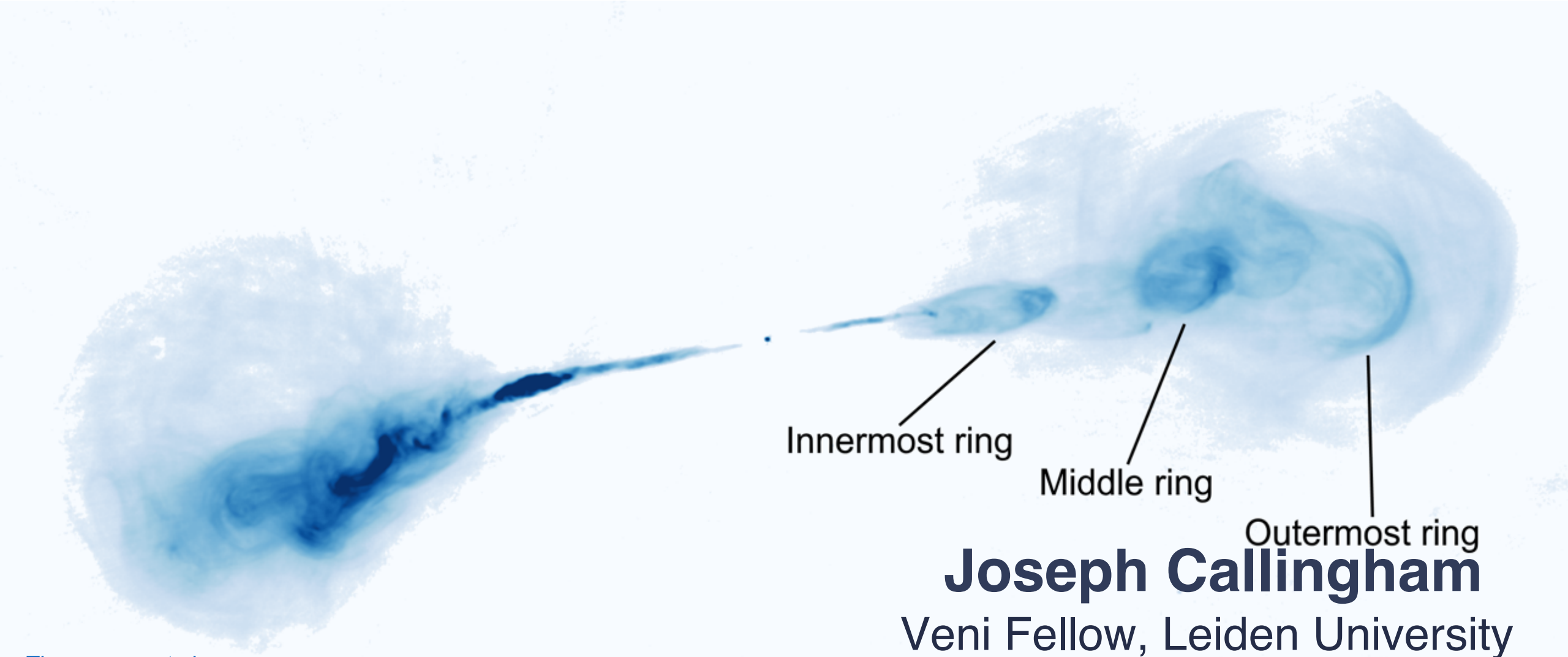
Peaked-spectrum sources at low frequencies



Timmerman et al.

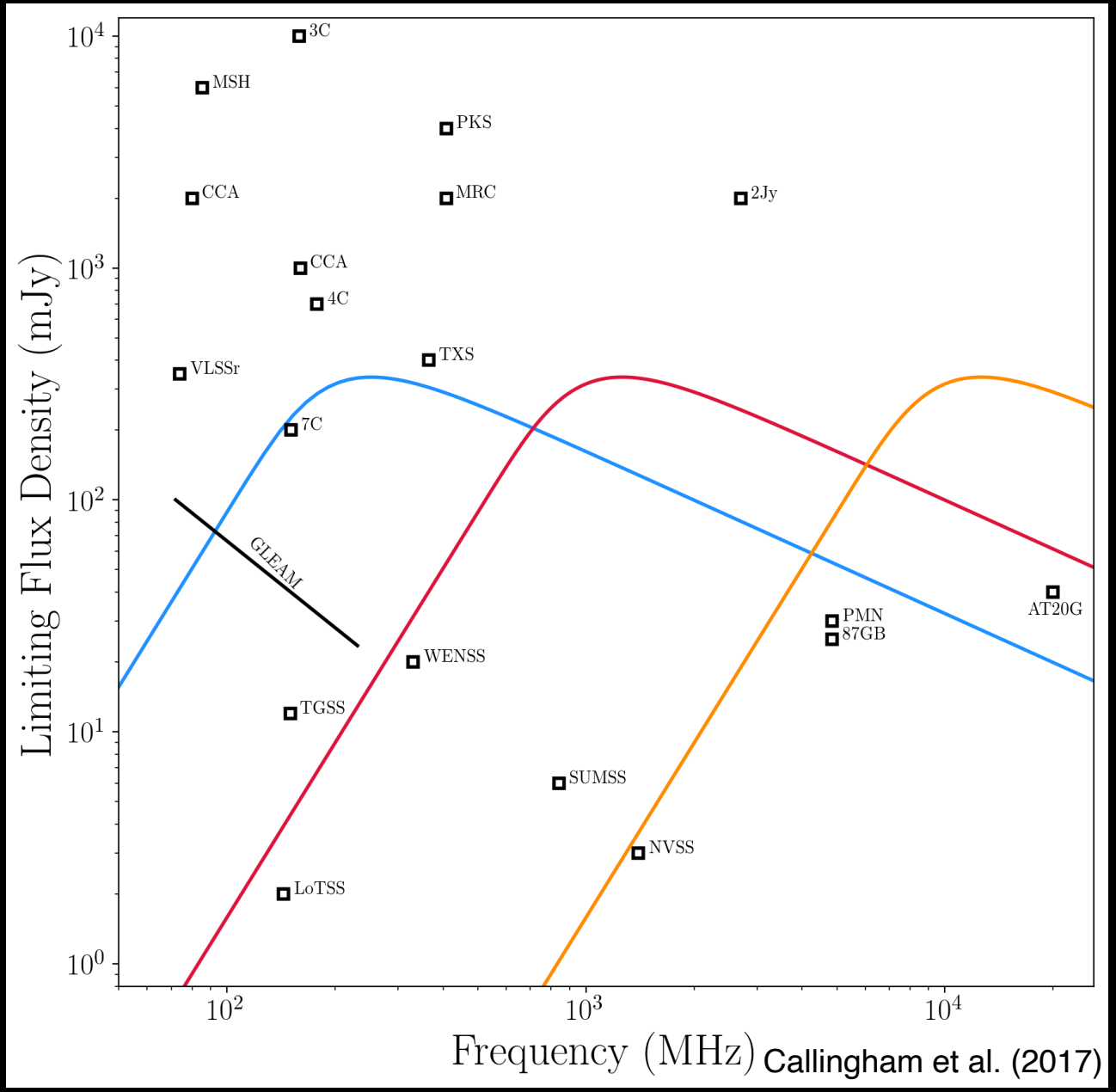
Joseph Callingham

Veni Fellow, Leiden University

Peaked-spectrum conference, Poland – 11th of May 2021

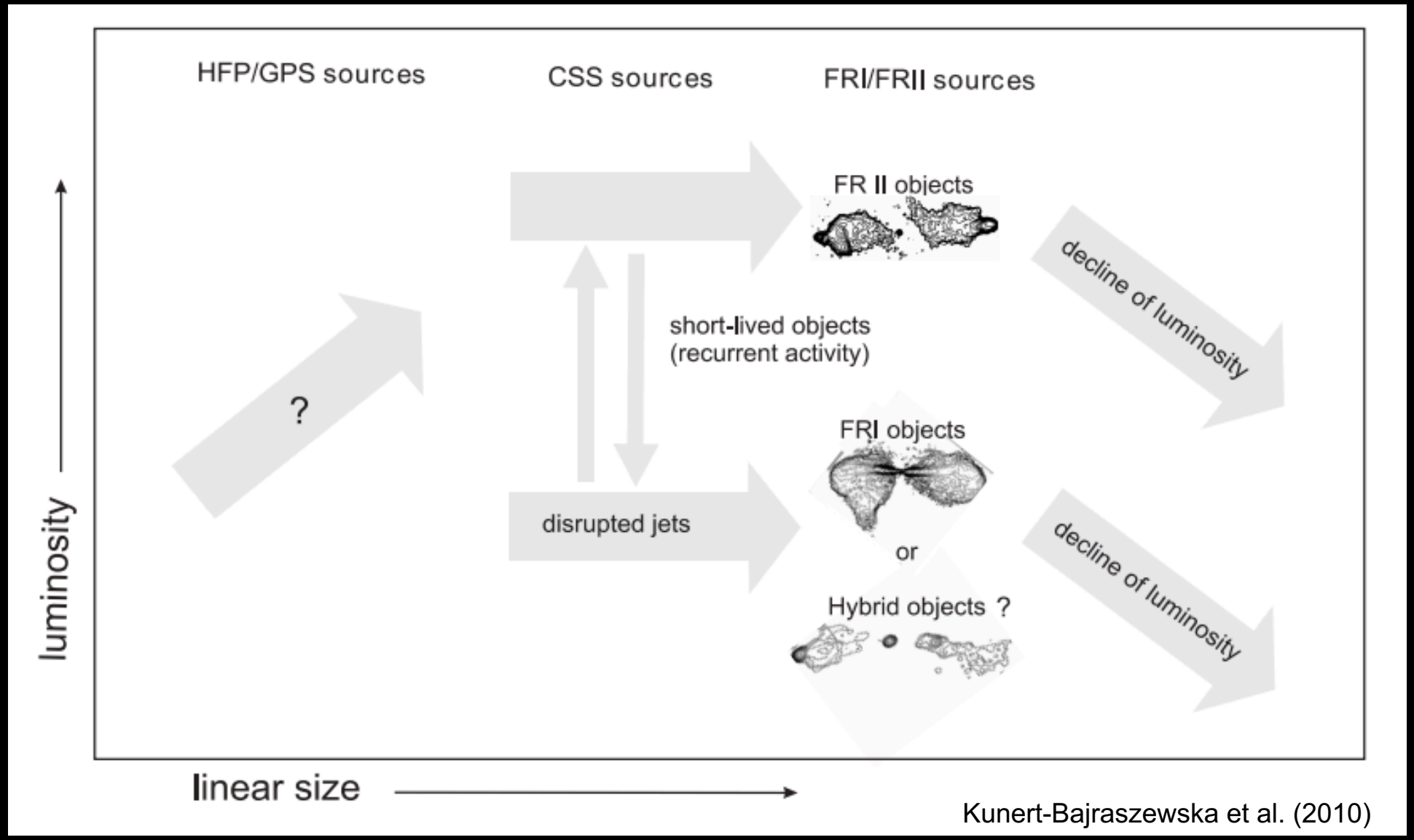
Why low-frequencies?

