



International  
Centre for  
Radio  
Astronomy  
Research

# The MWA GLEAM 4-Jy Sample

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and the GLEAM Team

# The Murchison Widefield Array (MWA)



Protected, radio-quiet site in Western Australia

Wide, continuous bandwidth: 30 MHz

Maximum baseline (Phase 1): 3 km

Angular resolution:  $\sim 2$  arcmin at 200 MHz



Credit: Sarah White, ICRAR/Curtin





# The southern sky at low radio-frequencies



## GaLactic and Extragalactic All-sky MWA Survey

(Wayth et al. 2015, Hurley-Walker et al. 2017)



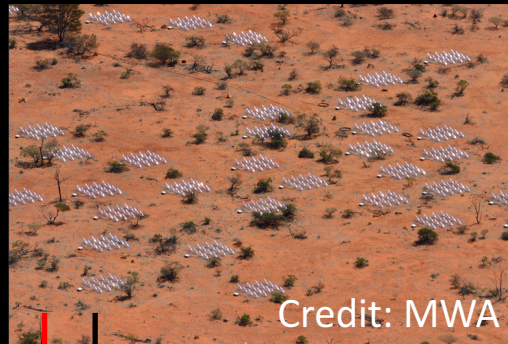
The Murchison Widefield Array (MWA)

Credit: Natasha Hurley-Walker

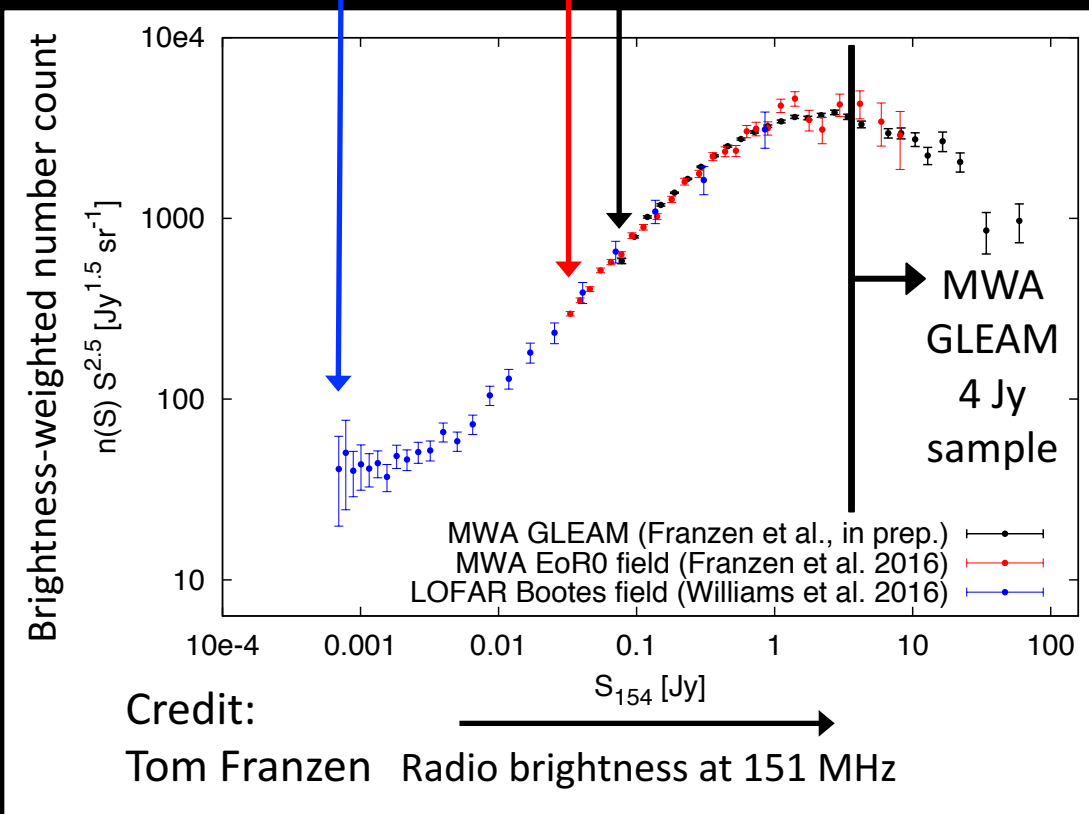
- Extragalactic catalogue of ~300,000 components
- Frequency range: 72 – 231 MHz
- 20 flux-densities per component
- $-90 < \text{Dec} / \text{deg} < +30$

