μm selected sources

(Symeonidis et al., 2009, in press, astroph/0905.0854)



What will *Herschel* see?

What does *BLAST* see?



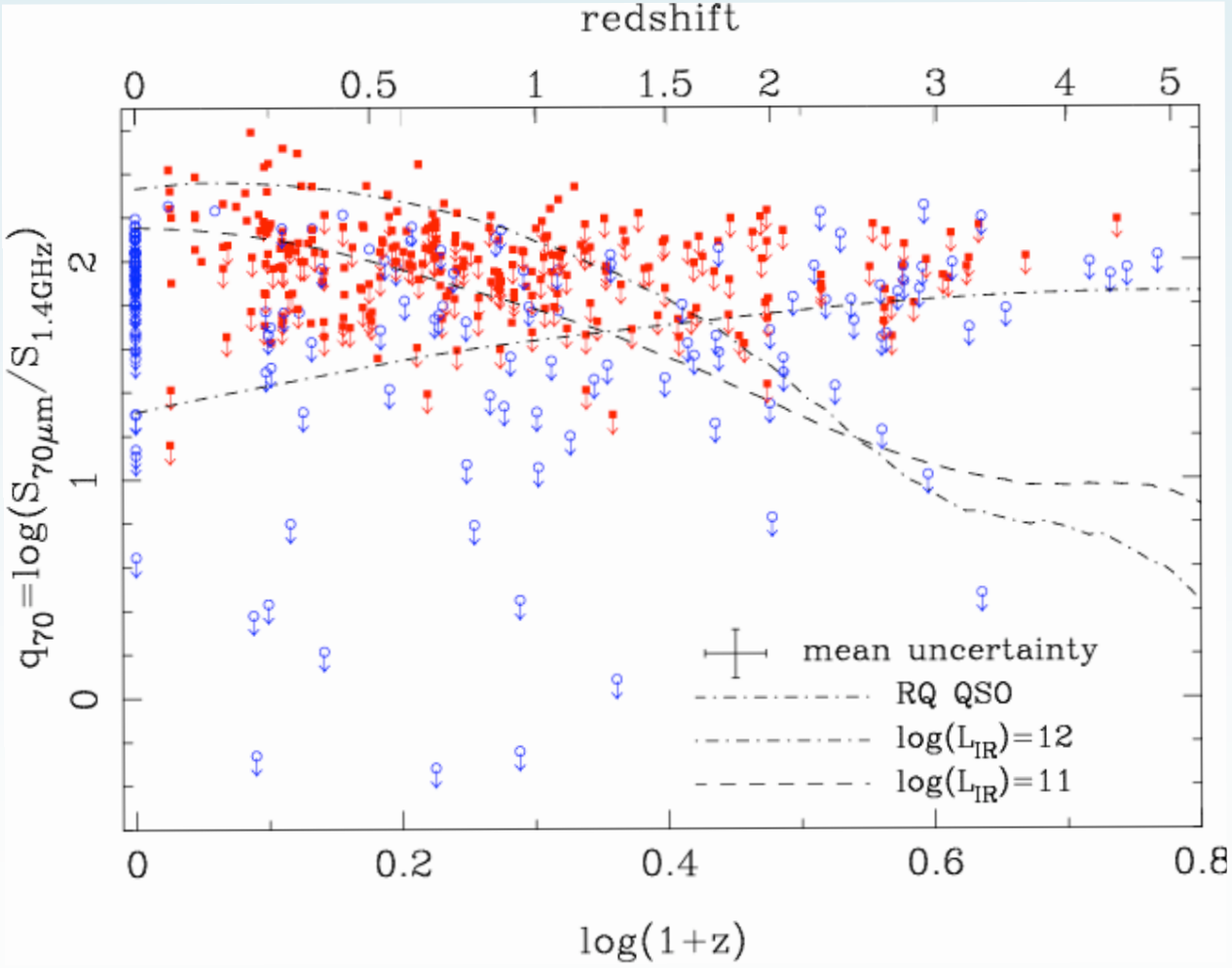
Conclusions

- Radio observations of the distant Universe used to study AGN, but we will now begin to get a full census of star formation from deep, wide radio surveys
- There are three crucial issues in exploiting such data:
  - distinguishing between AGN and SFG
  - calibrating the radio/SFR relation across all redshifts, radio luminosities and type of galaxy
  - obtaining redshifts from ancillary data
- The radio/IR relation appears to depend on IR SED and hence waveband. We must understand this locally before applying to high redshift.

