MWA Project Meeting 2025

The M(agnificent) W(idely-)A(waited) G4Jy Sample

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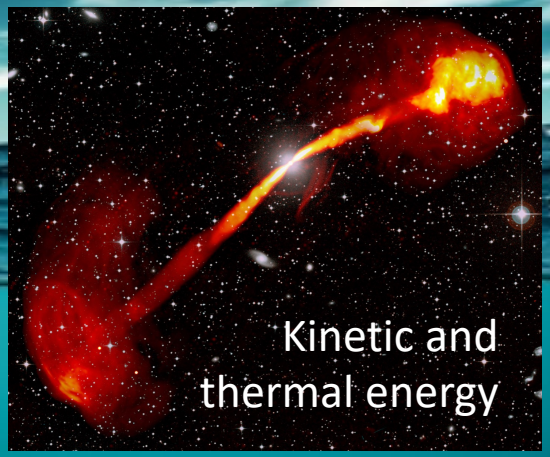
Output from active galactic nuclei (AGN)

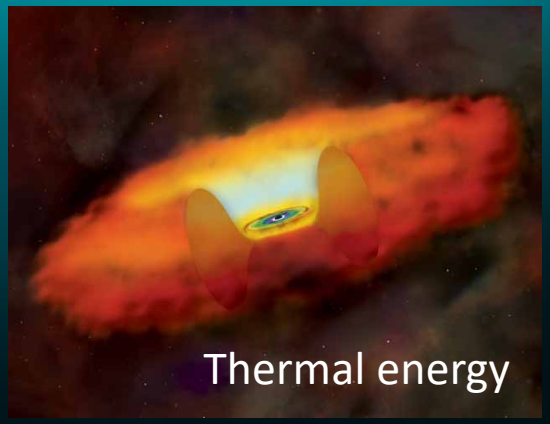
1. ‘Radio-loud’ AGN

The G4Jy Sample



“The brightest (and faintest) sources in the radio sky” (White 2023)

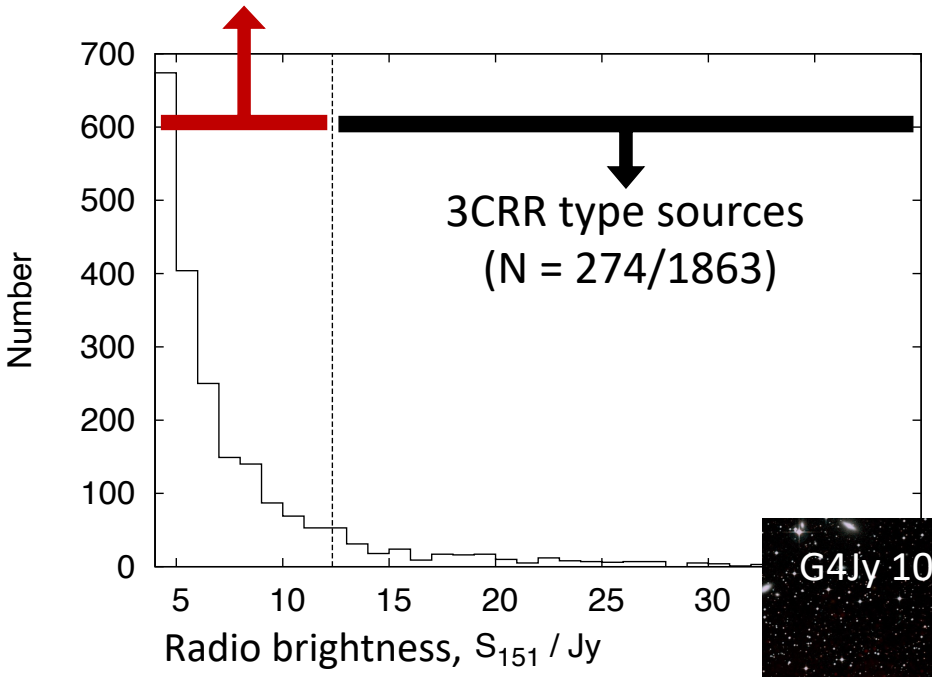
AGN samples from deep fields (e.g. the MIGHTEE Survey)



2. ‘Radio-quiet’ AGN

The brightest radio-sources in the southern sky

Fainter radio sources
(lower power or higher redshift)



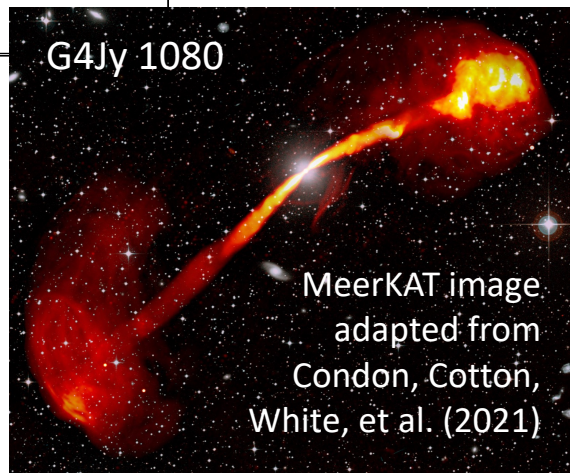
$S_{151\ MHz} > 4$ Jy

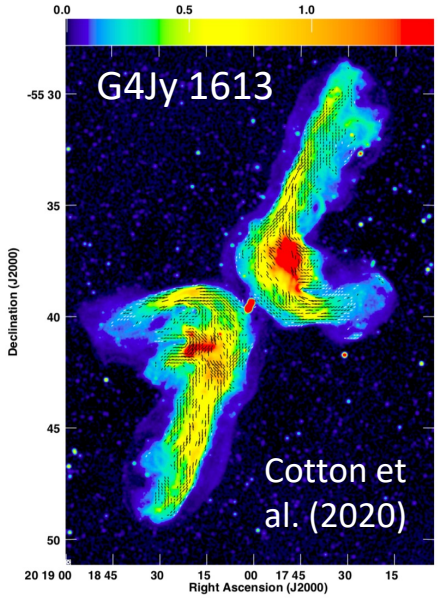
GLEAM

Hurley-Walker et al. (2017)

The GLEAM 4-Jy (G4Jy) Sample
White et al. (2020a, 2020b)