# Number counts at low radio-frequencies

LOFAR  
number  
counts



MWA  
number  
counts

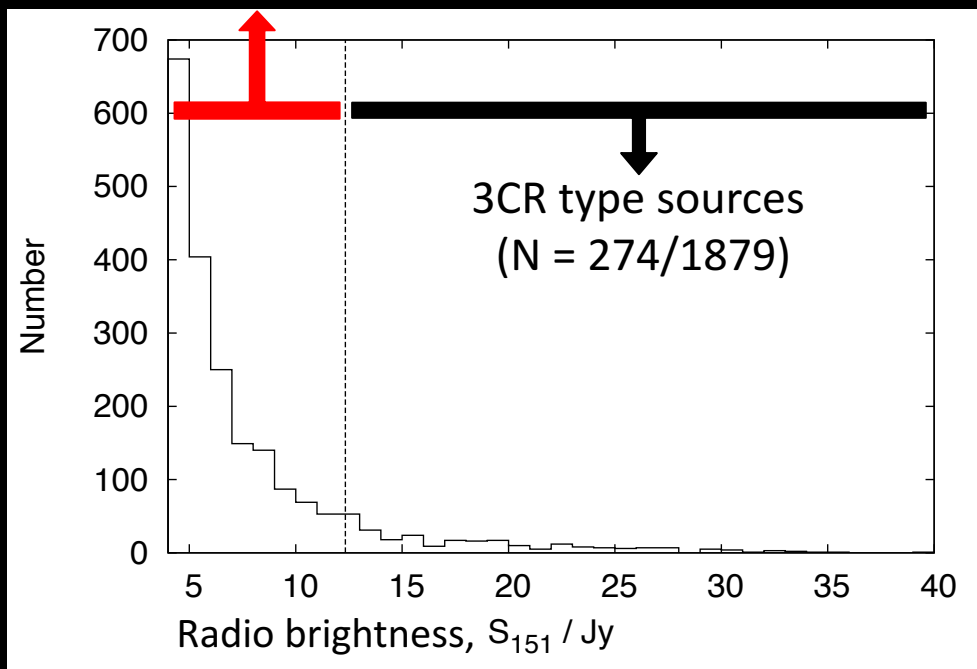




# The MWA GLEAM 4 Jy sample

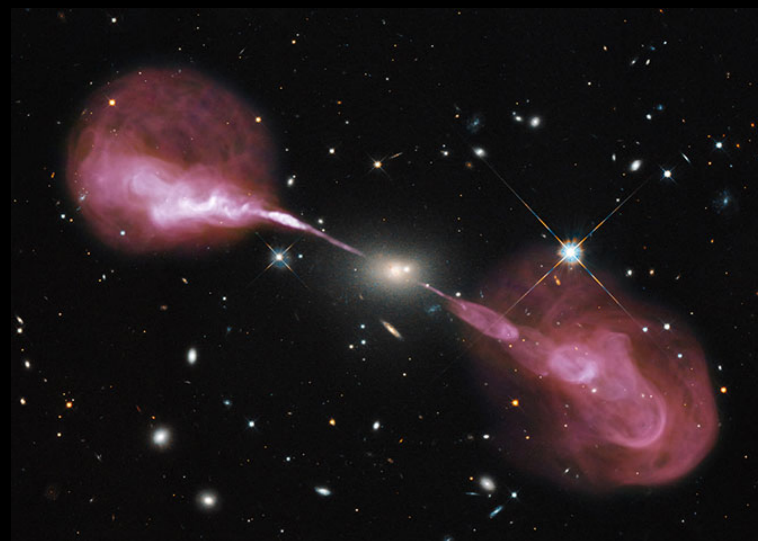
Fainter radio galaxies (lower power or higher redshift)

Jackson et al. (2016)



$$S_{151 \text{ MHz}} > 4 \text{ Jy}$$

Active galactic nuclei (AGN)  
dominate the sample



Credit: NASA, ESA, S. Baum, C. O'Dea,  
R. Perley, W. Cotton, and the Hubble  
Heritage Team



Sarah White



Tom Franzen



Carole Jackson



# Extended radio-galaxy at $z = 0.012$

GLEAM (200 MHz)  
image of IC 4296

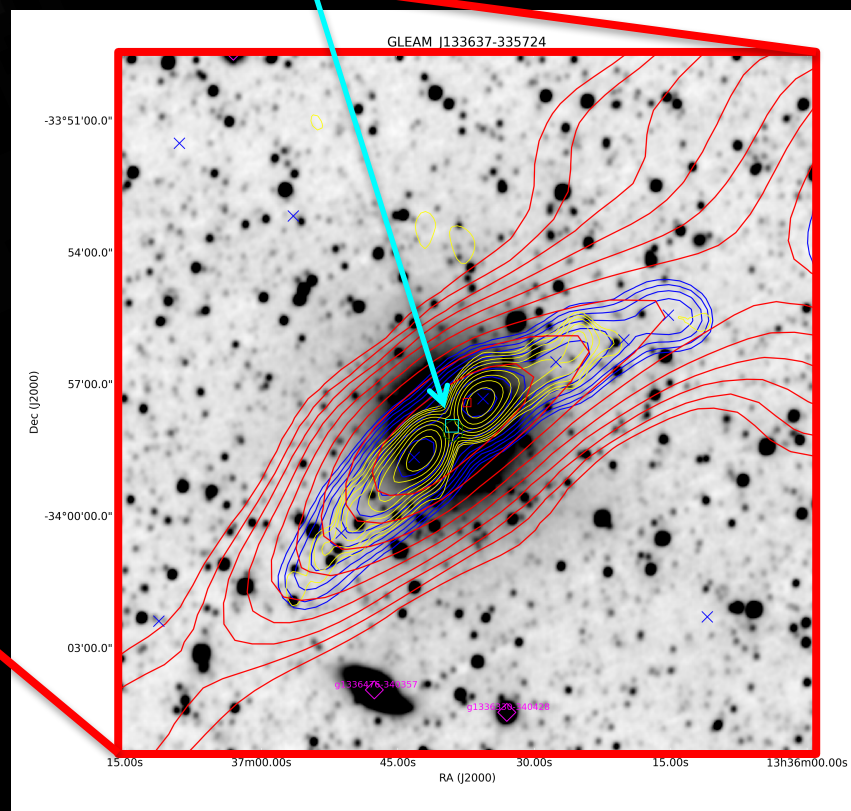
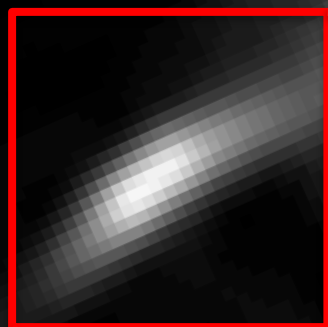
Background: WISE (W1)

TGSS (153 MHz)

GLEAM (200 MHz)

NVSS (1.4 GHz)

