Multi-wavelength analysis of AGN/SFG separation

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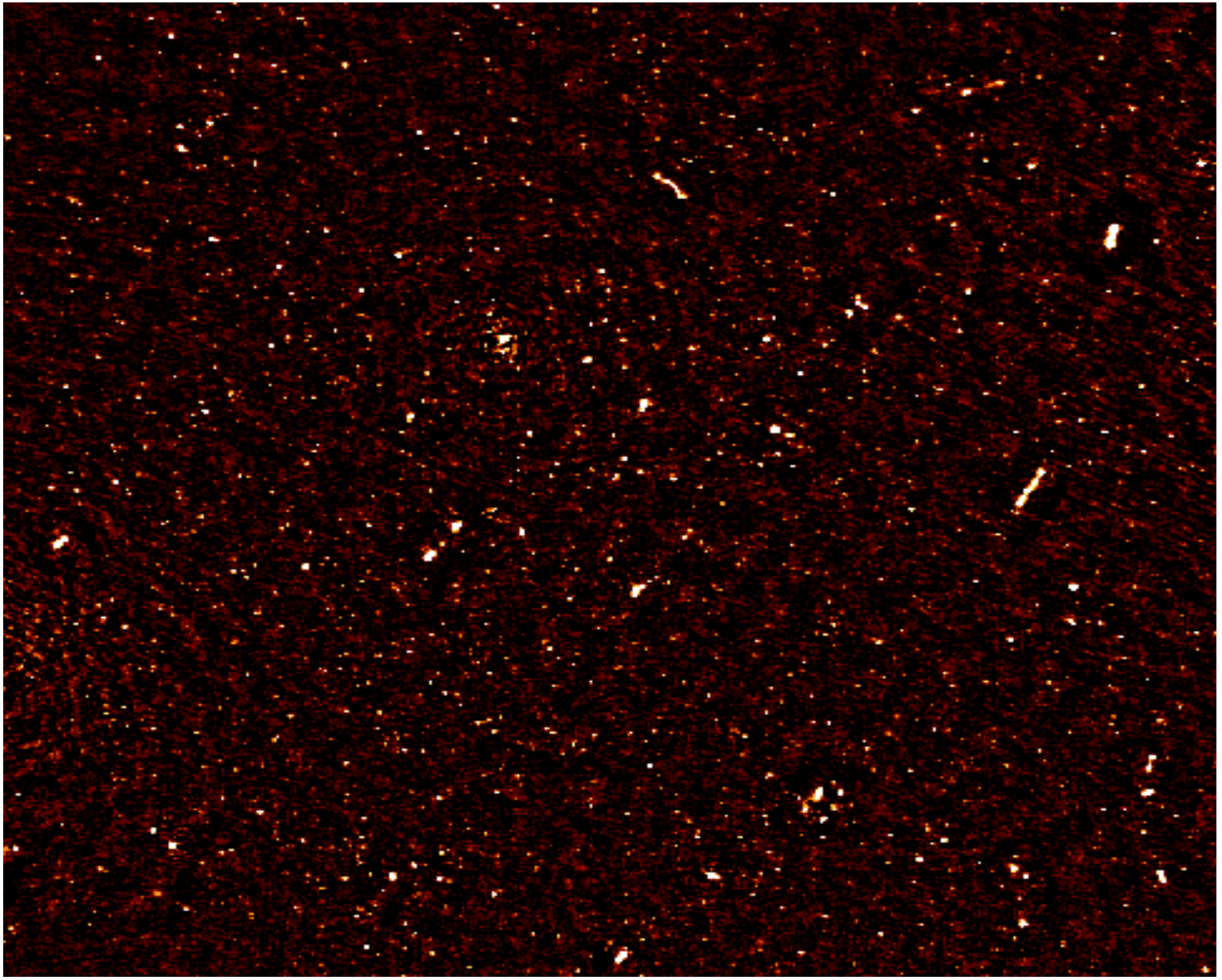
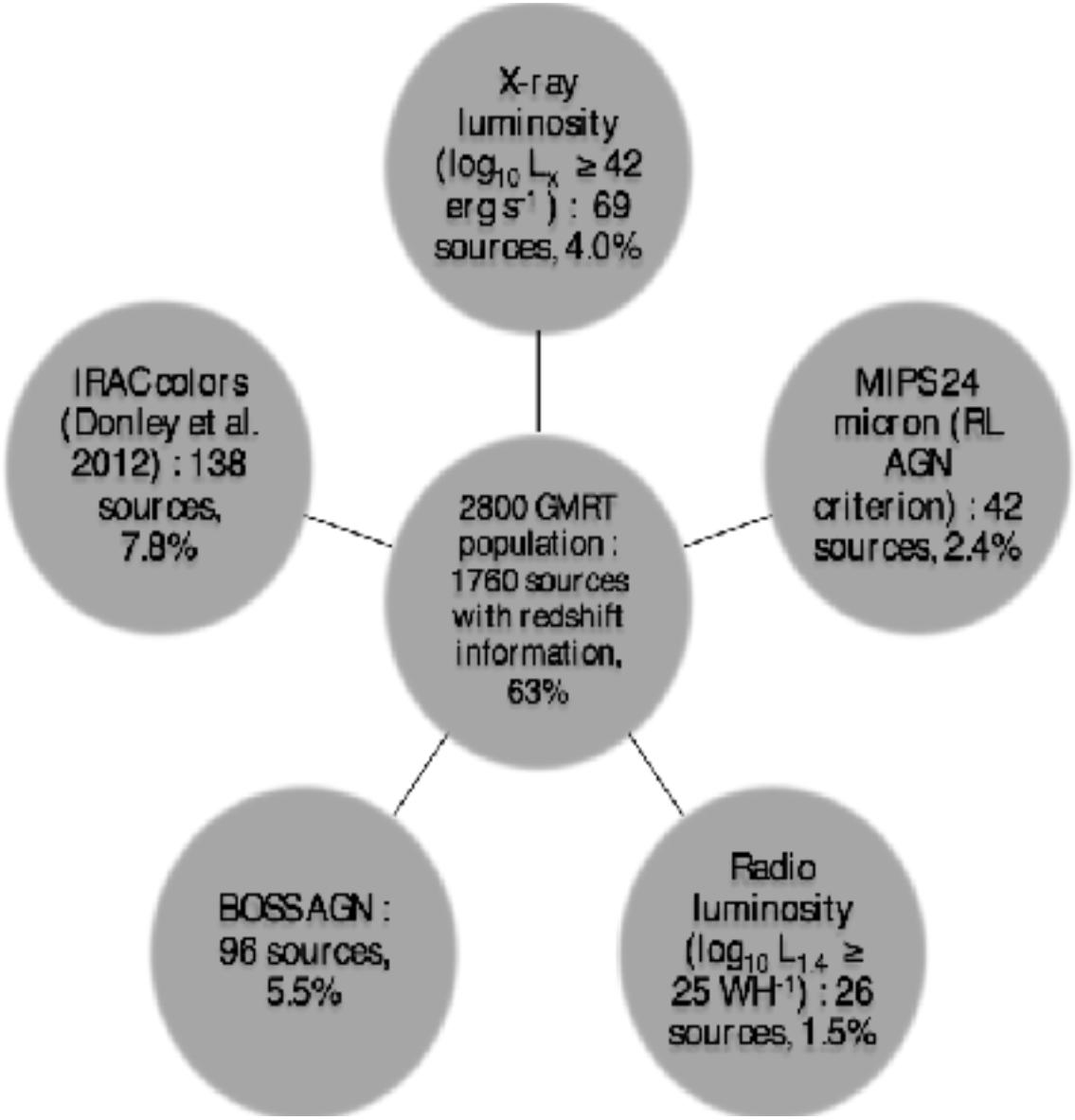
GMRT 610 MHz observations of EN1