MWA antenna,
Photo credit: Hurley-Walker





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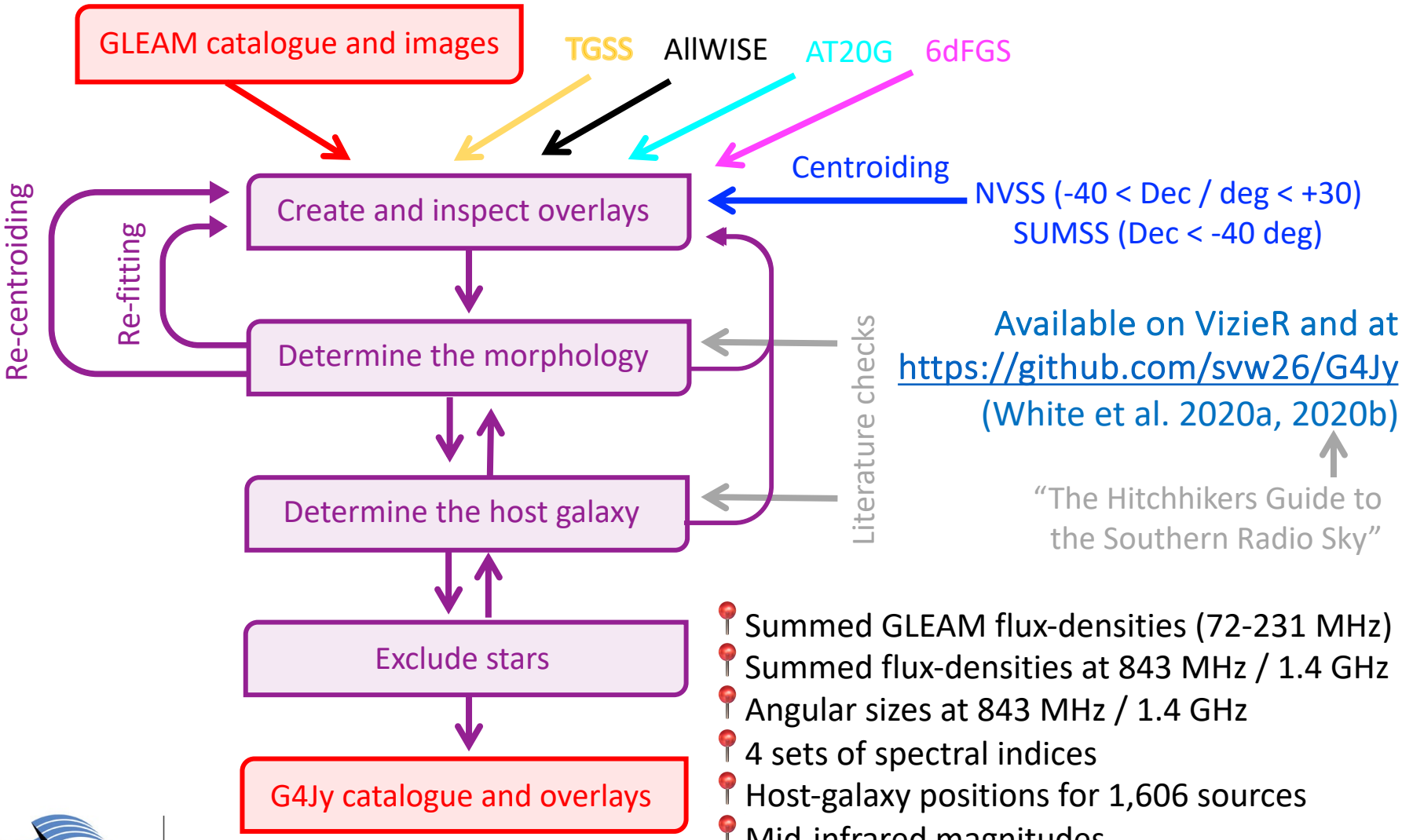
Creation of the G4Jy catalogue



Available on VizieR and at
https://github.com/svw26/G4Jy
(White et al. 2020a, 2020b)

"The Hitchhikers Guide to the Southern Radio Sky"

- Summed GLEAM flux-densities (72-231 MHz)
- Summed flux-densities at 843 MHz / 1.4 GHz
- Angular sizes at 843 MHz / 1.4 GHz
- 4 sets of spectral indices
- Host-galaxy positions for 1,606 sources
- Mid-infrared magnitudes

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Commissioning of SKA-Low

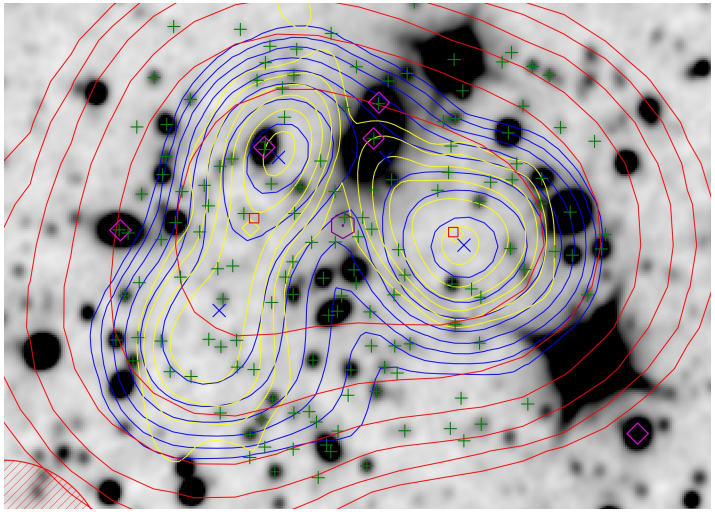
"You'll be happy to know that we have used the G4Jy catalogue as the basis for selecting target calibrators for commissioning of SKA-Low. The additional info that comes from the cross-matching (in particular the angular size from other catalogues and if sources are single/multiple etc) made the process very easy, so big thanks from the commissioning team!"

– Randall Wayth (SKAO)