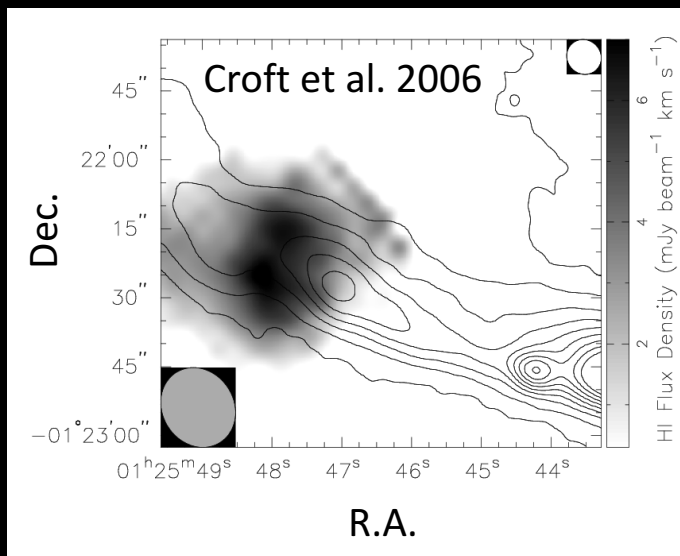
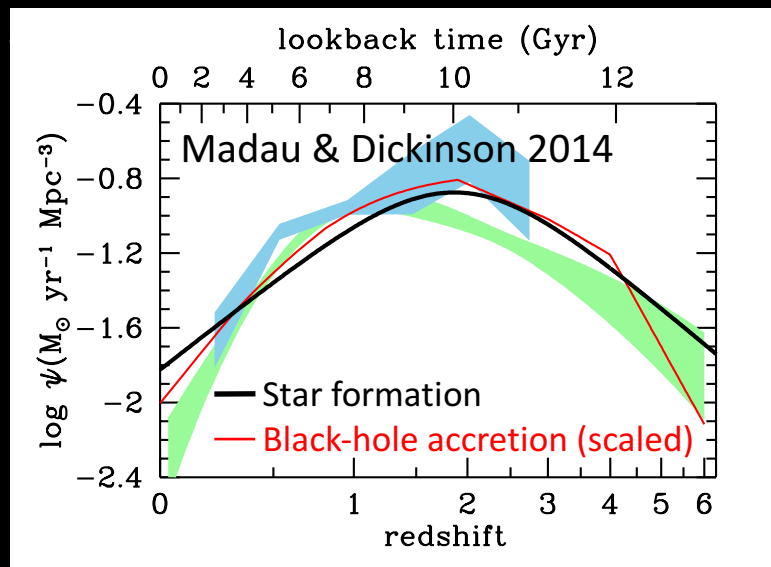
AT20G detection (20 GHz)



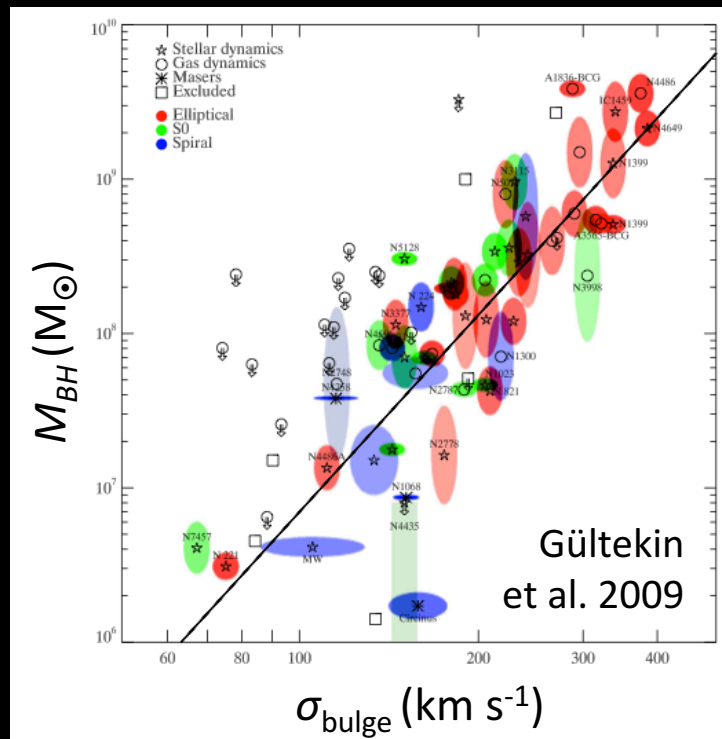
40 arcmin across,  
 $z = 0.012 \rightarrow 614$  kpc across  
Abell 3565 is 26 arcsec away



# Studying galaxy evolution with the 4 Jy sample



Star formation and accretion:  
peak over  $1 < z < 3$

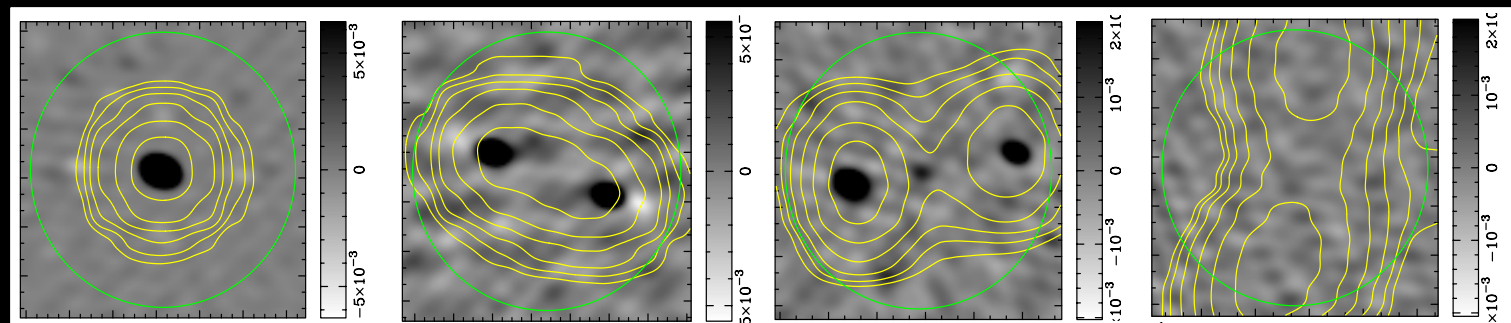
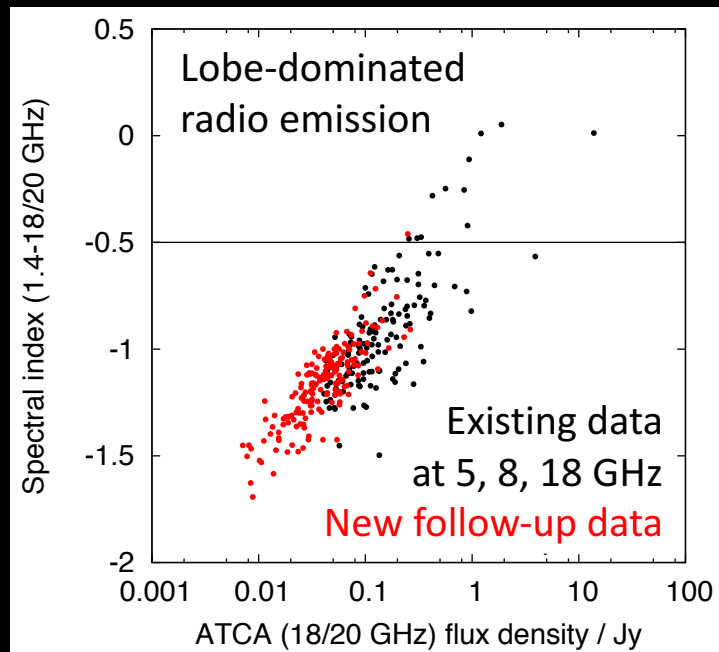
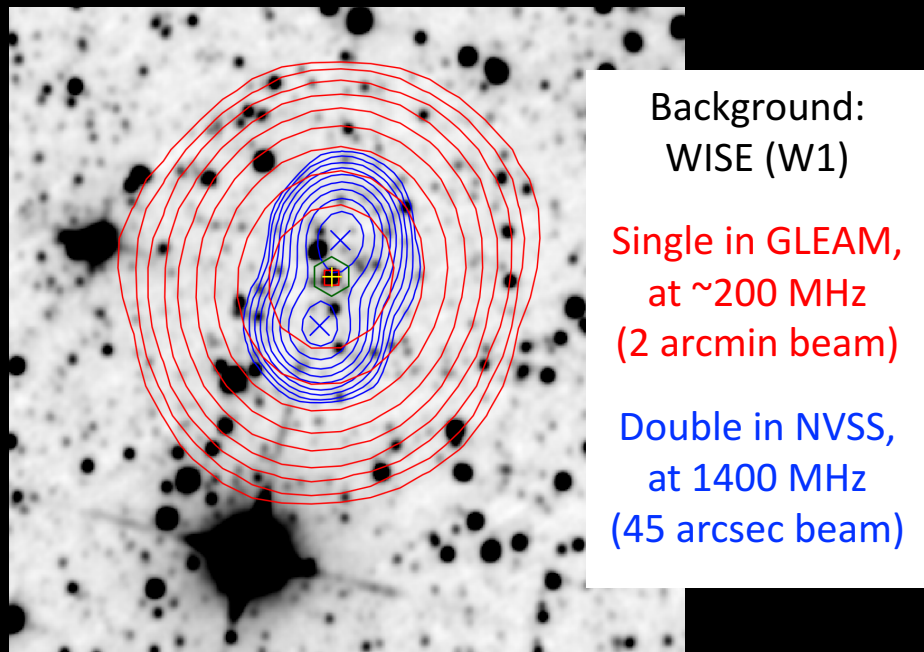