- Often cover large-fractional bandwidth – allowing selecting peaked-spectrum sources without reference to multiple surveys
- Based on the evolutionary peaked-spectrum picture, probes the largest nearby galaxies and the youngest high-z galaxies
- Challenges: lower resolution, lower sensitivity (usually), flux density scale issues



Callingham et al. (2017)

Why low-frequencies?



Kunert-Bajraszewska et al. (2010)

Some questions about PS sources at low-frequencies

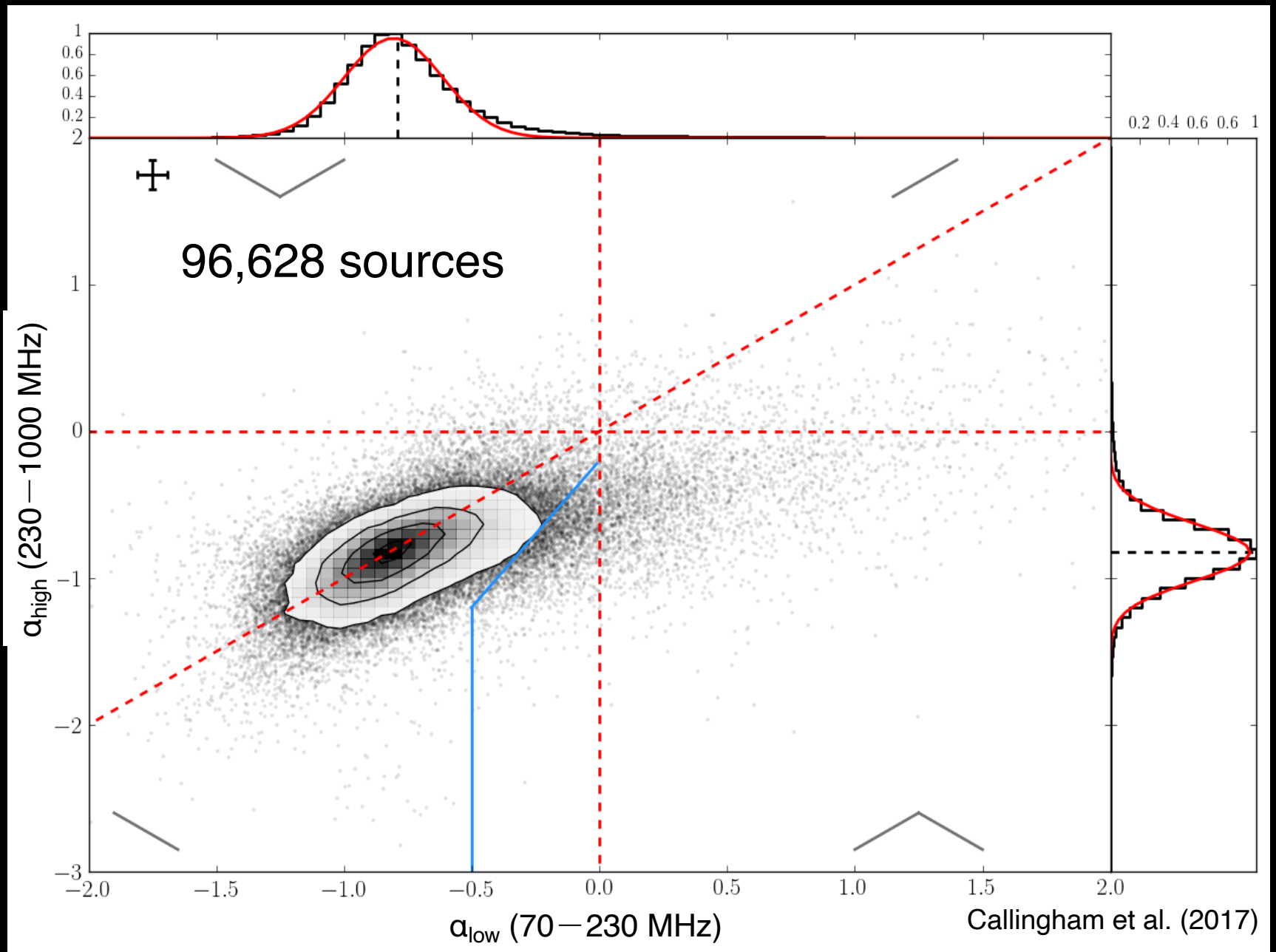
- How do the sources relate to canonical GPS and CSS sources?
- How many are core-jet and how many show double-structure? Should they all be lobe-dominated?
- As a population, are there more or less PS sources than at gigahertz-frequencies? What does this tell us about evolution?

What low-frequency telescopes are operating?

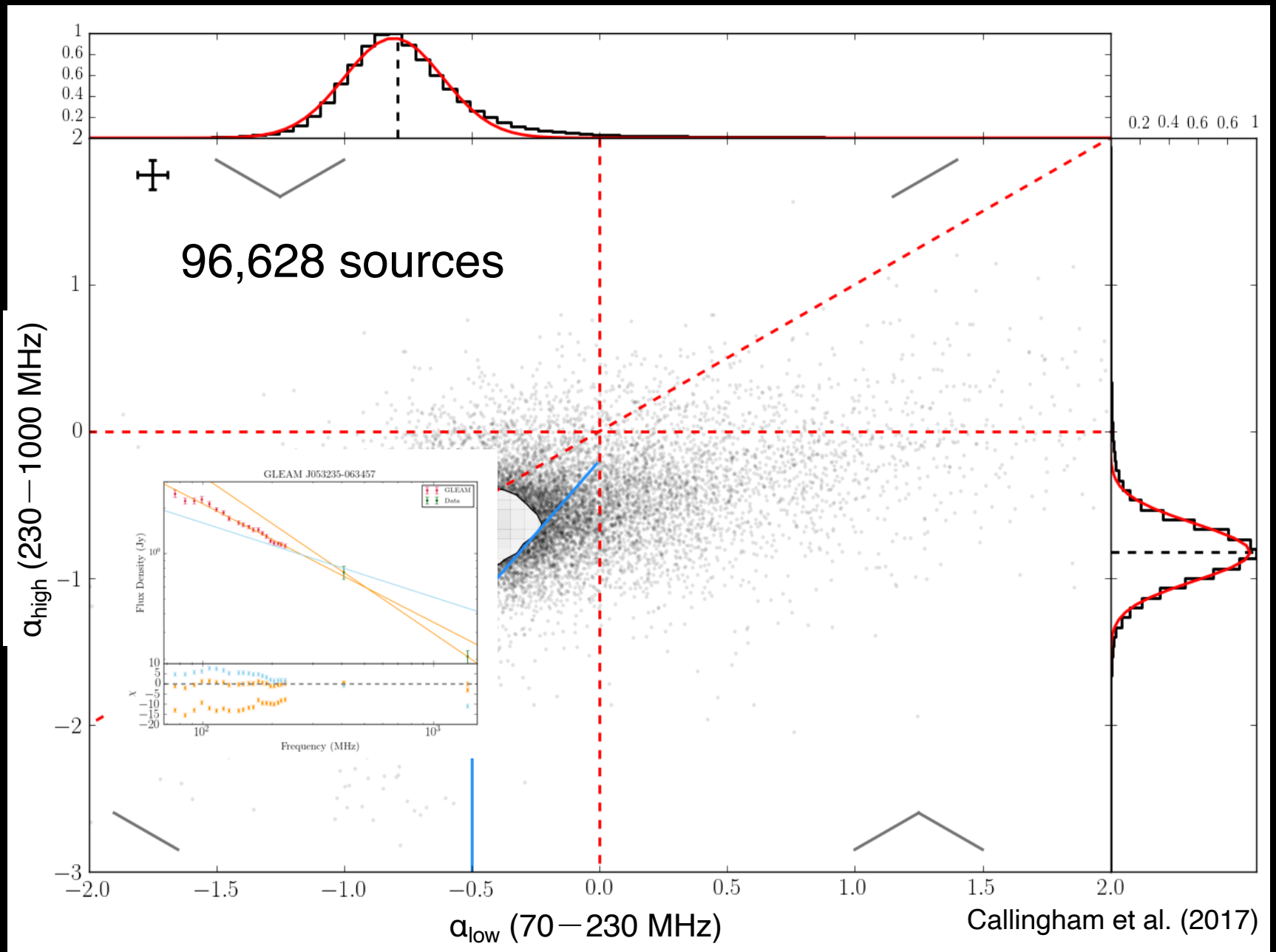
The SED Revolution with GLEAM

- MWA GLEAM survey (Hurley-Walker, Callingham et al. 2017)
  - 305,615 sources over 59% of the sky at 2’ resolution, σ ~ 10 mJy
  - every source: 20 fluxes spanning 72—231 MHz