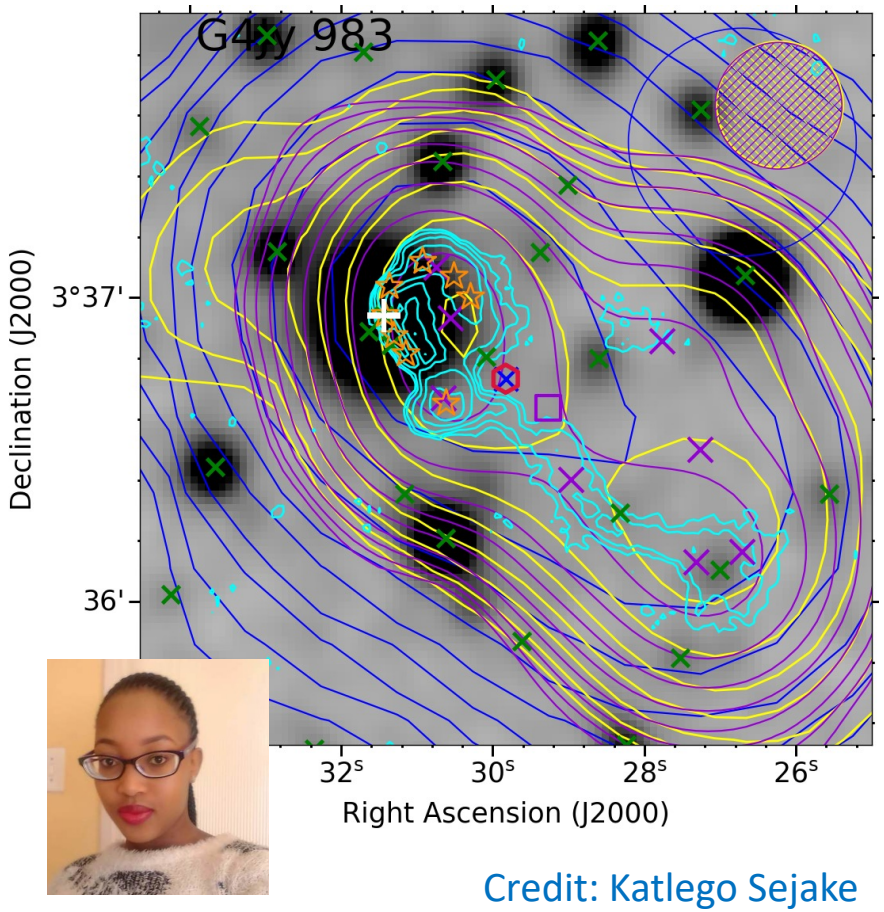
🤗

127 new host-galaxy identifications

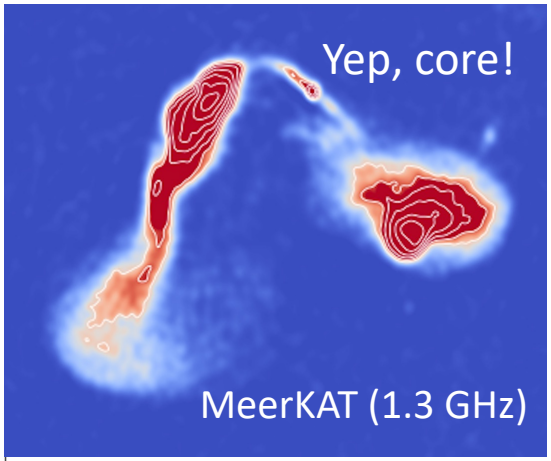
Background: AllWISE (W1) GLEAM (200 MHz) NVSS (1.4 GHz) TGSS (150 MHz)



VLASS (3 GHz) RACS-low (888 MHz)



5 mins per source (PI: White)



Credit: Katlego Sejake

Credit: Ian Heywood (Sejake et al. 2023)

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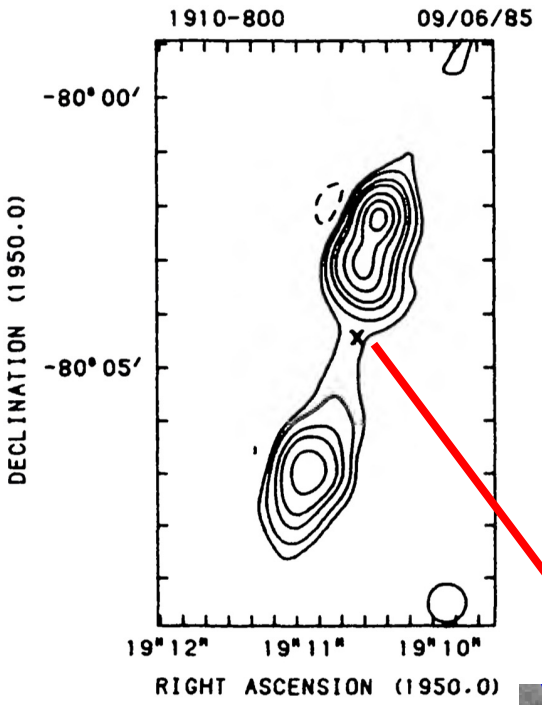
Some host galaxies may be very dust-obscured

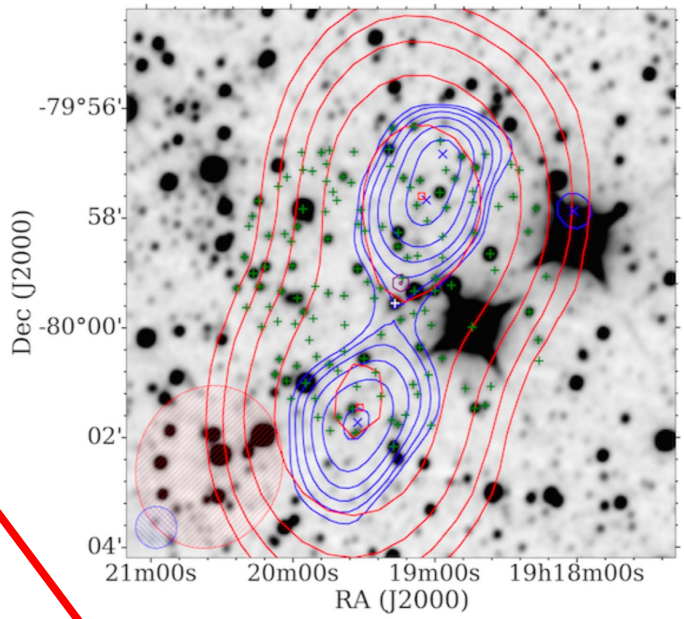
Jones & McAdam (1992)



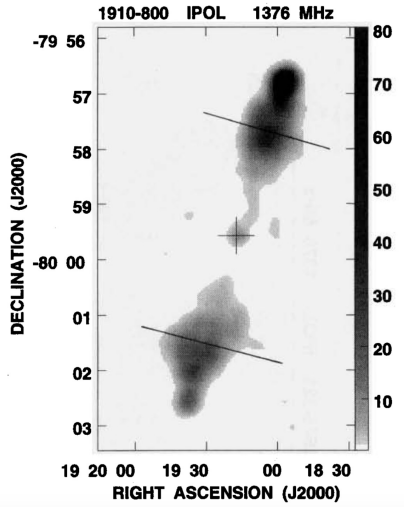
G4Jy 1525

GLEAM (200 MHz) SUMSS (843 MHz)

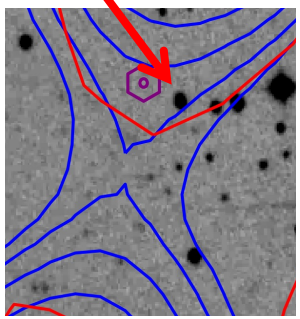
Background: AllWISE (W1)

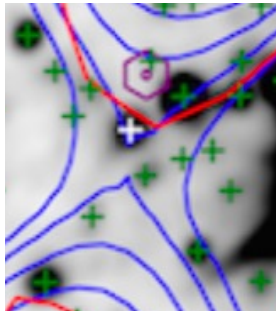


Subrahmanyan et al. (1996)