Co-evolution of the black hole  
and host galaxy

Star formation triggered by radio jets

# Higher frequencies to determine the morphology

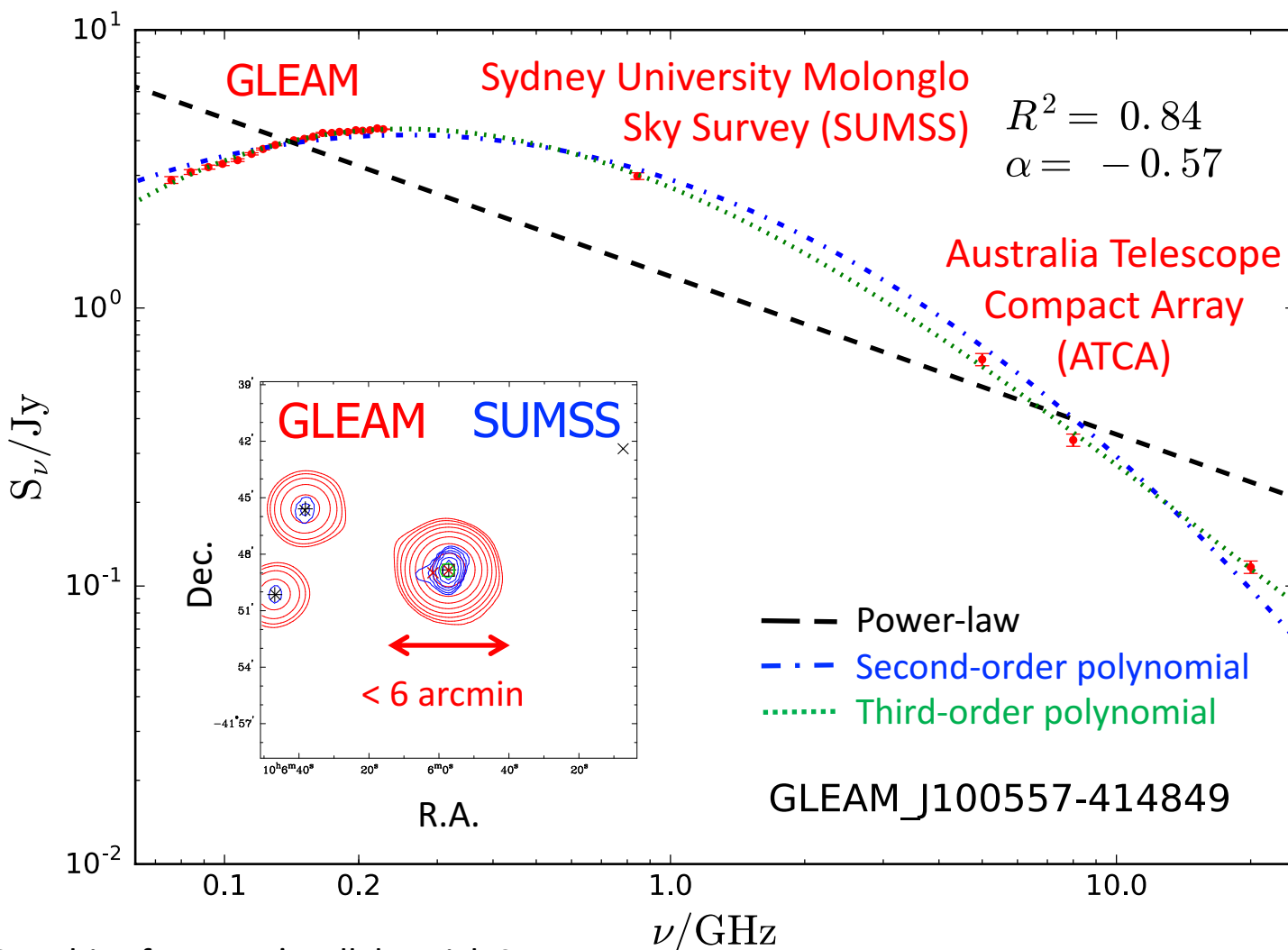
Collapse 'component list' (1879) into a 'source list' (1825) -> ~ 77% are compact at ~ 1 GHz