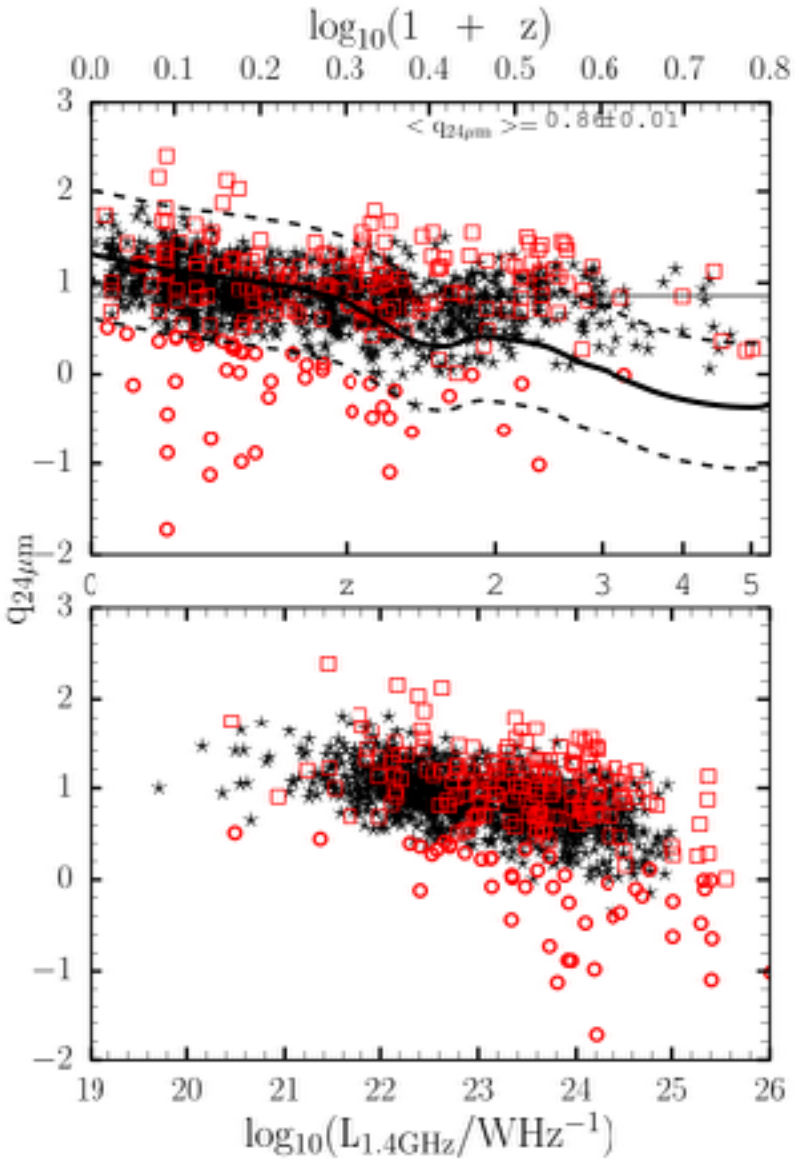


AGN DIAGNOSTICS



Catalogue	Size	Fraction%
GMRT	2800	100%
SERVS band 1 or 2	2369	85%
SERVS band 1 and 2	2234	80%
SWIRE all bands	1091	39%
MIPS 24μm	1672	60%
X-RAY	92	3.3%
MRR13-PHOTZ	1456	52%
MRR13-FIR-LUM	1279	46%
SPECZ	817	29%
REDSHIFTS	1760	63%