Radio contours on an optical image



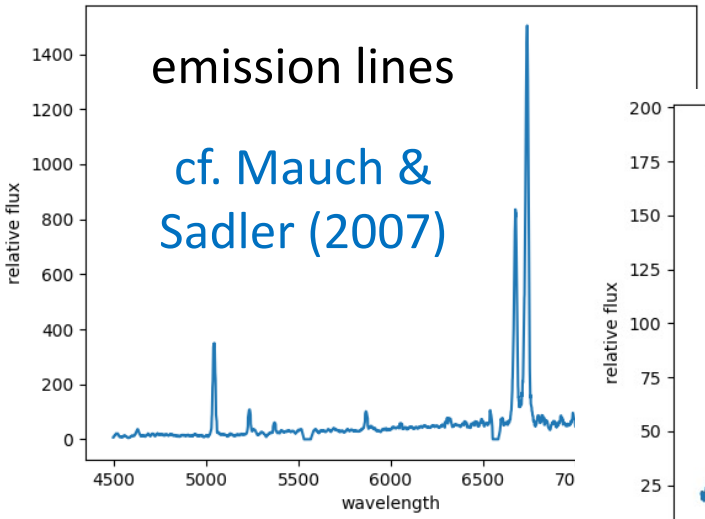


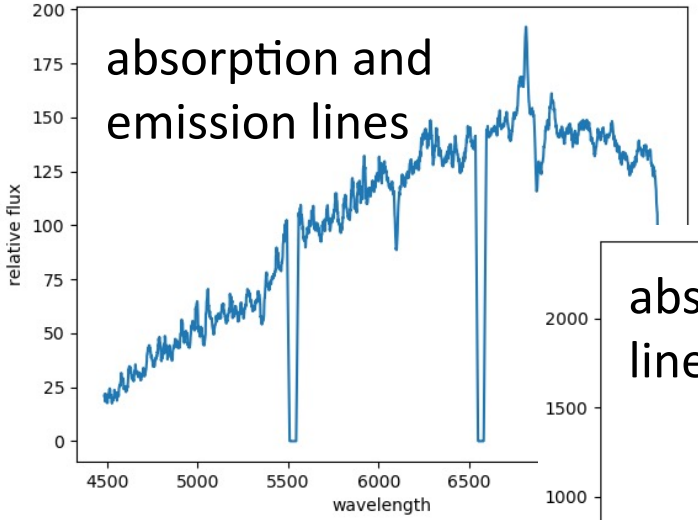
Radio contours on a mid-infrared image

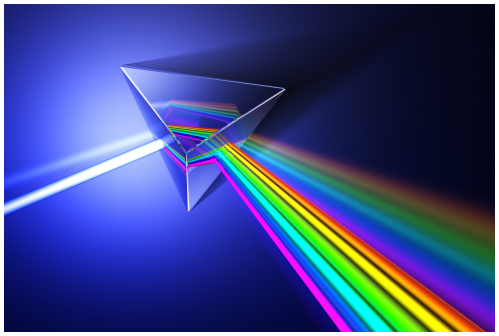
Improving availability of redshifts over the southern sky

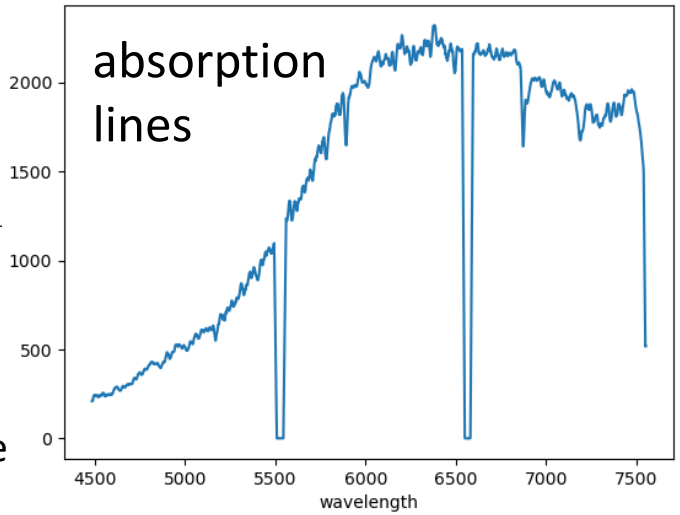
Southern African Large Telescope (SALT) spectra for 586 G4Jy sources (PI: White, ongoing multi-semester program)

R < 20.0, so 4 magnitudes deeper than the 6-degree Field Galaxy Survey (6dFGS DR3: Jones et al. 2009)





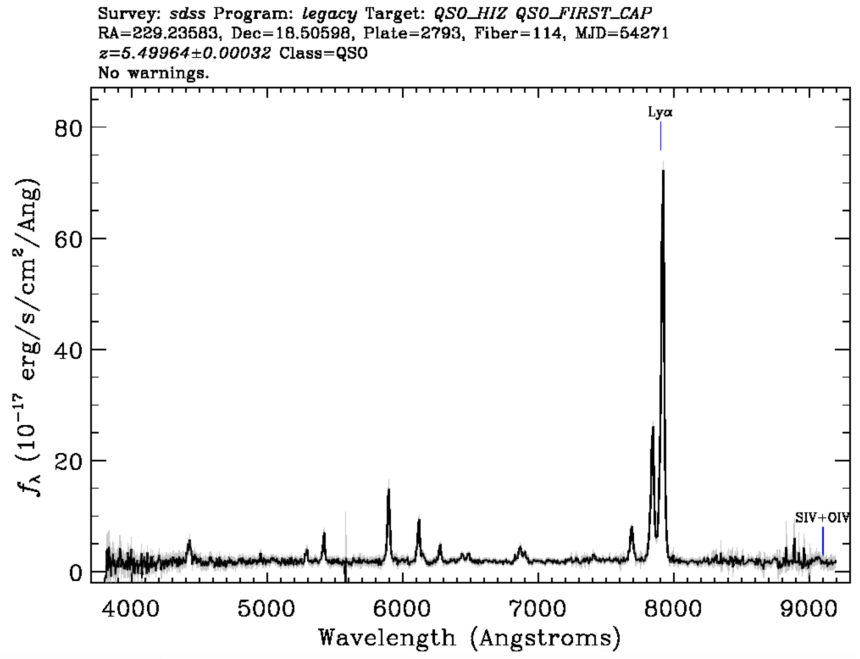




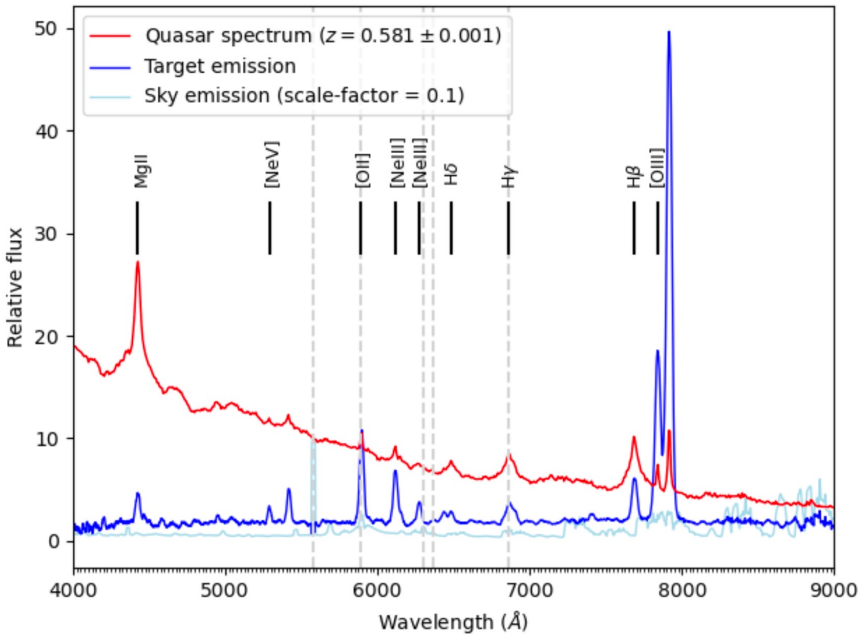
(in units of Angstrom)