GLEAM Colour-Colour Diagram



GLEAM Colour-Colour Diagram



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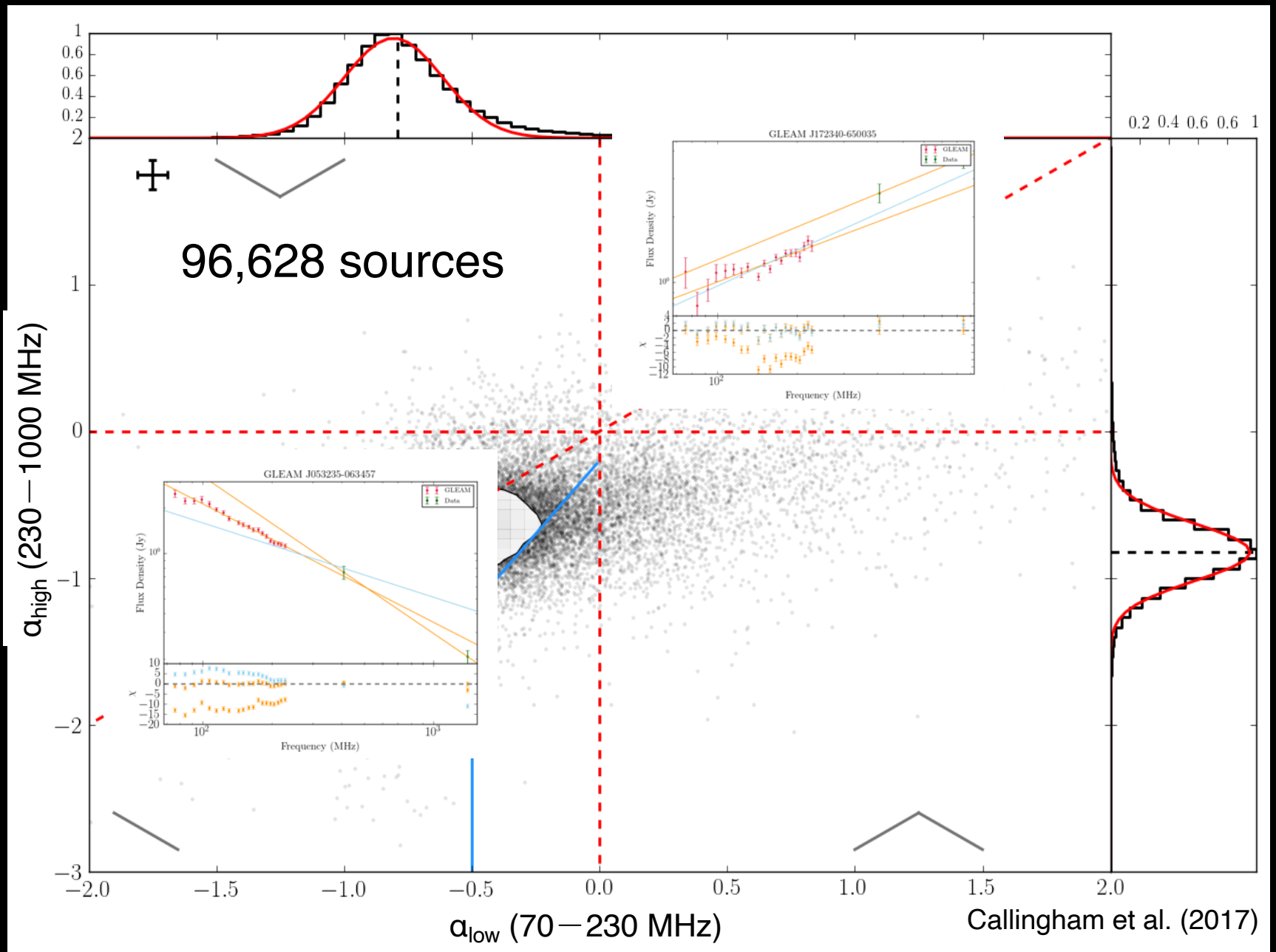
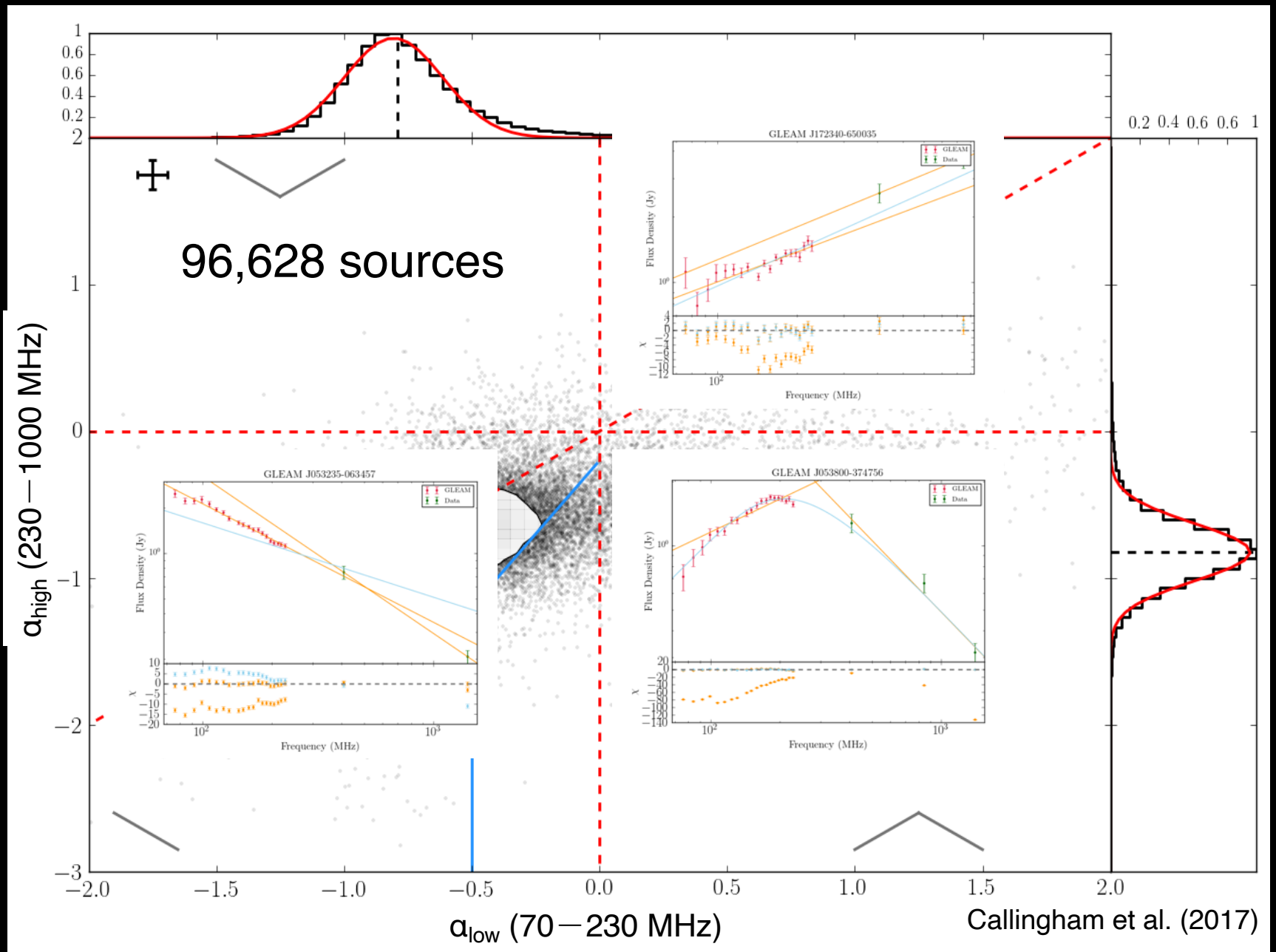
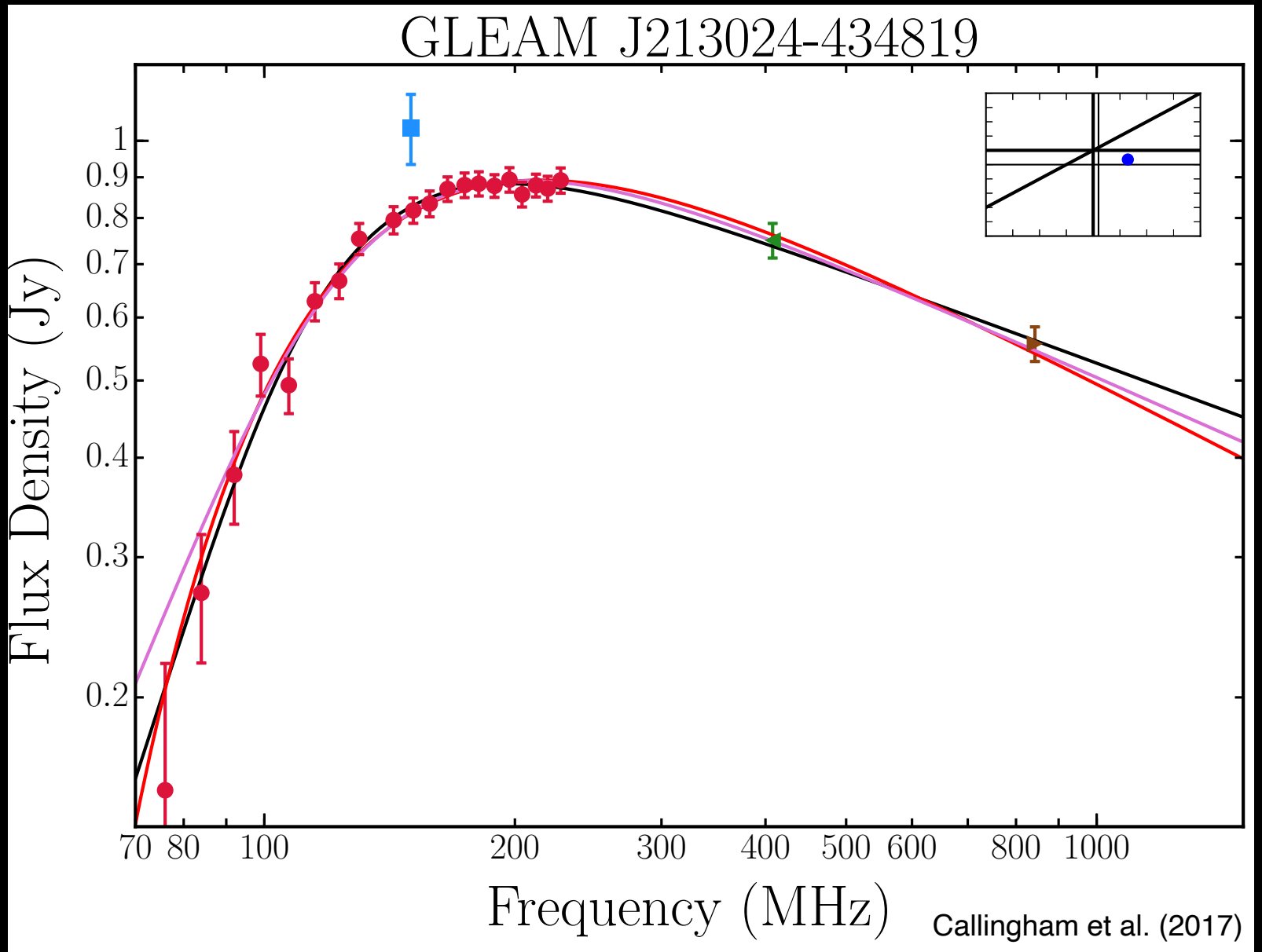