Grey-scale: ATCA follow-up at 18 GHz (13 arcsec beam) **NVSS emission (45 arcsec beam)**



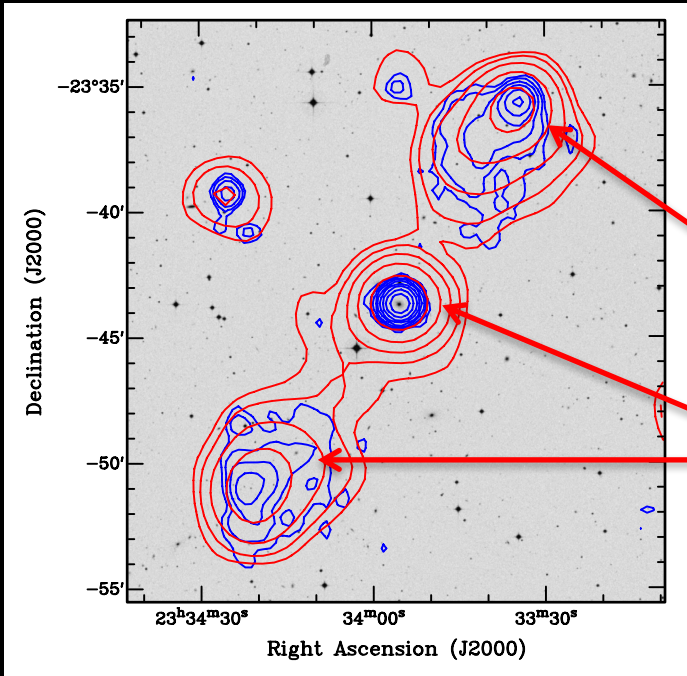
# Spectral curvature, from 70 MHz to 20 GHz



See this afternoon's talk by Nick Seymour

# Radio spectra of restarted radio-galaxies

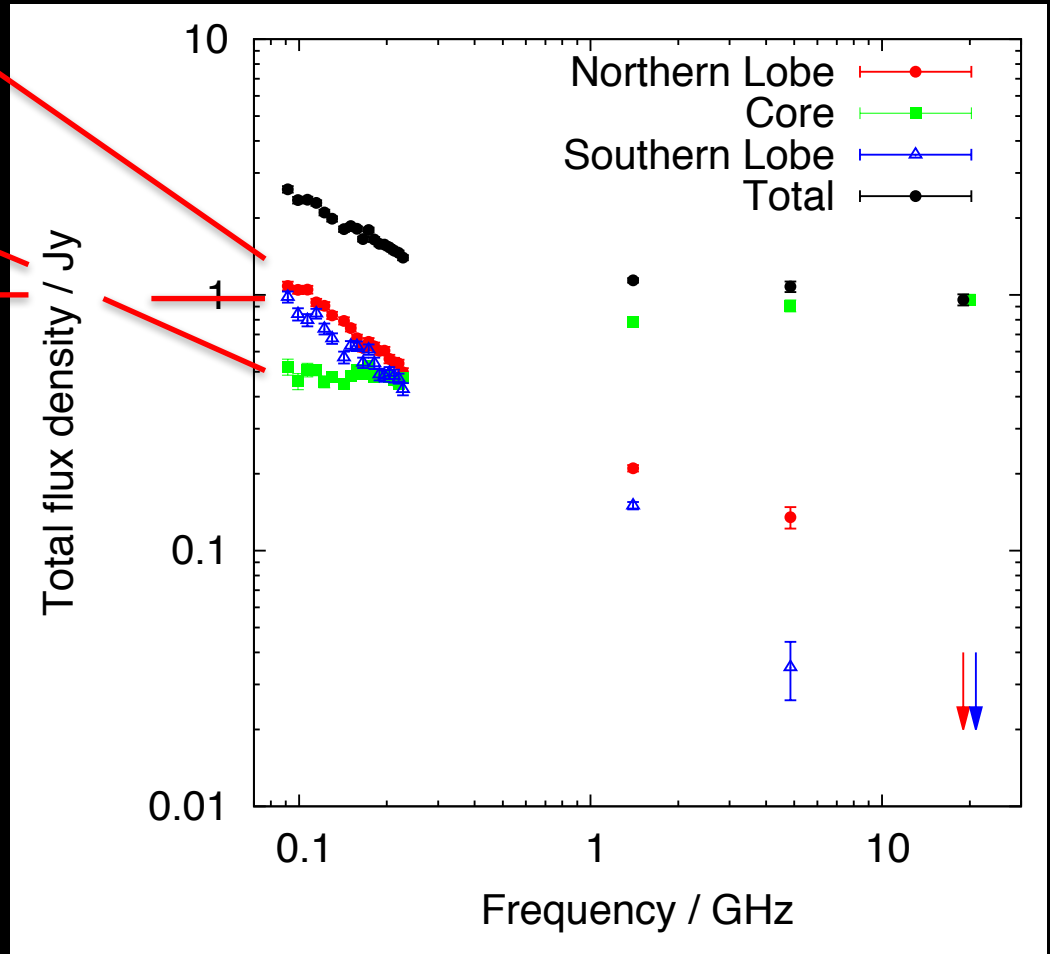
Even when unresolved at higher redshift, candidate restarted radio galaxies can be identified from their broad-band radio spectra