Thanks to Matt Hilton for RSSMOSPipeline software

Improving ~~availability of~~ redshifts over the southern sky



SDSS DR16, Ahumada et al. (2020)



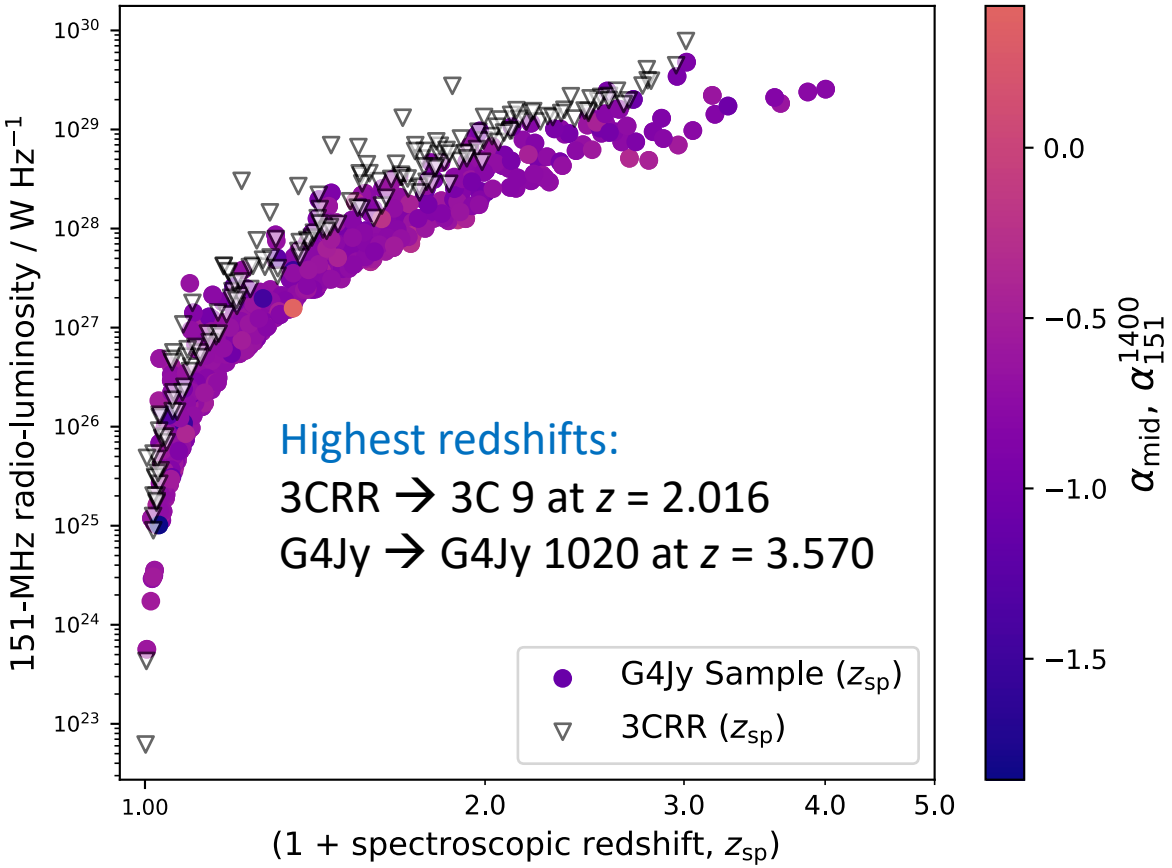
Re-fitted by White et al. (2025a)

Table 3. SDSS spectroscopic redshifts for five G4Jy sources, with new redshifts presented as a result of re-fitting the target spectrum (Appendix 3 and Figure 10). The 'SDSS best-fit' values are where the reduced-χ^2 metric is the global minimum (per source). Each of the sources listed are quasars.

Source name	Redshift origin	SDSS objID	SDSS best-fit redshift	Alternative SDSS redshift	Reduced-χ^2 ranking	Re-fitted redshift (this work)
G4Jy 148	SDSS DR16	1237679323928789061	2.78413 ± 0.00024	1.97376 ± 0.00034	2nd	1.965 ± 0.005
G4Jy 176	SDSS DR16	1237666274203271475	1.68729 ± 0.00086	1.63661 ± 0.00034	5th	1.660 ± 0.005
G4Jy 679	SDSS DR12	1237667254525952687	0.24639 ± 0.00010	1.19644 ± 0.00060	6th	1.196 ± 0.001
G4Jy 845	SDSS DR12	1237658423552376915	2.46126 ± 0.00015	1.71835 ± 0.00016	4th	1.706 ± 0.001
G4Jy 1240	SDSS DR12	1237667967497077036	5.49964 ± 0.00032	0.58067 ± 0.00005	3rd	0.581 ± 0.001

Calculating intrinsic properties (e.g. the radio luminosity)

MWA antenna,
Photo credit: Hurley-Walker



White et al. (2025c, submitted)