GLEAM Colour-Colour Diagram

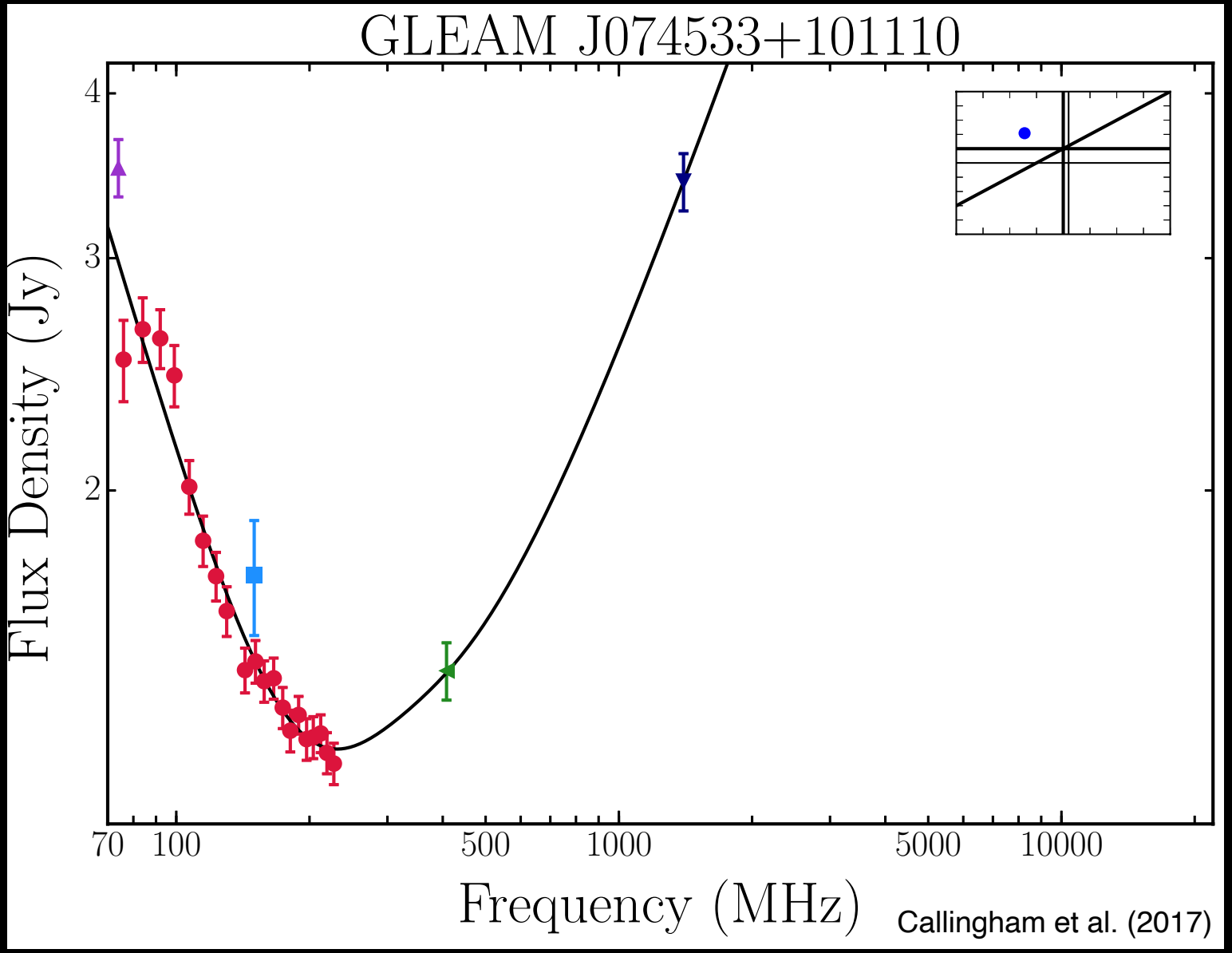


X-treme sources – only FFA can trace these



Callingham et al. (2017)

Restarted GPS sources?



Callingham et al. (2017)

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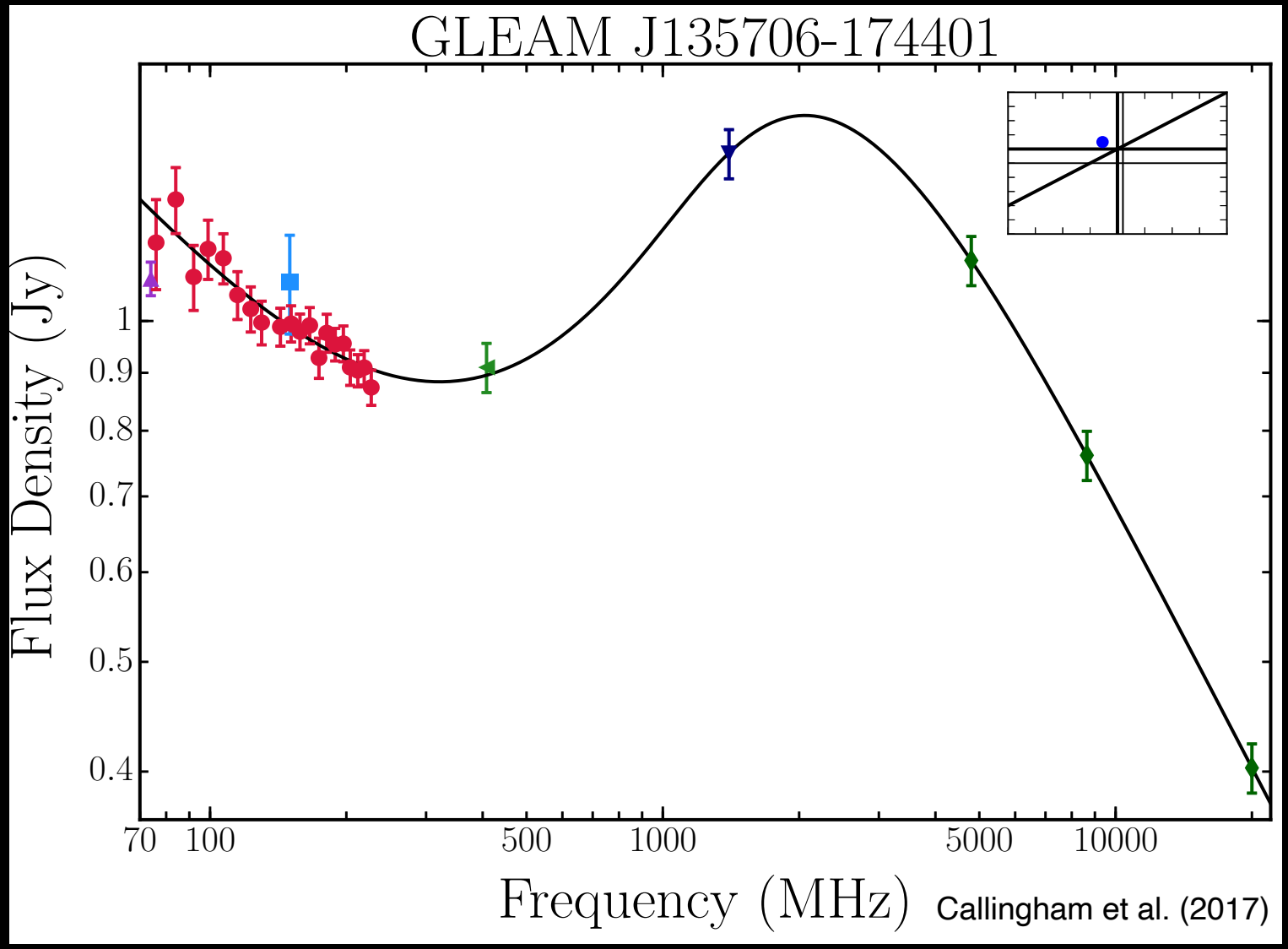
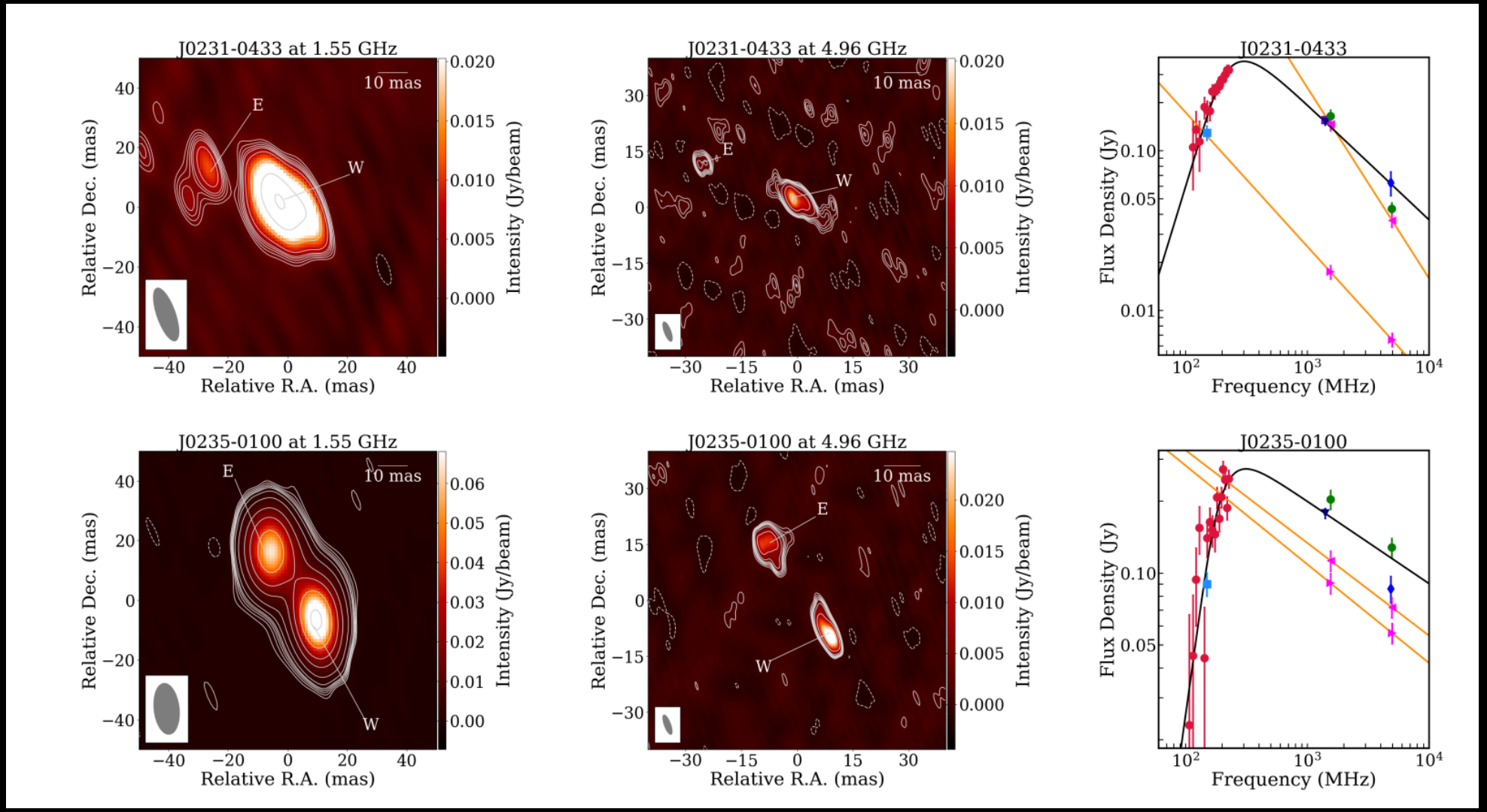