Giant radio galaxy B2331-241

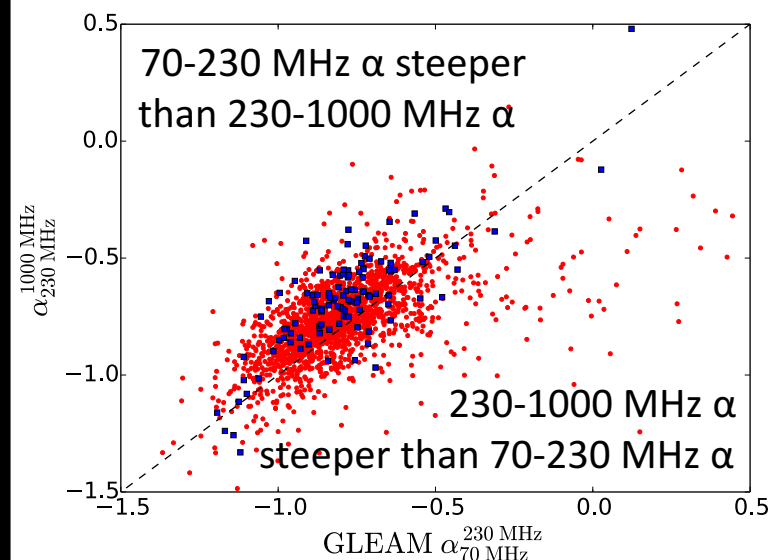
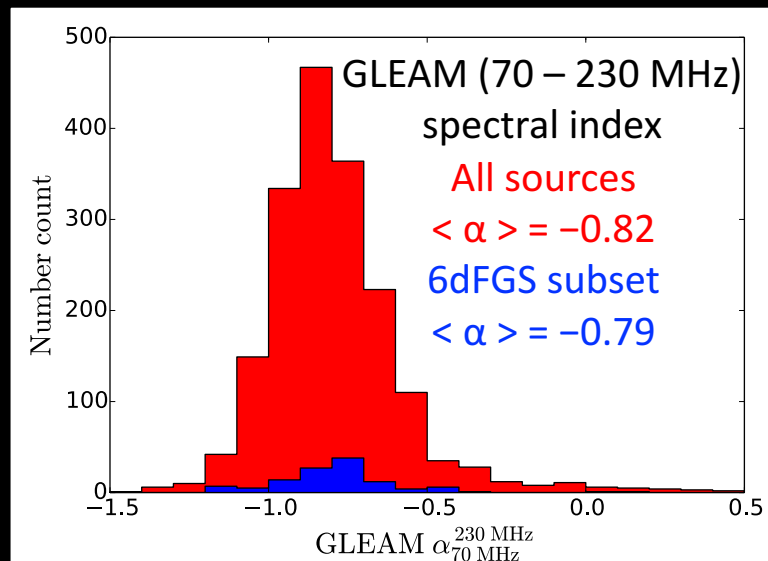
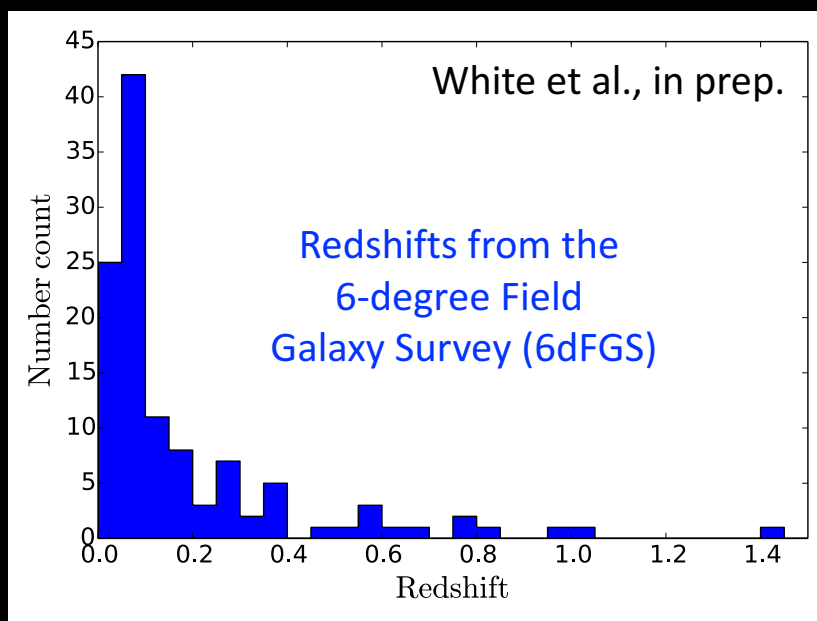
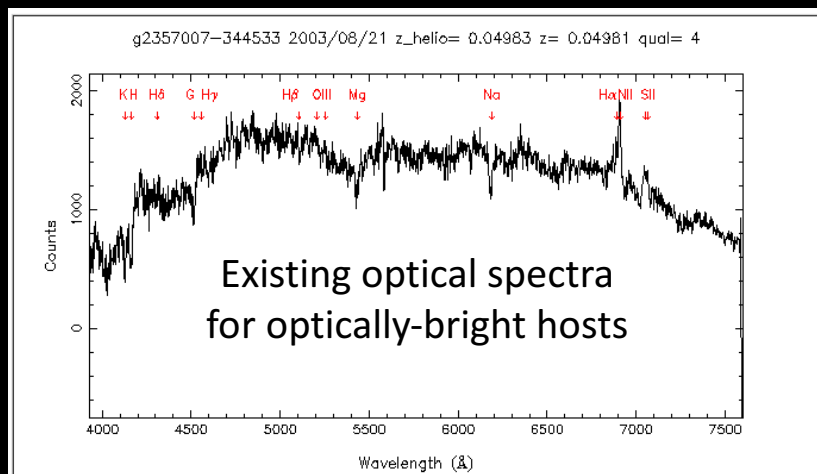
GLEAM (70-231 MHz)  
 NVSS (1.4 GHz)  
 PMN (4.85 GHz)  
 AT20G (20 GHz)