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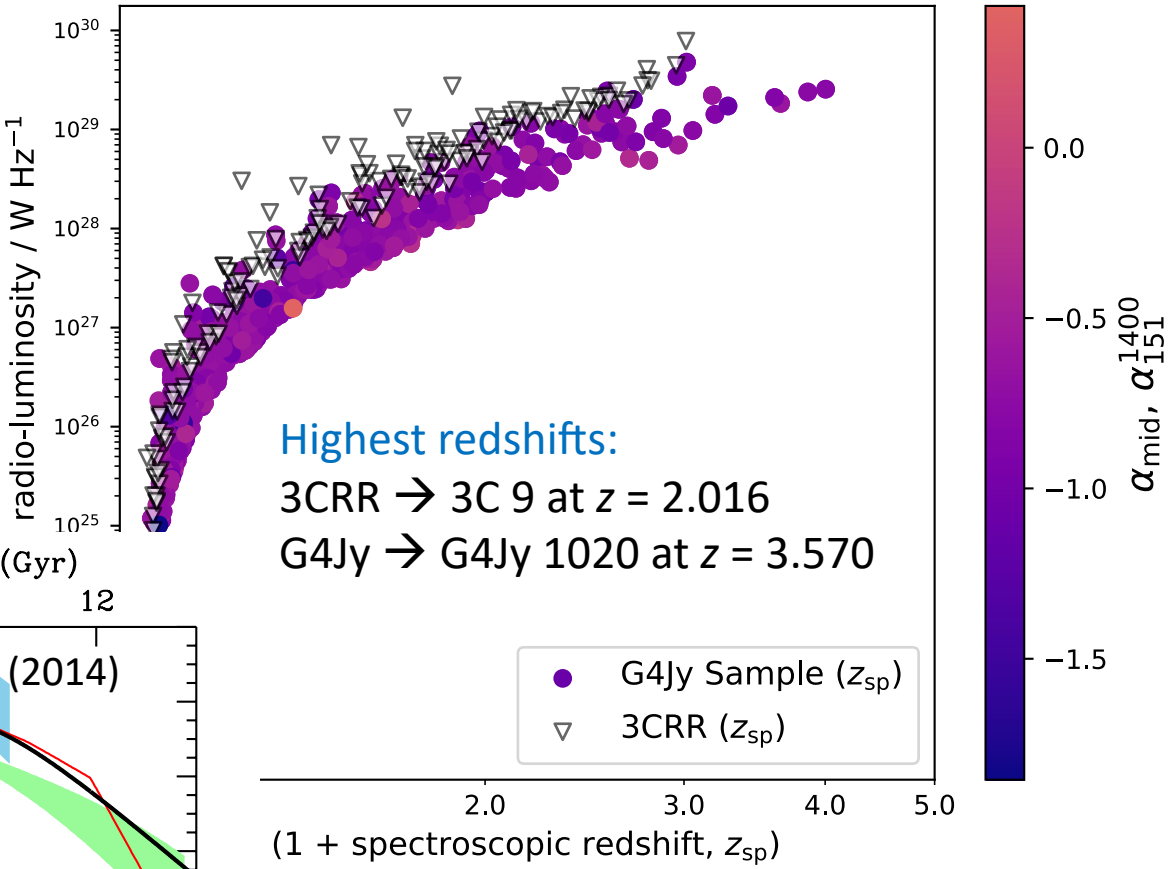
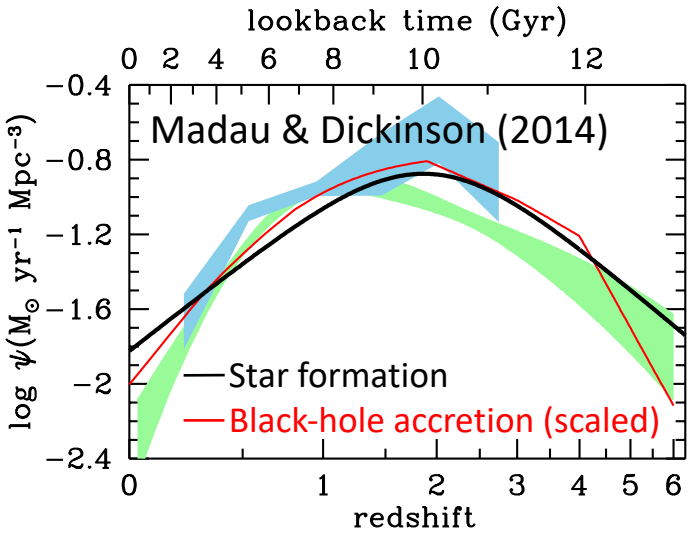
Calculating intrinsic properties (e.g. the radio luminosity)

MWA antenna,
Photo credit: Hurley-Walker

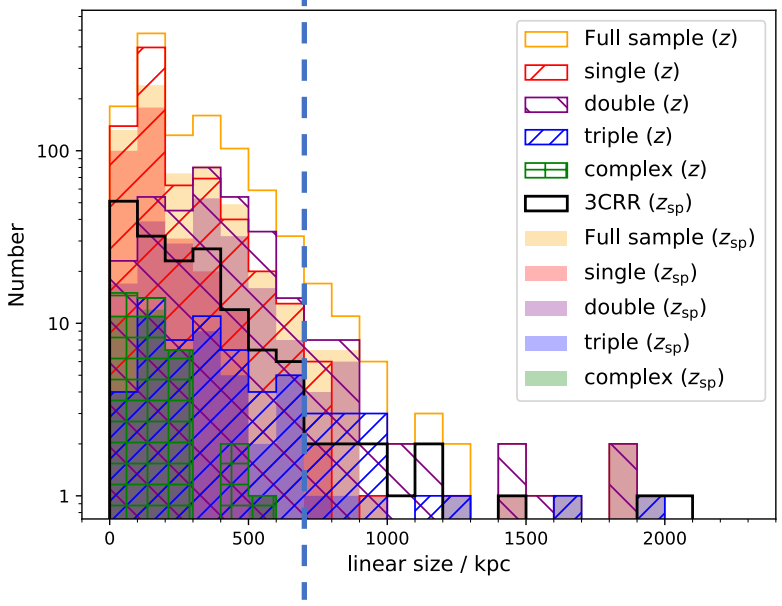


White et al. (2025c, submitted)



Calculating linear sizes → identify Giant Radio Galaxies

If considering the threshold as > 700 kpc



White et al. (submitted)

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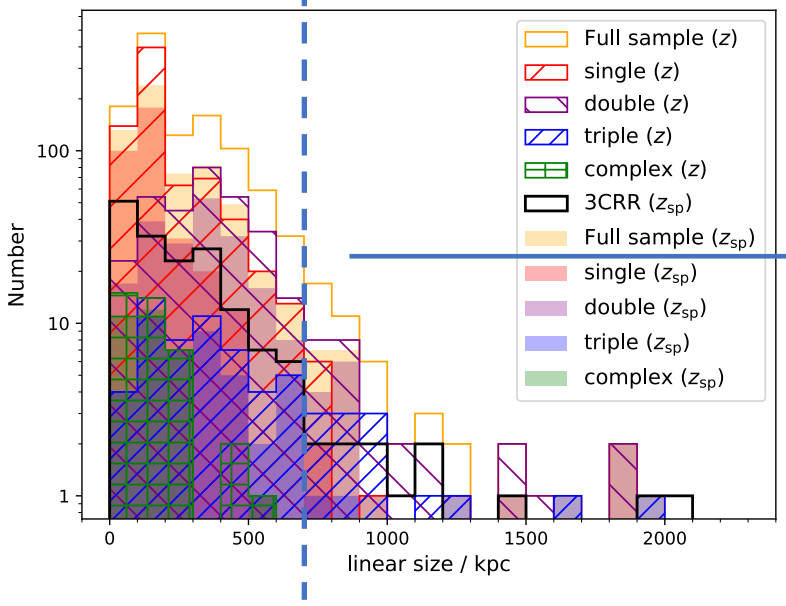
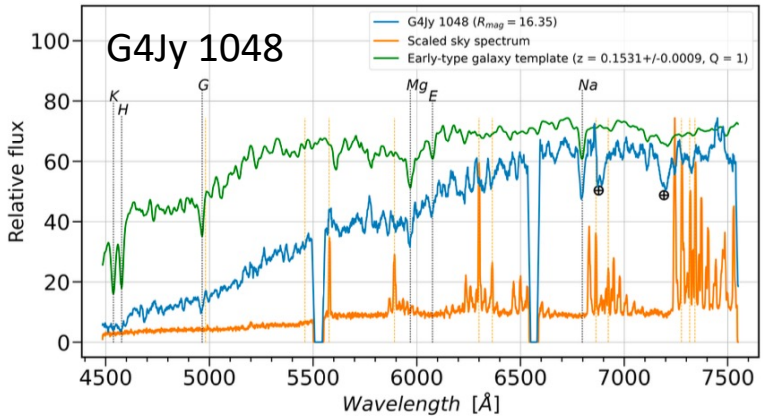
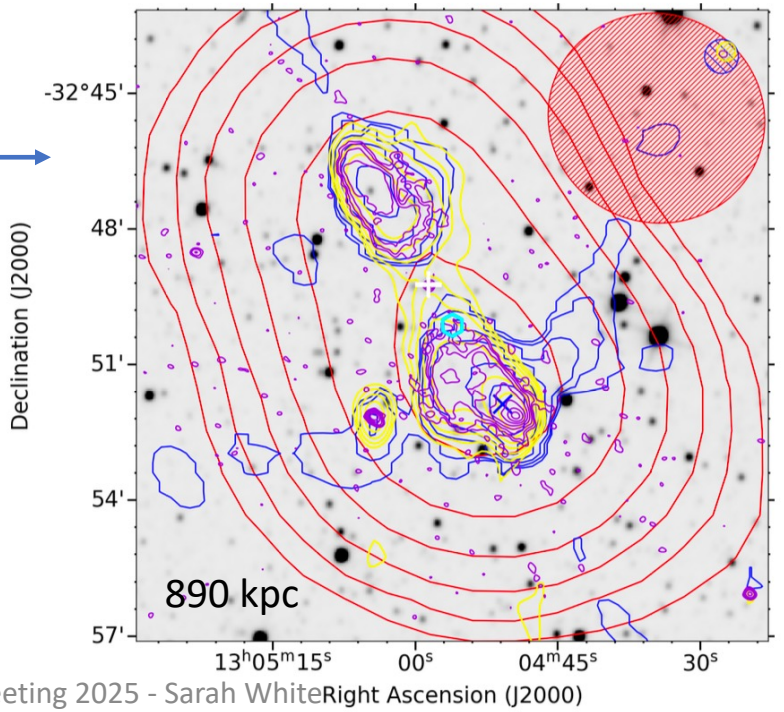