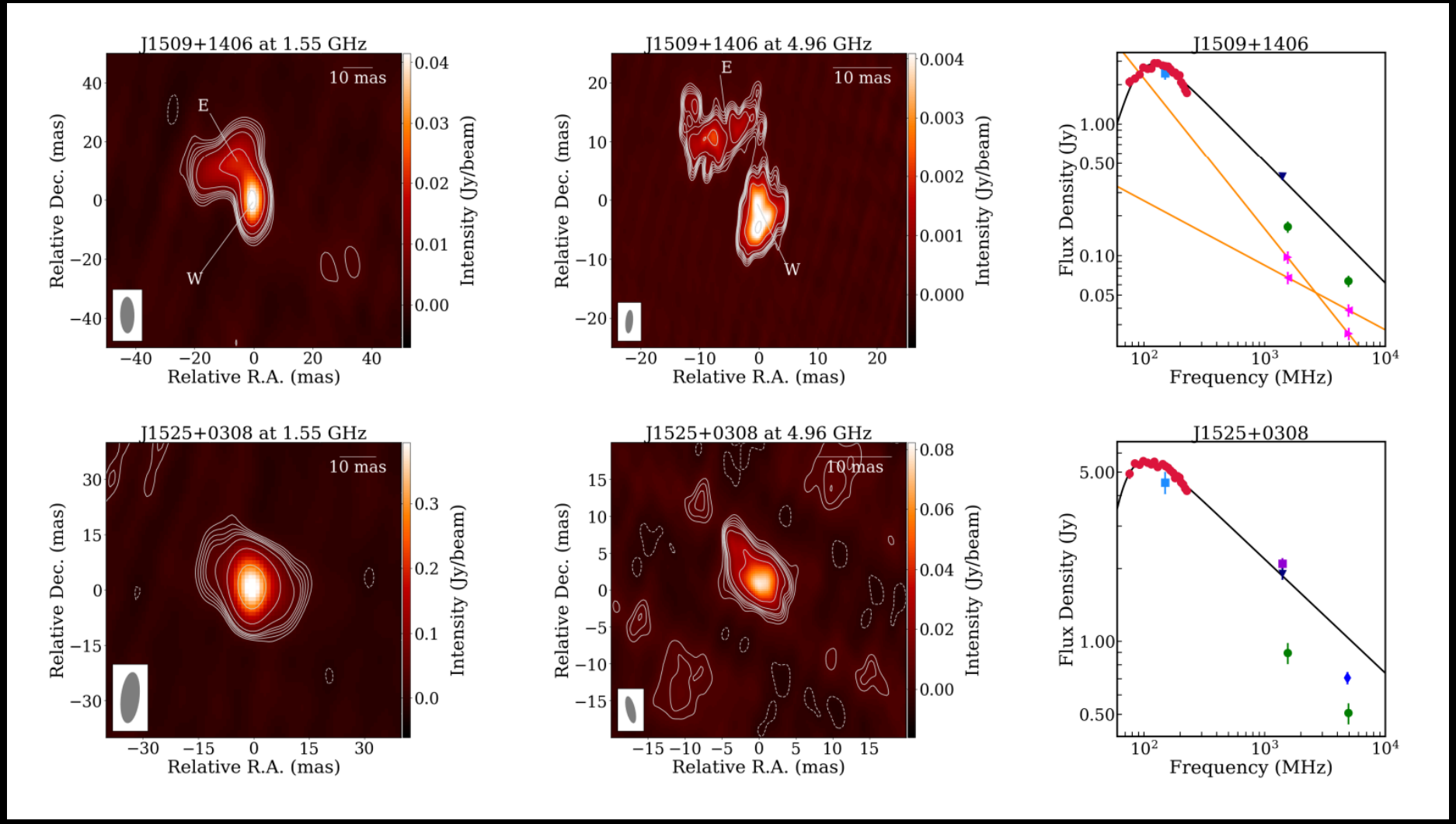
Doubles and core-jets



› See Kat Ross' talk too

Keim, Callingham, Röttgering (2019)

Doubles and core-jets



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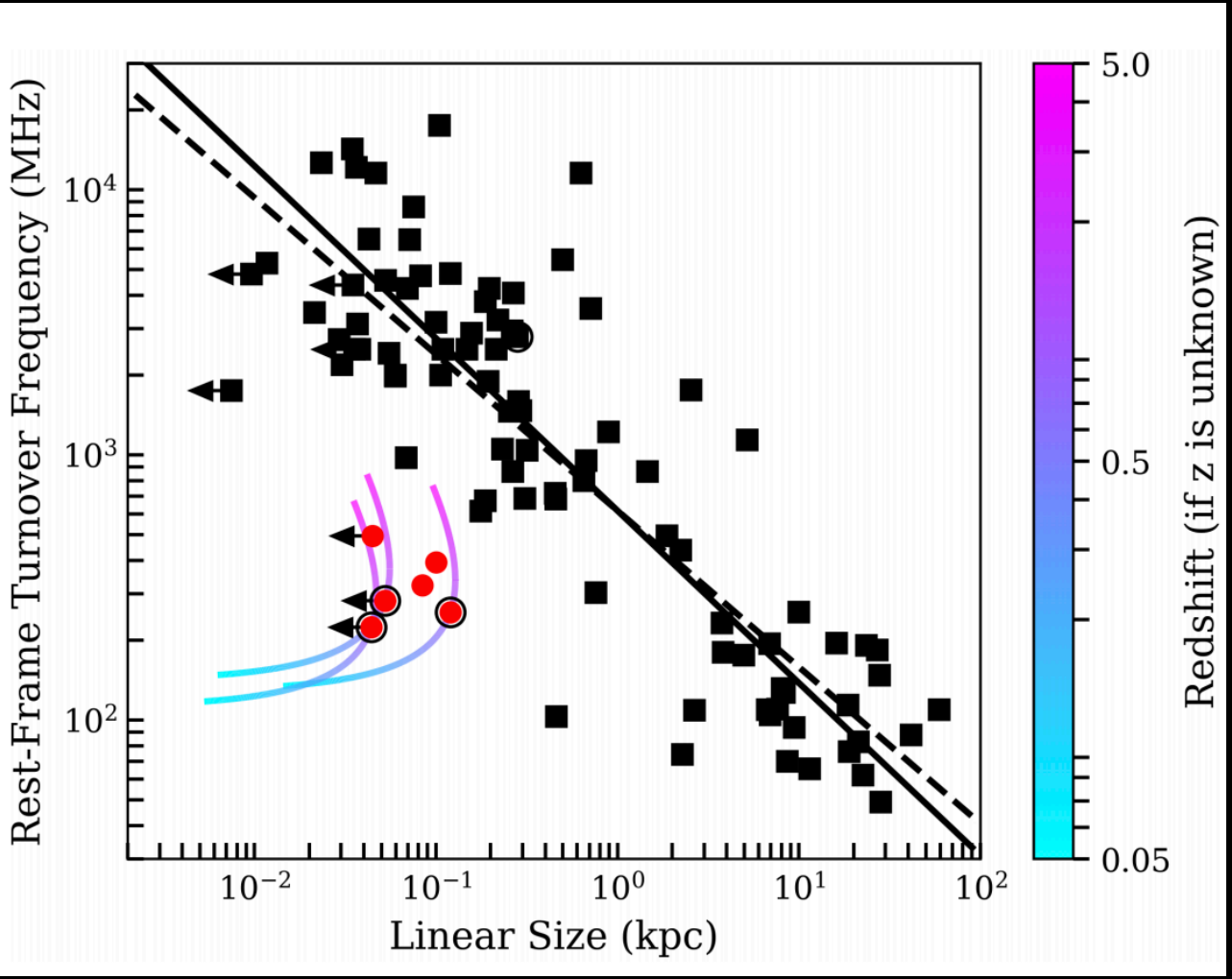