Figures courtesy  
 of Tom Franzen



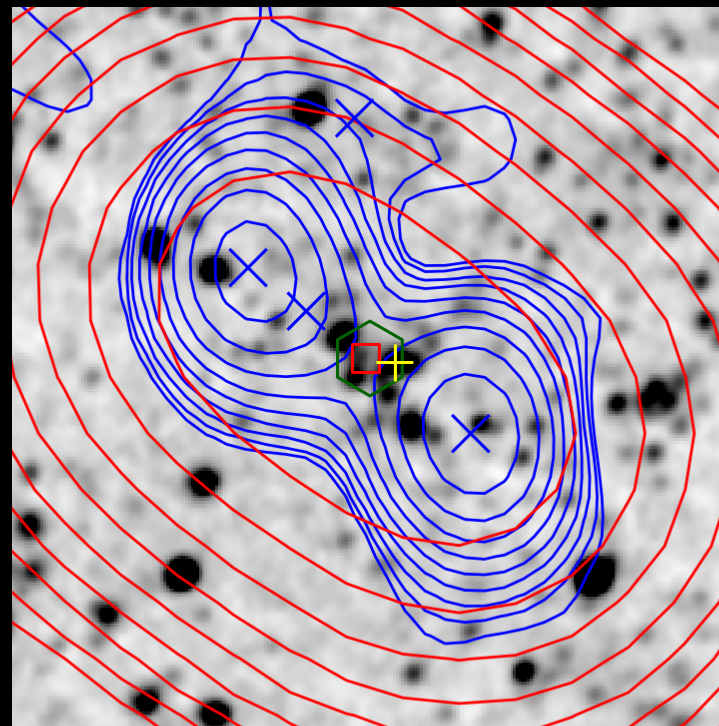
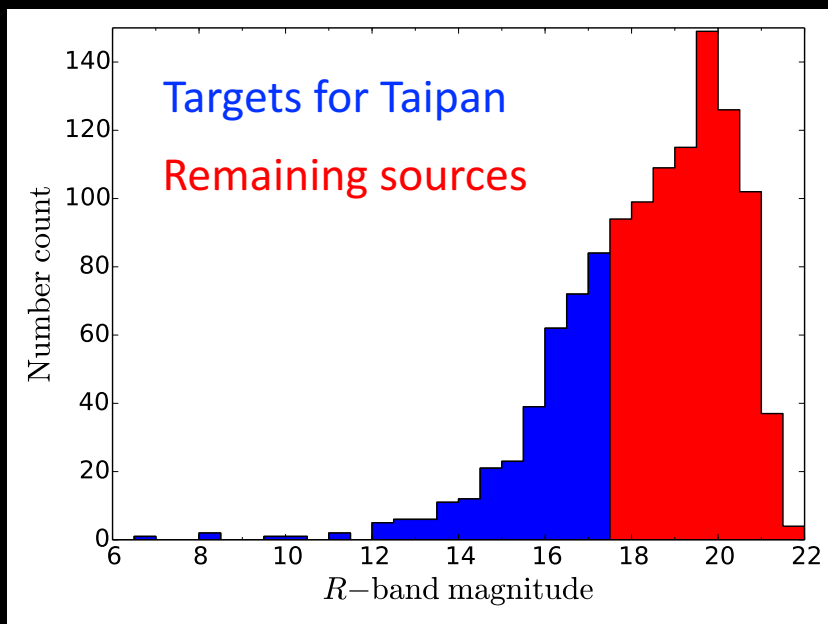


# 116 sources with 6dFGS (optical) spectra



## Ambiguity of host galaxy for GLEAM\_J010521-450527

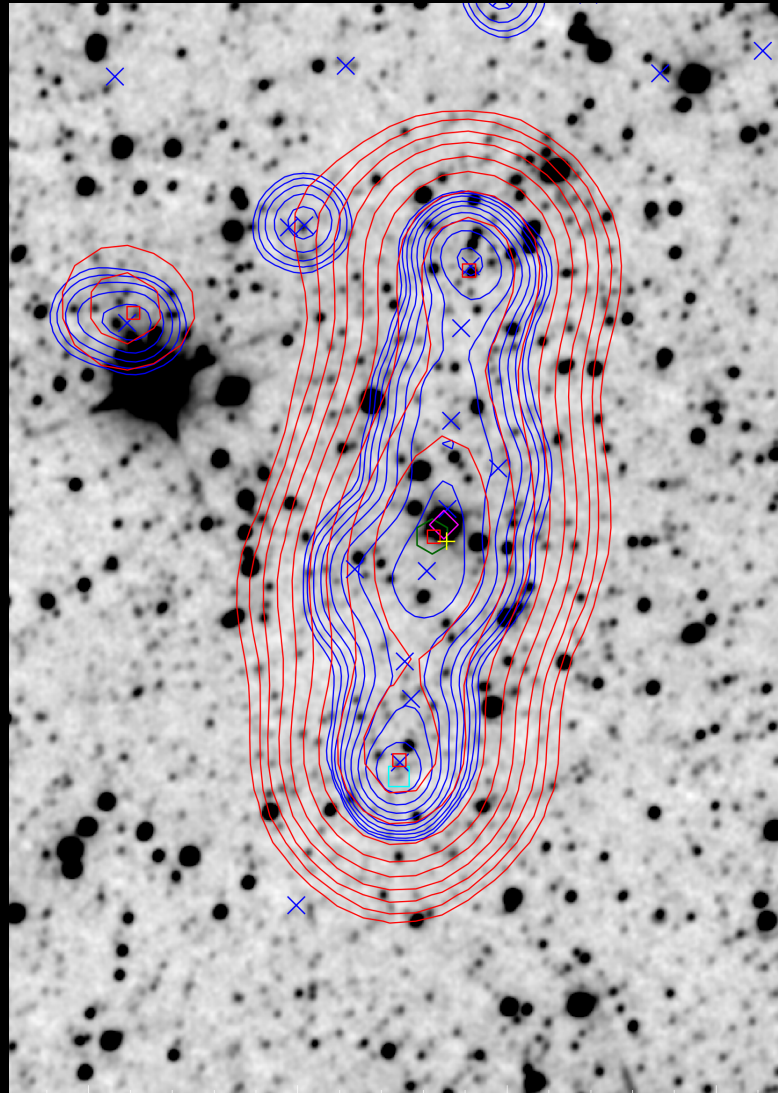
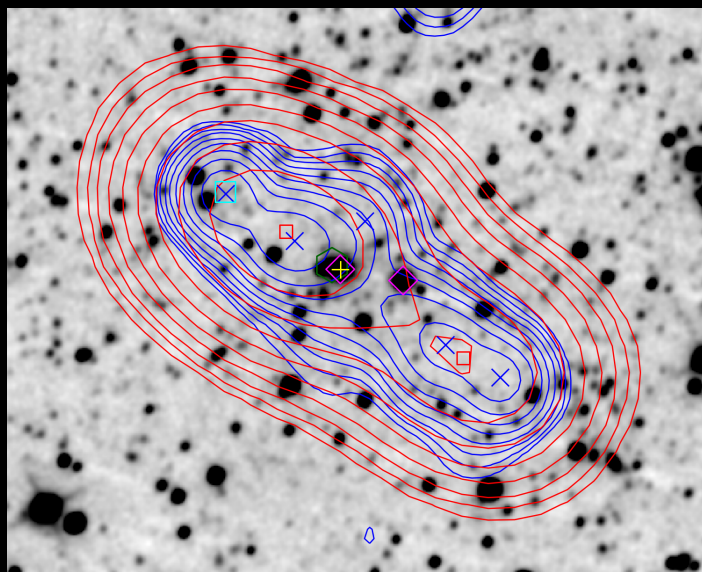
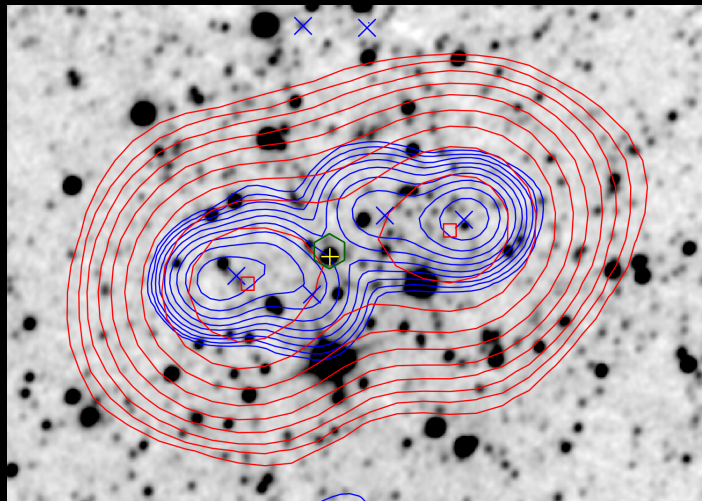
- Using a Likelihood Ratio method to check host-galaxy positions
- Comparison with automated results from PUMA (Line et al. 2017)