Mid Infrared – Radio Flux Ratio

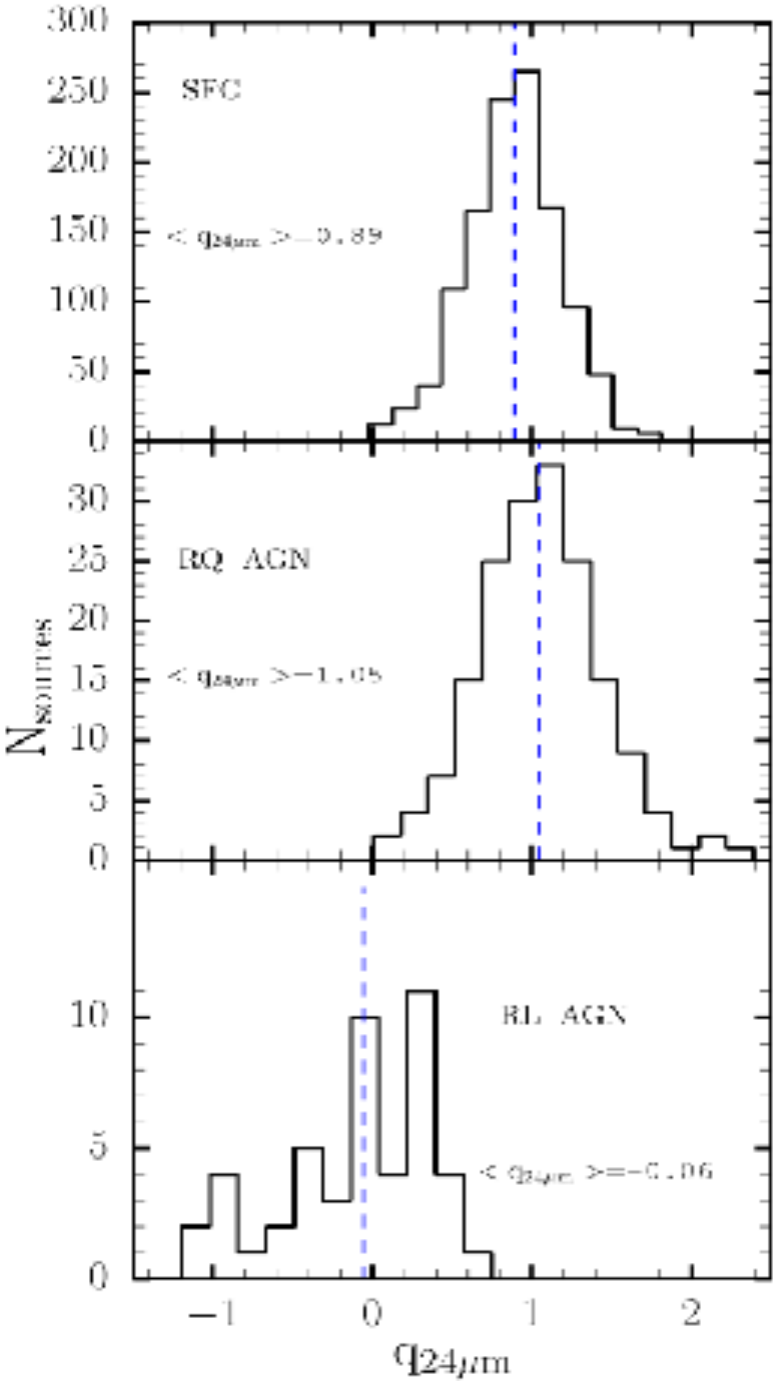


- ✓ $q_{24\ \mu m} = \log_{10}(S_{24\mu m} / S_{1.4\ GHz})$
- ✓ We measure a median $q_{24\mu m}$ value of 1.10 ± 0.02 for sources with redshifts within the same range as studied by Sargeant et al, 2010 .
- ✓ For our full sample with redshifts we measure a median $q_{24\mu m}$= 0.86 ± 0.01 at a median redshift of ≈ 0.71.