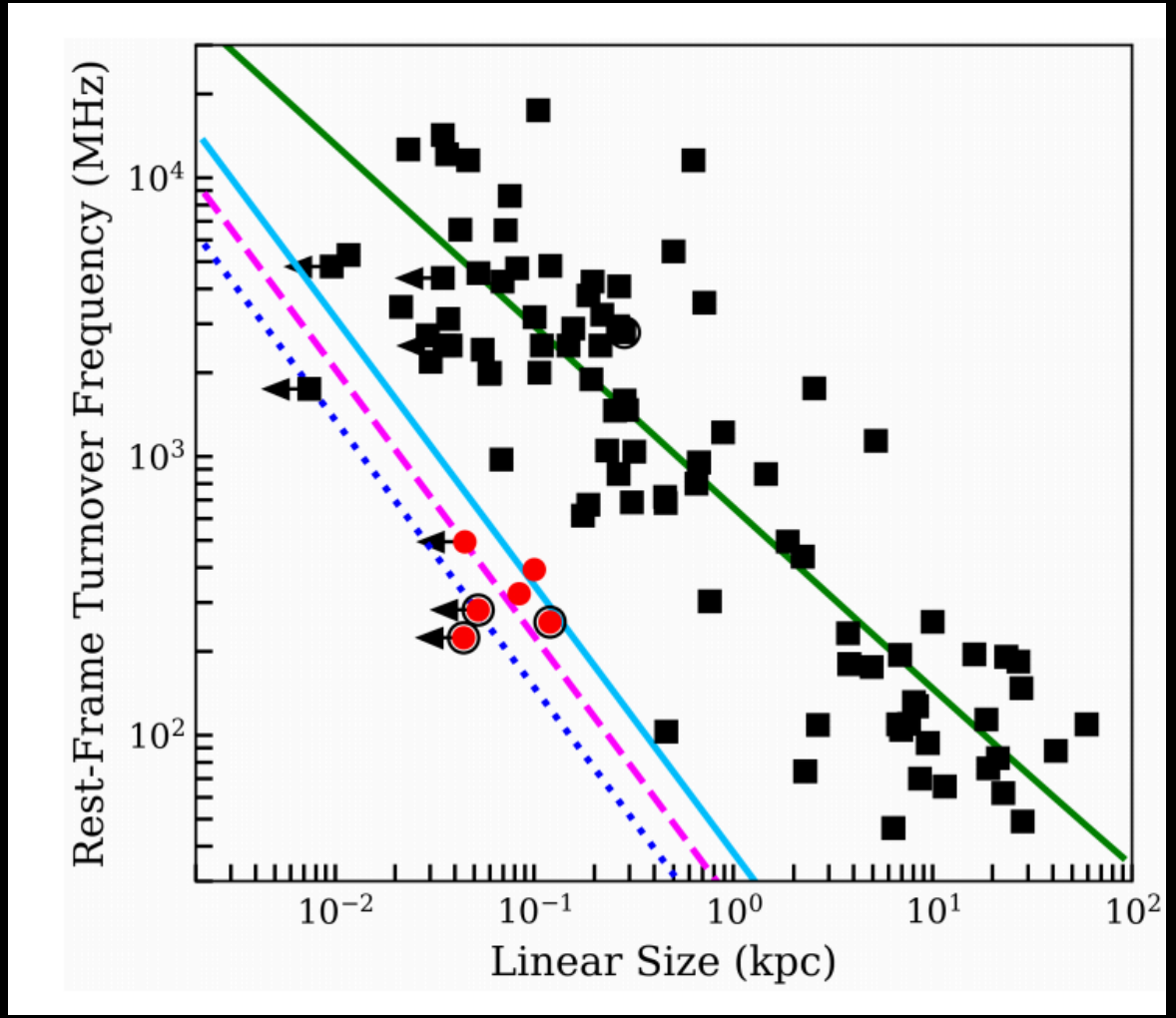

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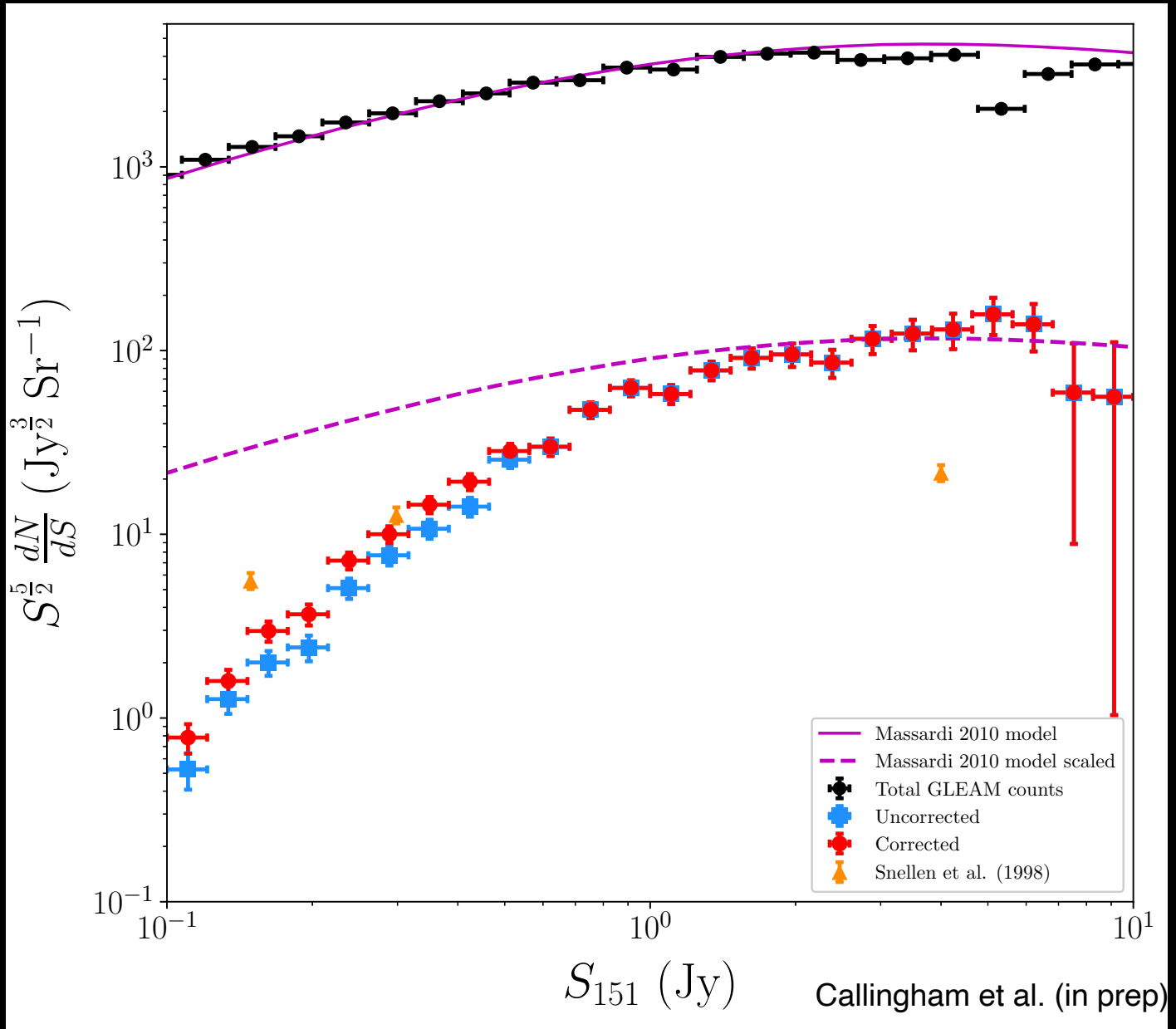
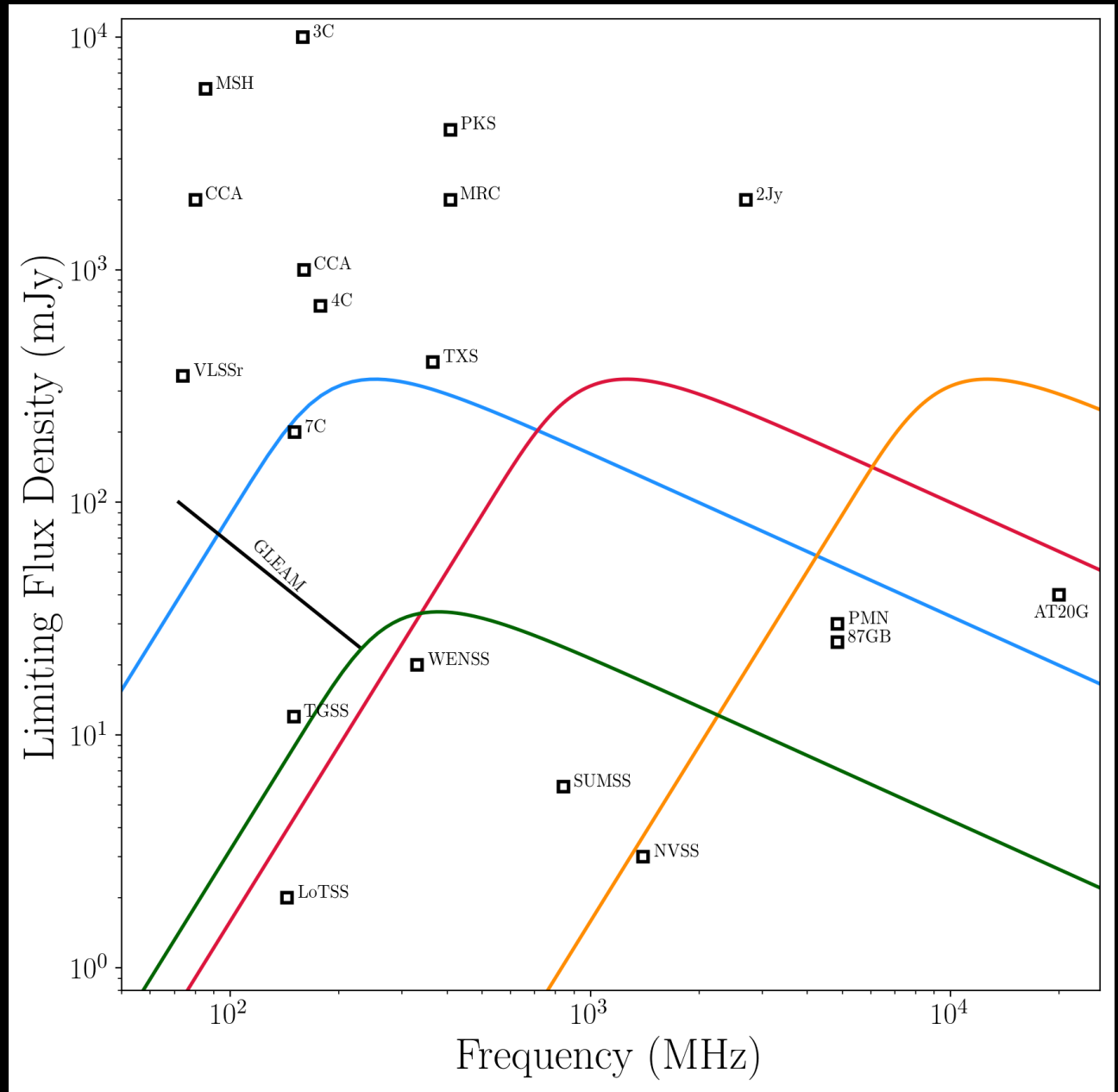
Keim, Callingham, Röttgering (2019)

Source Counts – too many?