White et al. (submitted)



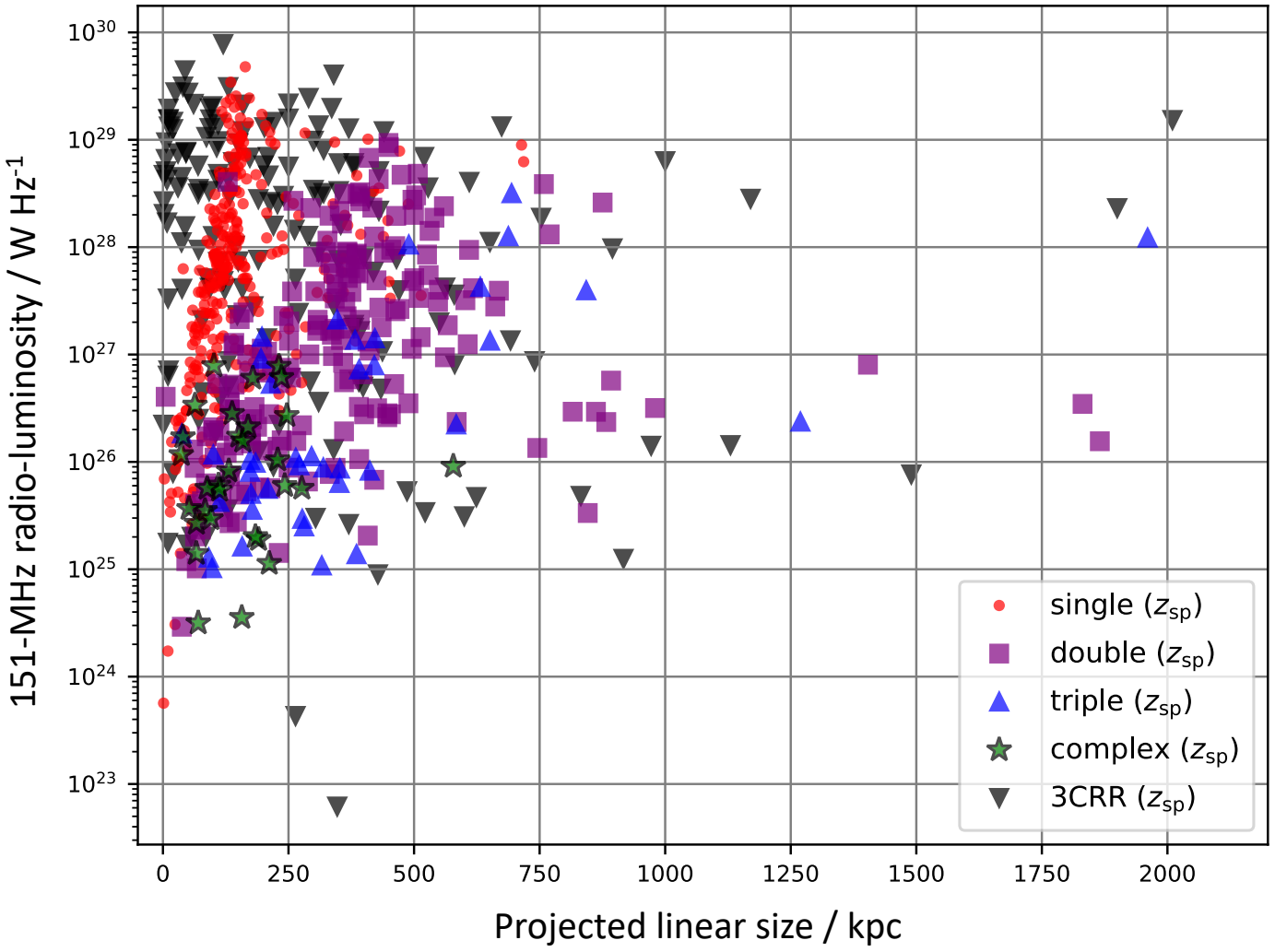
SALT optical spectrum

Confirming a GRG (Sejake et al., in prep.)



GLEAM + TGSS + NVSS + RACS-high radio contours

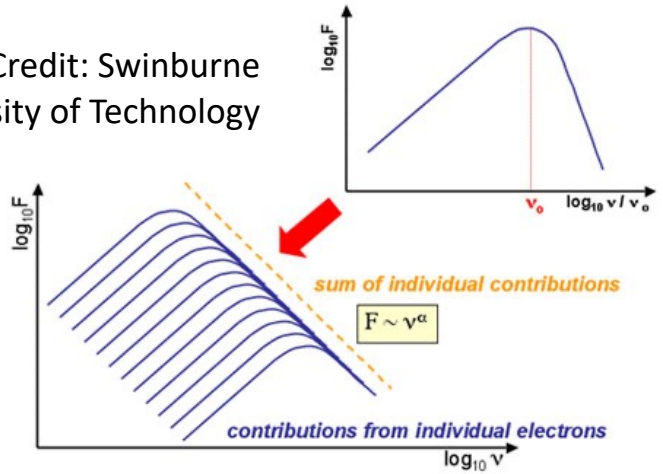
The radio-power – size, *P*—*D*, diagram