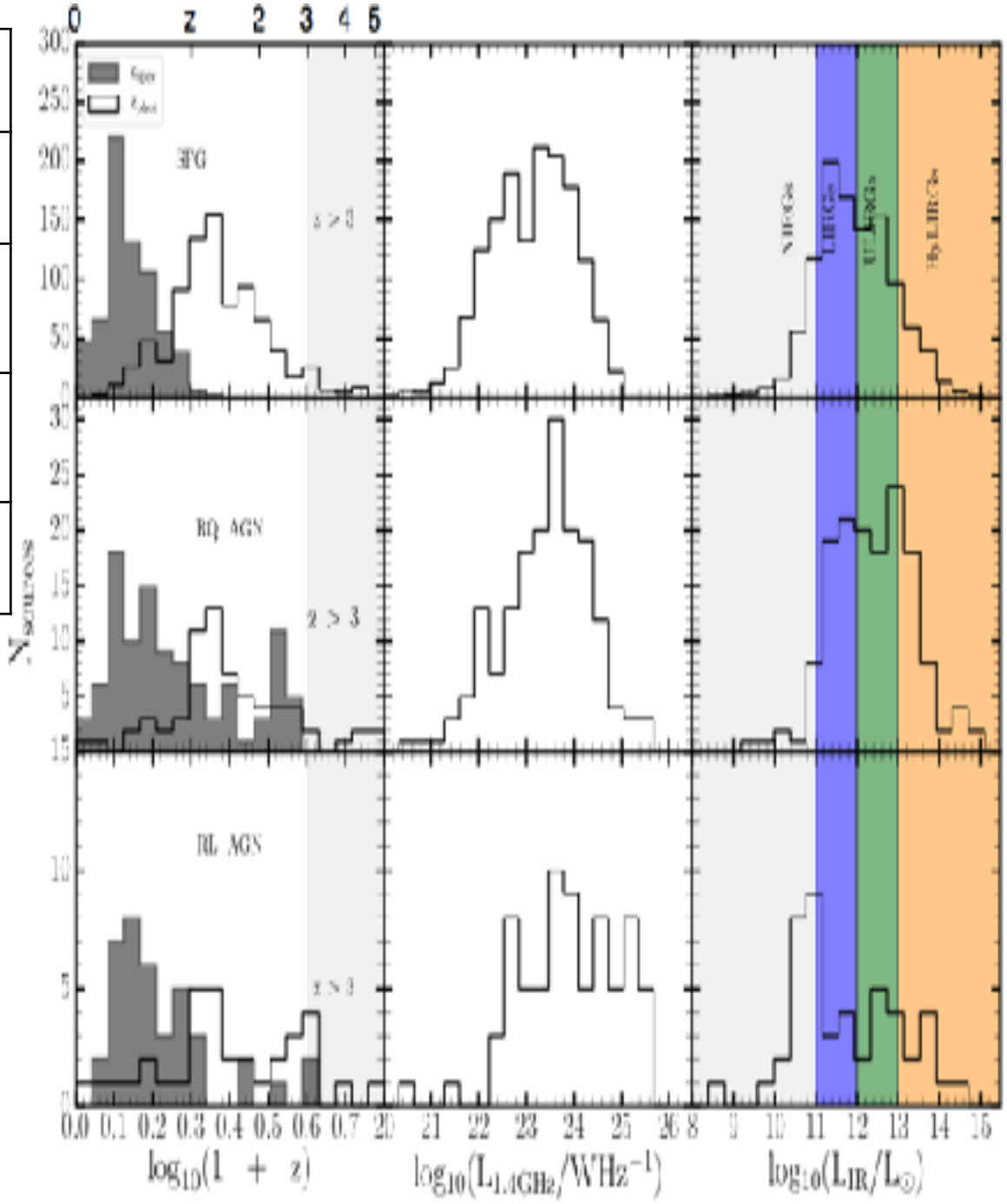
Class	Number	Fraction %
SFG	1513	86
RQ AGN	173	10
RL AGN	74	4