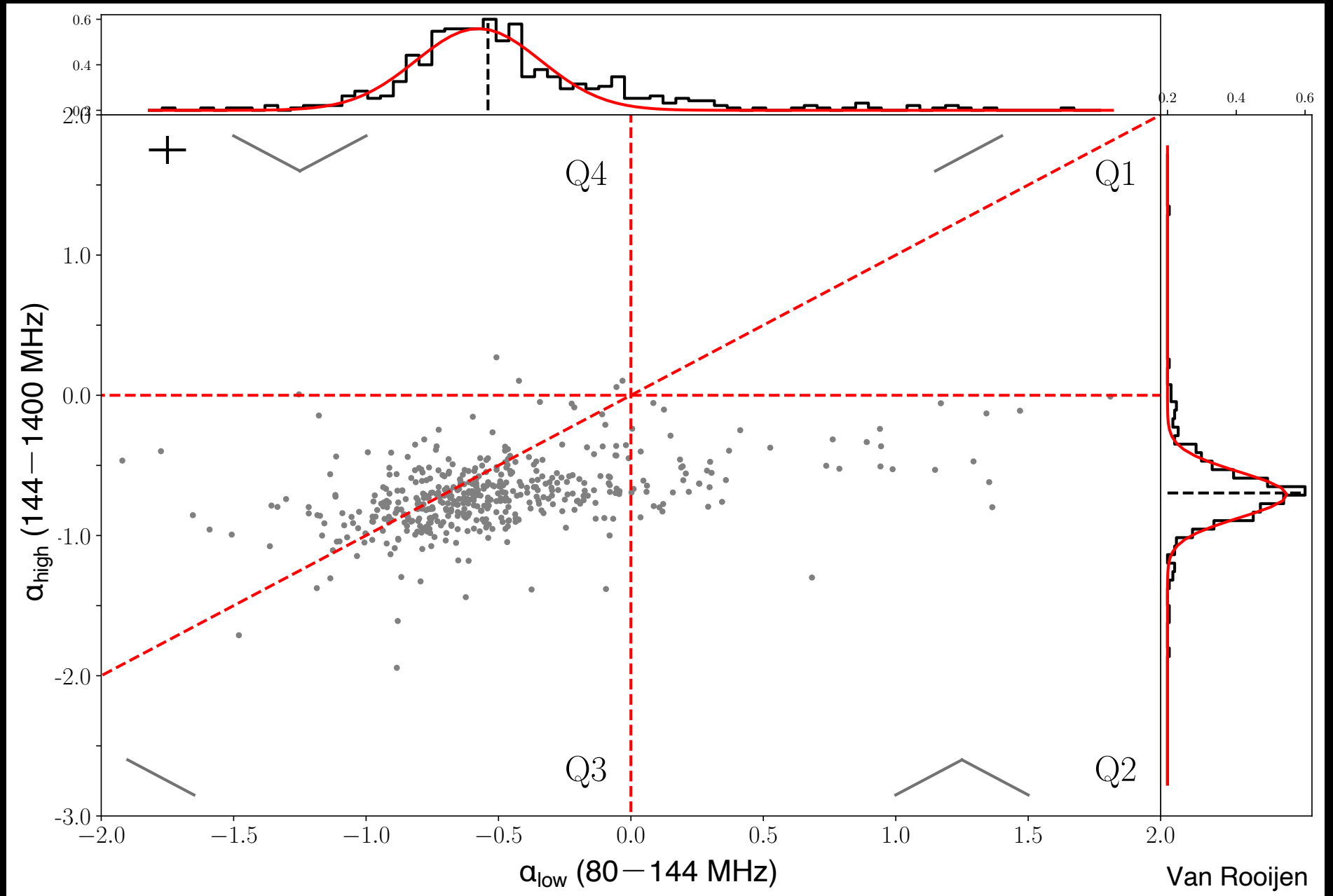


Callingham et al. (in prep)

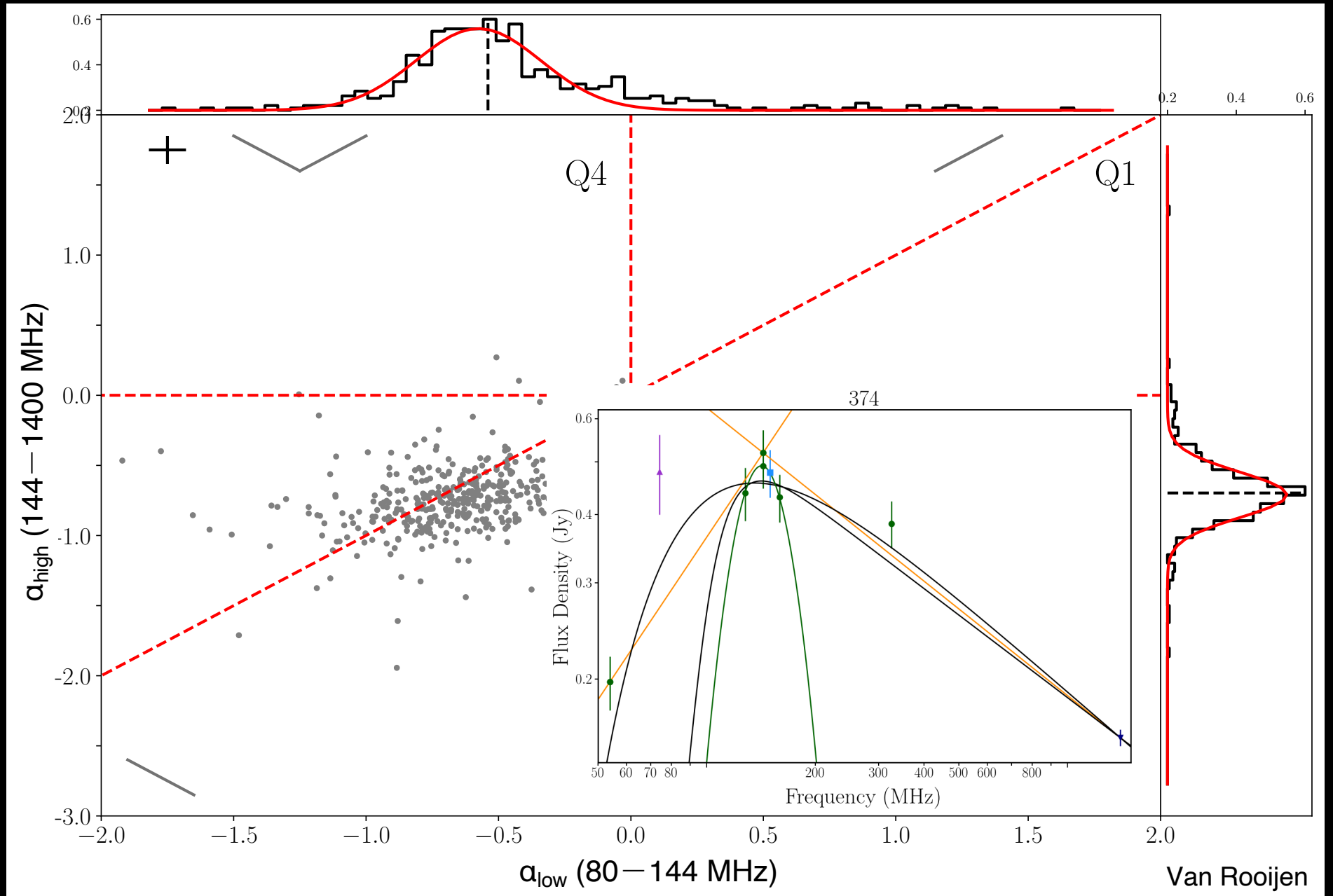
LoTSS and LoLSS



Which peaked-spectrum source?

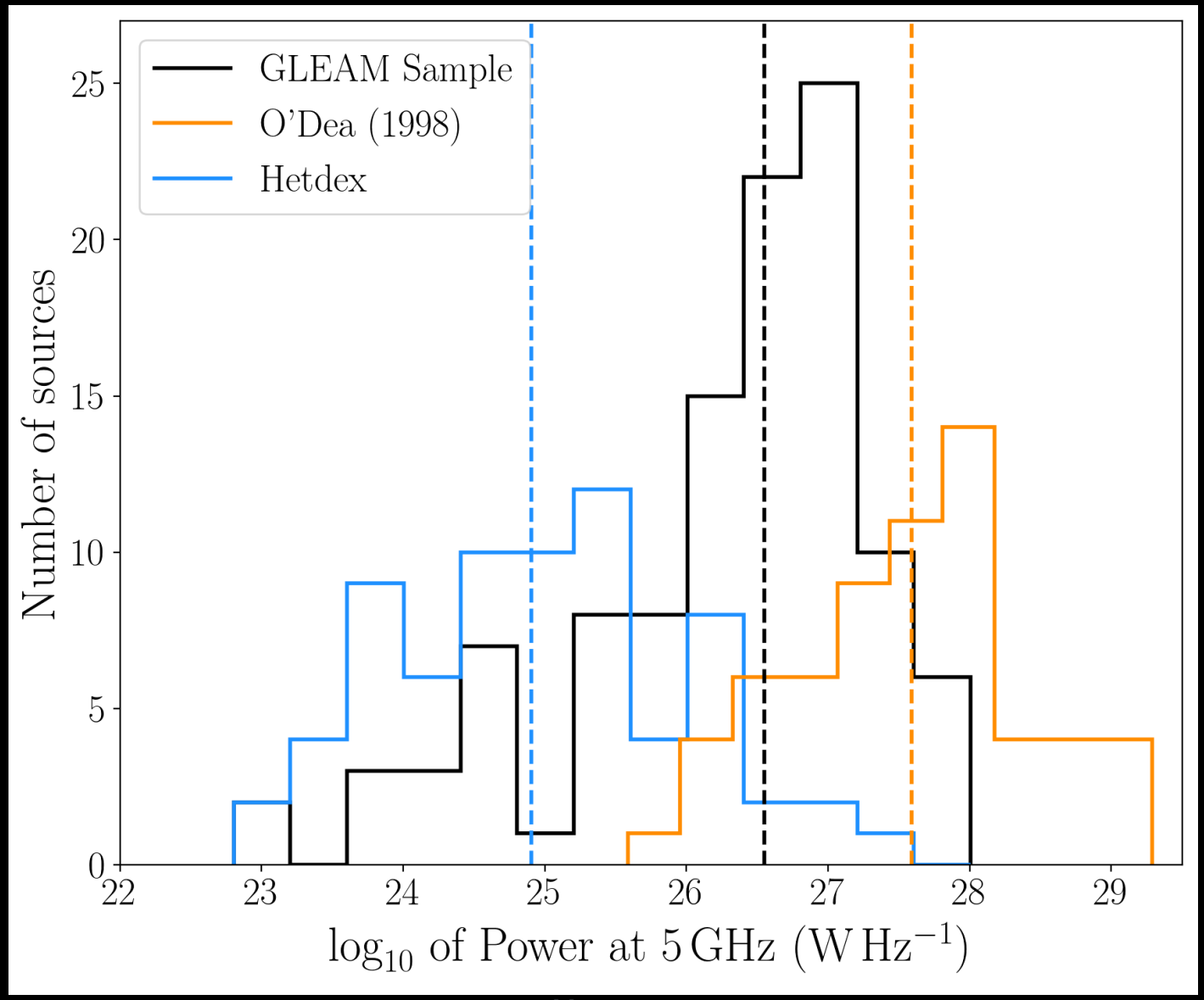


Which peaked-spectrum source?