Fin

Far-IR/Radio Correlation

Observed Flux Density Ratio



Seymour et al. 2009

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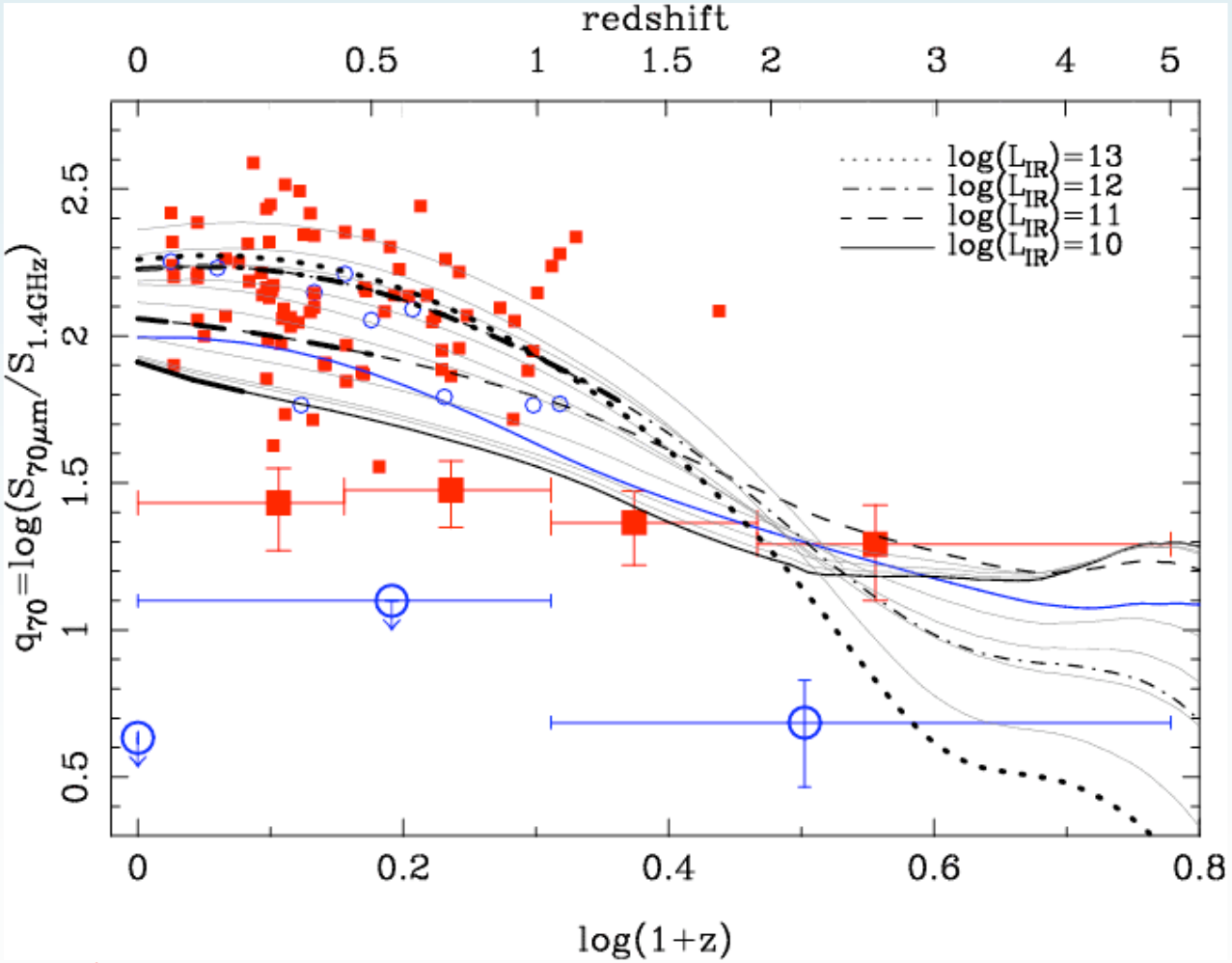

Seymour et al. 2009

The link between IR SED and radio spectral index??

Structure of Talk

- Motivation to Observe in the Radio
- *Spitzer* Observations of High Redshift Radio Galaxies
- Extreme Starbursts at High Redshift

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