- Optical follow-up from the Taipan spectroscopic survey

# Sources with multiple GLEAM detections

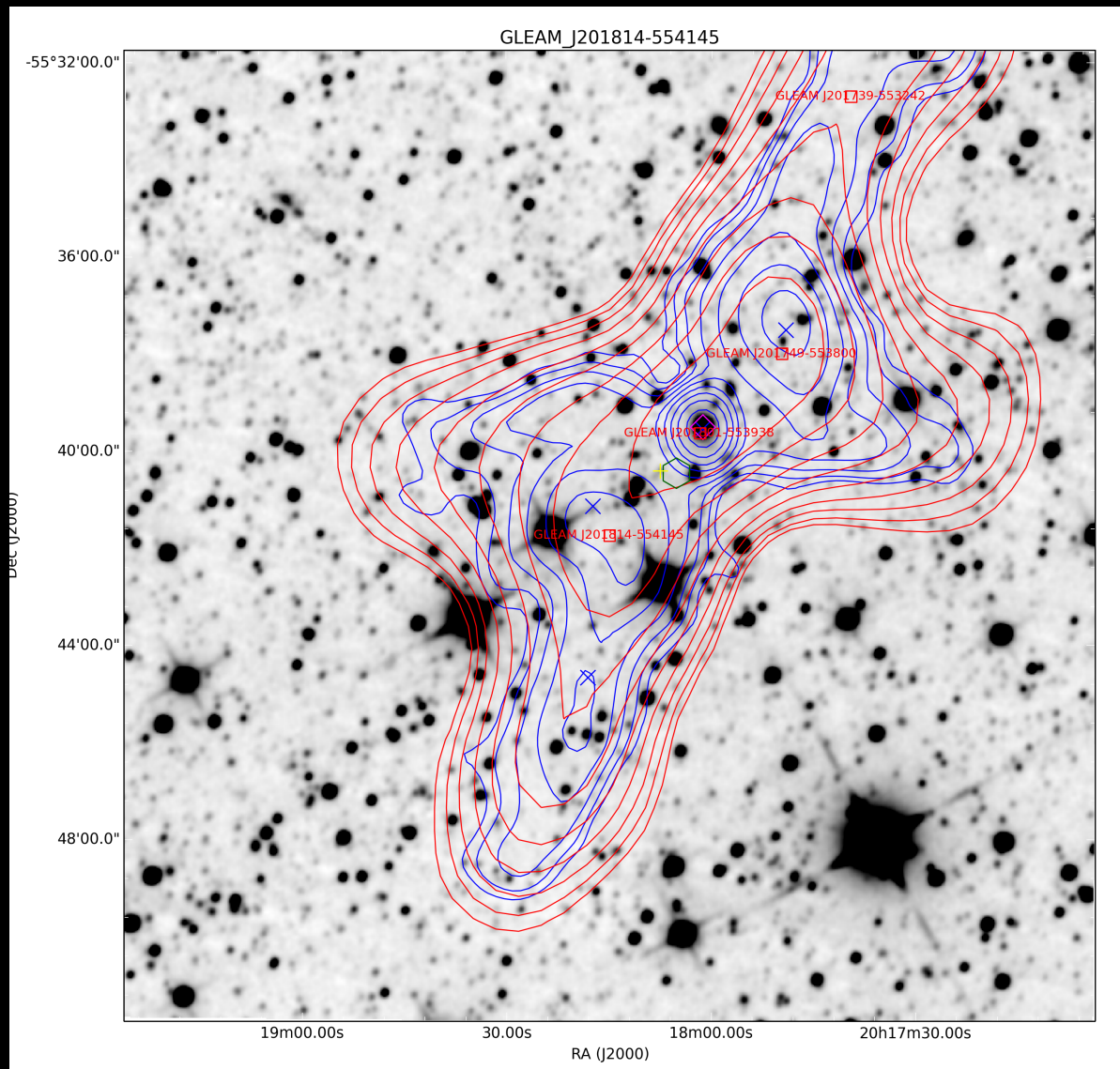
GLEAM (200 MHz)    NVSS (1.4 GHz)





# A source with two jet axes

GLEAM  
(200 MHz)  
NVSS  
(1.4 GHz)



# An unresolved, restarted radio-galaxy