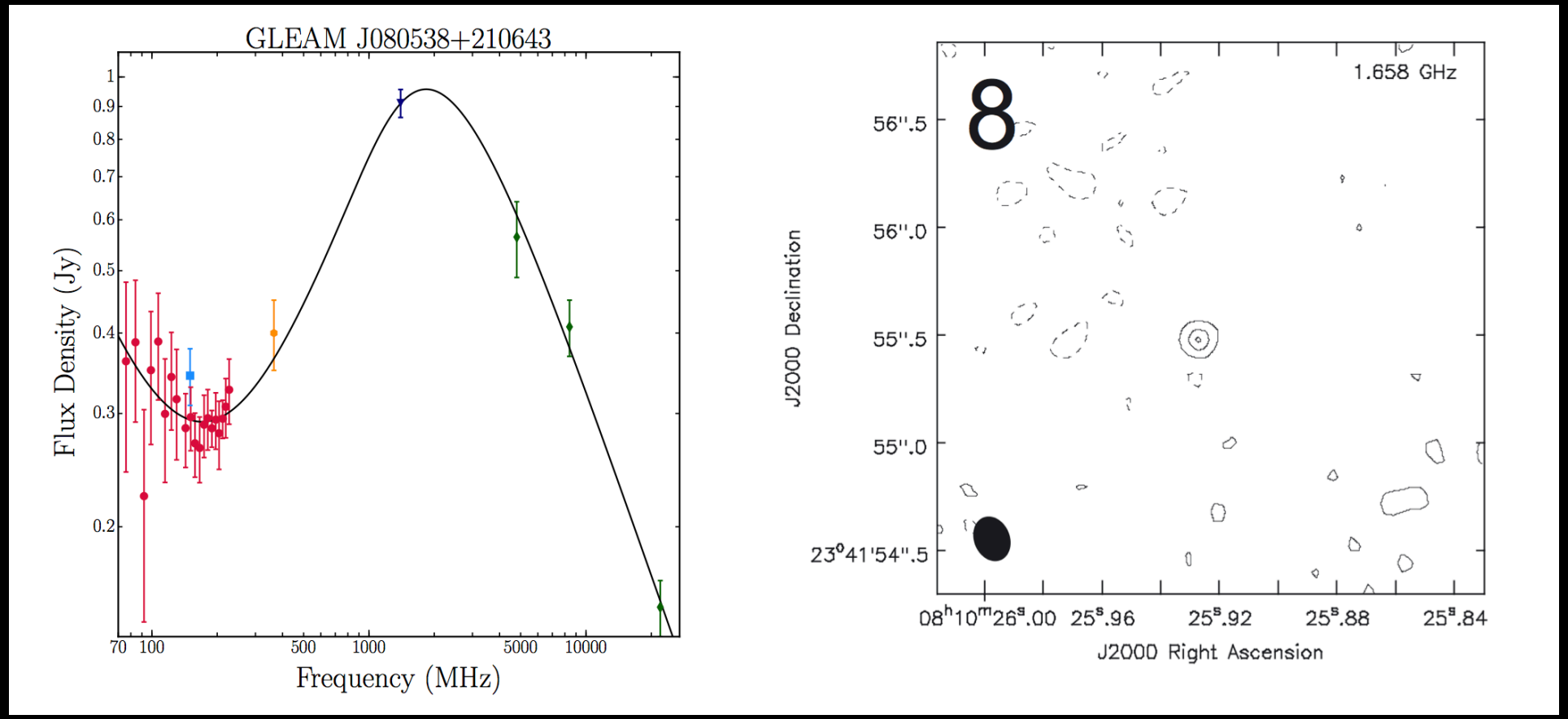


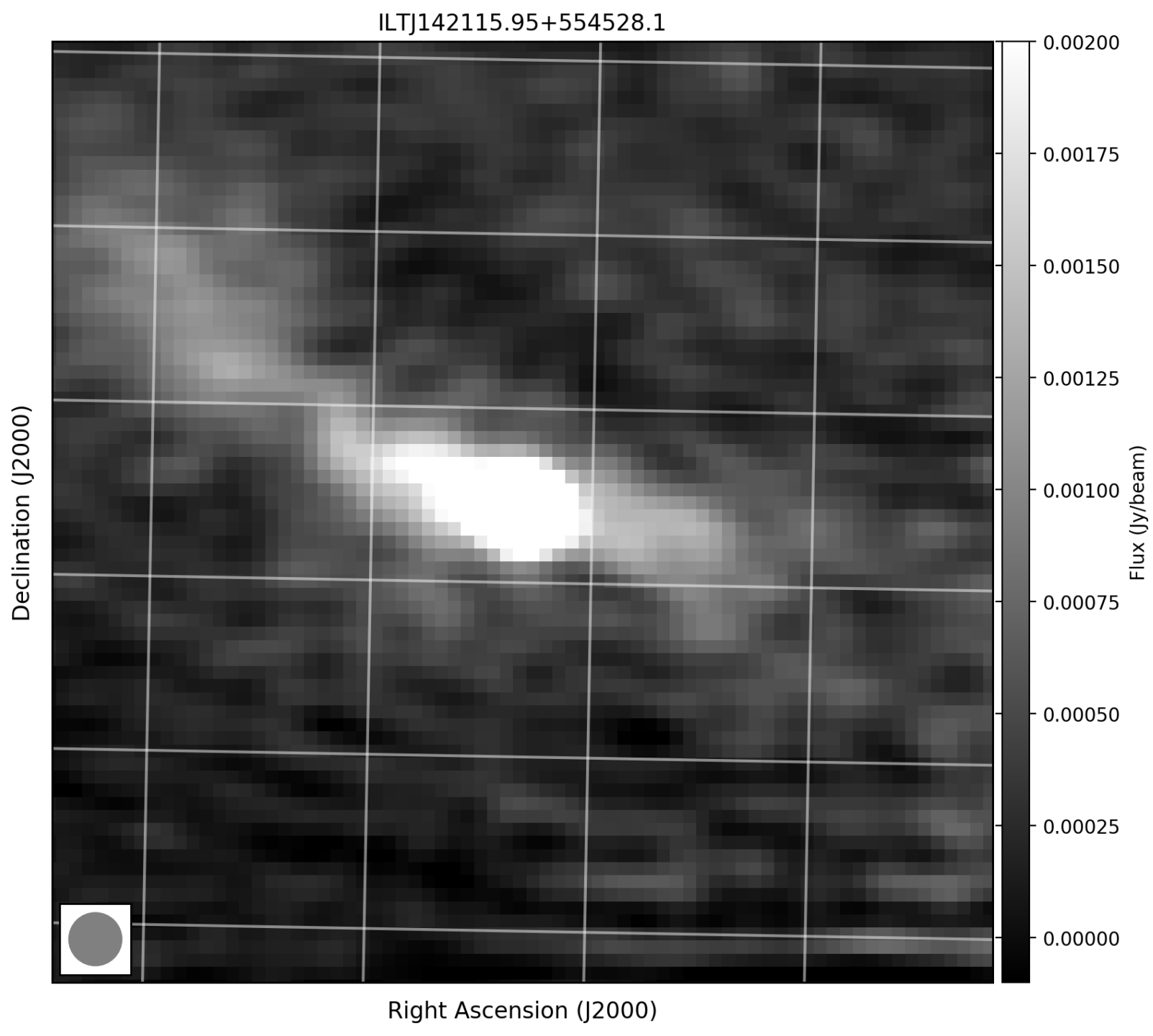
Too many…

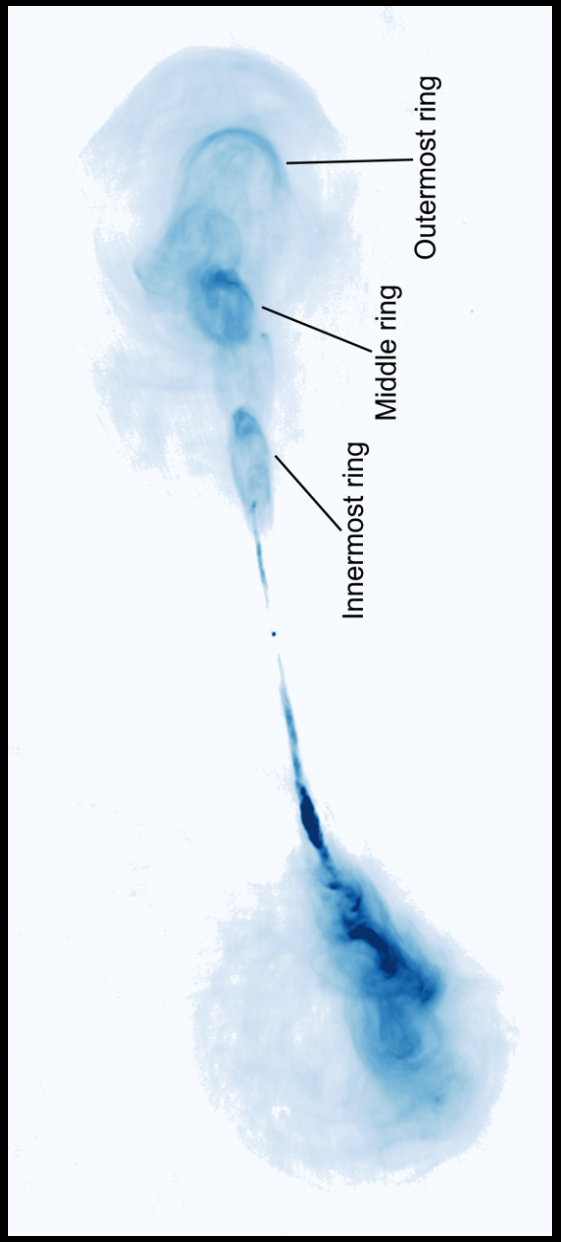
- ~10 % of sources that have NVSS counterpart are peaked-spectrum
- Obviously completeness issues but compared to complete sample with GLEAM, we have double the number of sources selected at the same frequency (~4.5%). Why?



Resolution power of LOFAR




ILTJ142115.95+554528.1
Declination (J2000)
Right Ascension (J2000)
Flux (Jy/beam)
0.00200
0.00175
0.00150
0.00125
0.00100
0.00075
0.00050
0.00025
0.00000

Conclusions

- Low-frequencies provided a unique way to sample PS sources (with its own advantages and disadvantages – and only will grow in importance with e.g. SKA)
- These sources are likely low luminosity counterparts to GPS sources identified at higher freq.
- Maybe dominant precursors to FR1 galaxies?
- Finding discrepancy in the number of GPS/CSS sources selected with LoTSS with those selected by GLEAM. Variability bias? Evolution?
- Using the spectra is a very useful way to find restarted GPS/CSS sources? Duty cycle?