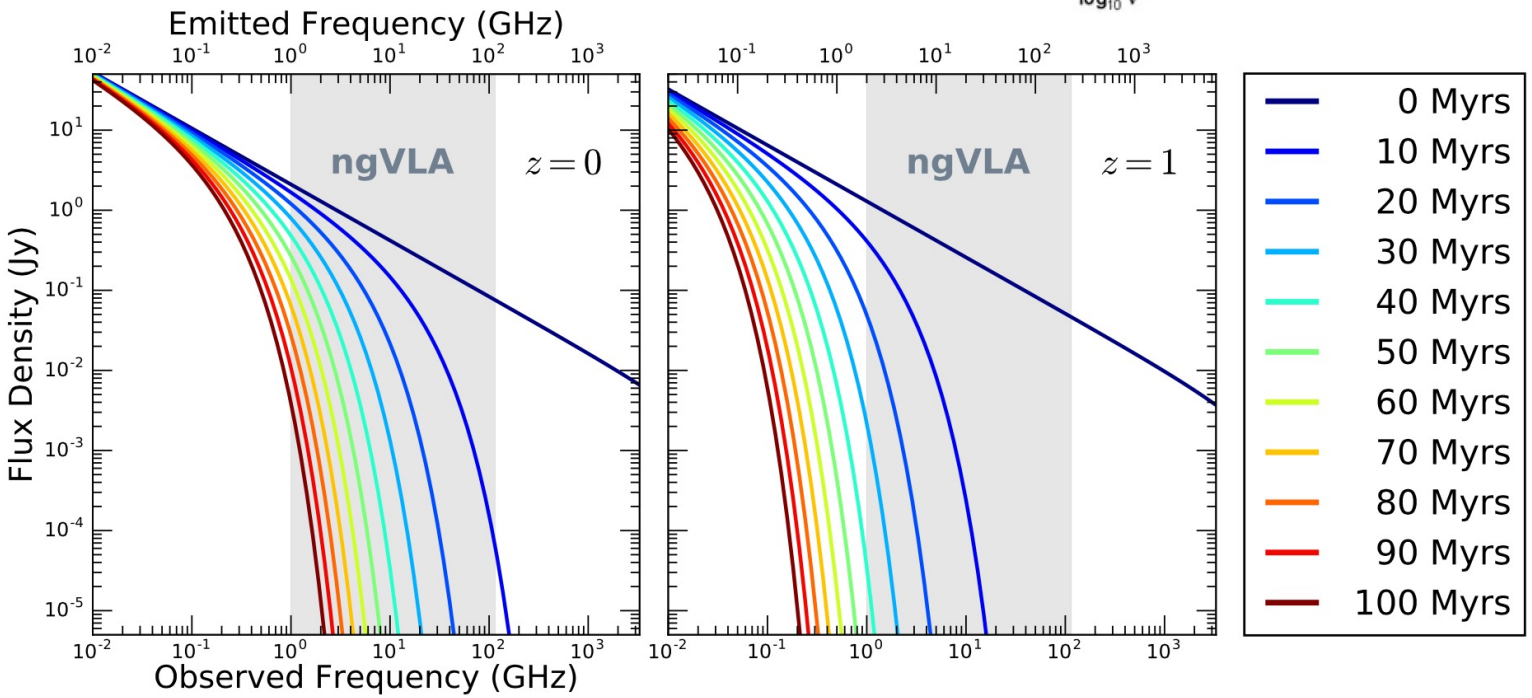


White et al. (2025c, submitted)

Radio spectral curvature as an indicator of ‘age’

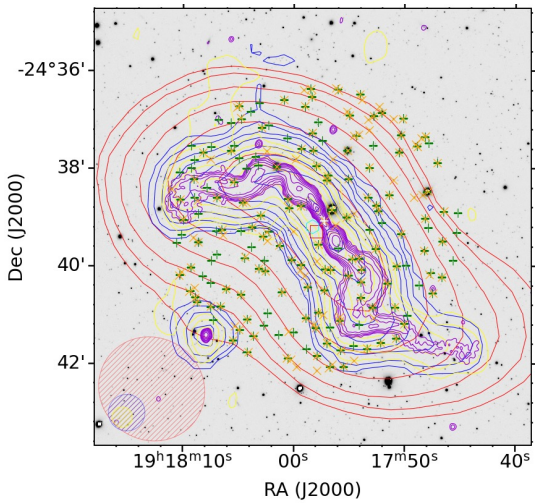
Credit: Swinburne University of Technology





Harwood et al. (2013), Nyland et al. (2018)

Ready for studying active galaxies in the SKA era



https://github.com/svw26/G4Jy

Low radio-frequencies: MWA (72-231 MHz) -> SKA-Low

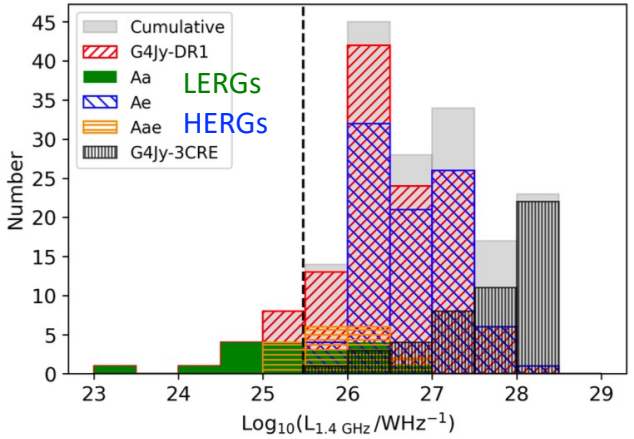
Unbiased selection; study AGN lifetime via spectral curvature

The GLEAM 4-Jy Sample (White et al. 2020a, 2020b)

- 1,863 radio sources, 96% accessible by **ALMA**
- **MeerKAT** (cf. SKA-Mid) follow-up of 140 sources with 'enigmatic' radio morphology (Sejake et al., 2023)

Multiwavelength data (White et al., 2025c, 2025d, tbc)

- New redshifts (e.g. García-Pérez et al. 2024), including those from **SALT** (White et al., 2025a; Sejake et al., in prep.)
- Currently $0.0 < z < 3.6$ from 34% spec-z completeness
- Spectral curvature → radio-power – size – age diagram



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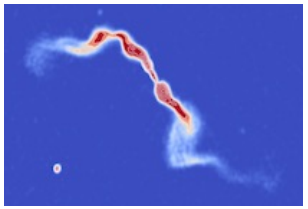
You need the G4Jy Sample ;)
and the G4Jy Sample needs you!



Do you have experience with…?	What for?	Why? :P
The Karl G. Jansky Very Large Array (VLA)	Pin-pointing the host galaxies for sources that remain unidentified	All of the subsequent science depends on robust IDs
GLEAM-X imaging and the catalogue	Updating the low-frequency radio data, incl. visual inspection	More-accurate flux-densities for studying spectral curvature
FORS2 on the Very Large Telescope (VLT)	Following up fainter ($r > 19.5$) sources with optical/NIR spectra	Calculate intrinsic properties for sources at $0 < z < 4$
RACS-high imaging or MeerKAT follow-up	Updating the angular sizes that were based on 45” resolution	Identify compact sources and (with z) giant radio-galaxies

https://github.com/svw26/G4Jy
https://zenodo.org/communities/g4jy/records

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