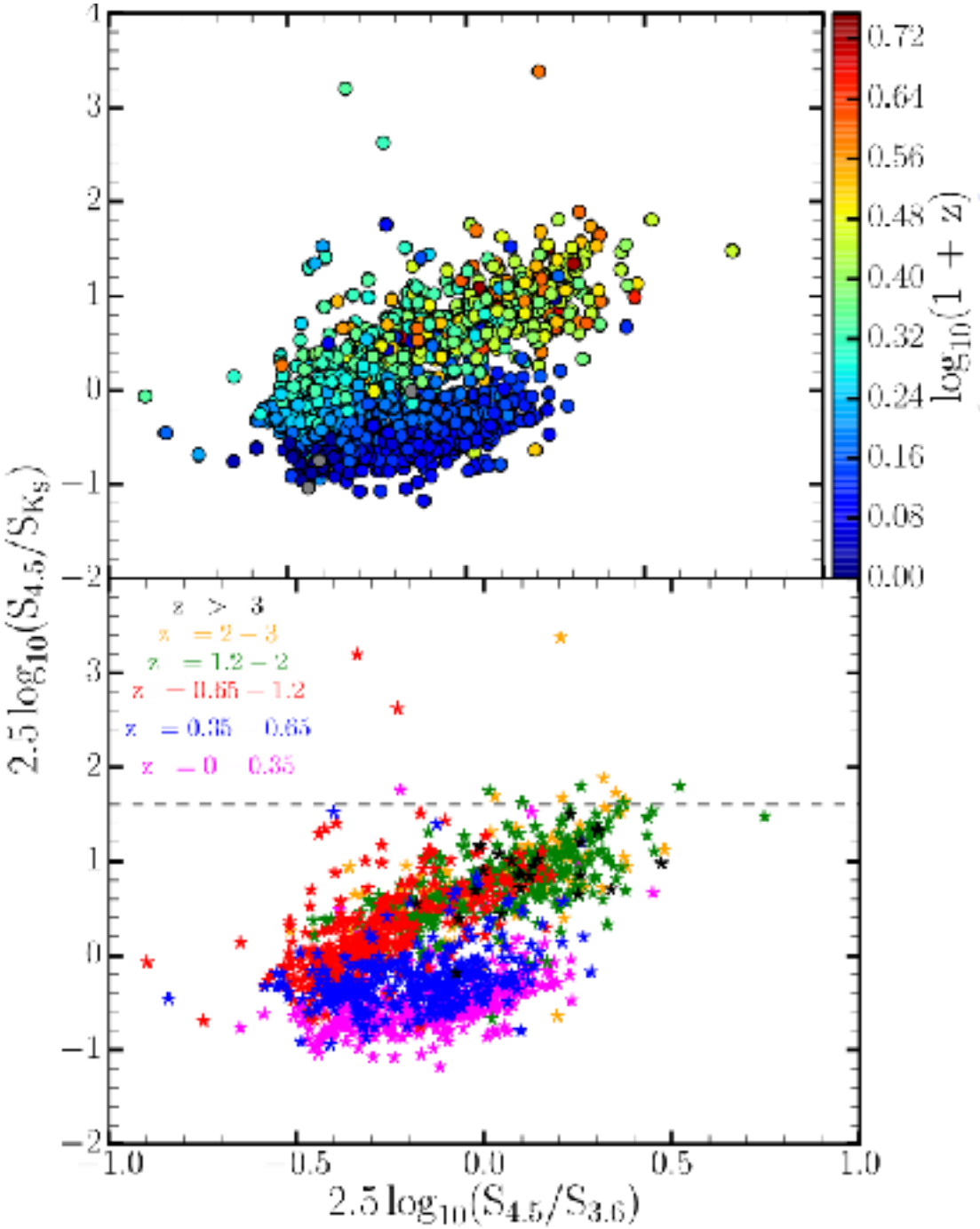
Properties of Classified Sources

Indicator	Radio luminosity	X-ray	BOSS AGN	IRAC colors	MIPS 24 μm
Radio luminosity	26	_	_	_	_
X-ray	1	69	_	_	_
BOSS AGN	2	26	96	_	_
IRAC colors	6	35	45	138	_
MIPS 24 μm	5	5	5	2	42



$L_{IR}/L_{\odot}$ range	Type	SFG#	RQ AGN#	RL AGN #
$\log_{10}(L_{IR}/L_{\odot})<11$	NIRGs	149	11	16
$11\leq\log_{10}(L_{IR}/L_{\odot})<12$	LIRGs	439	45	13
$12\leq\log_{10}(L_{IR}/L_{\odot})<13$	ULIRGs	339	48	8
$\log_{10}(L_{IR}/L_{\odot})\geq13$	HyLIRGs	155	45	10

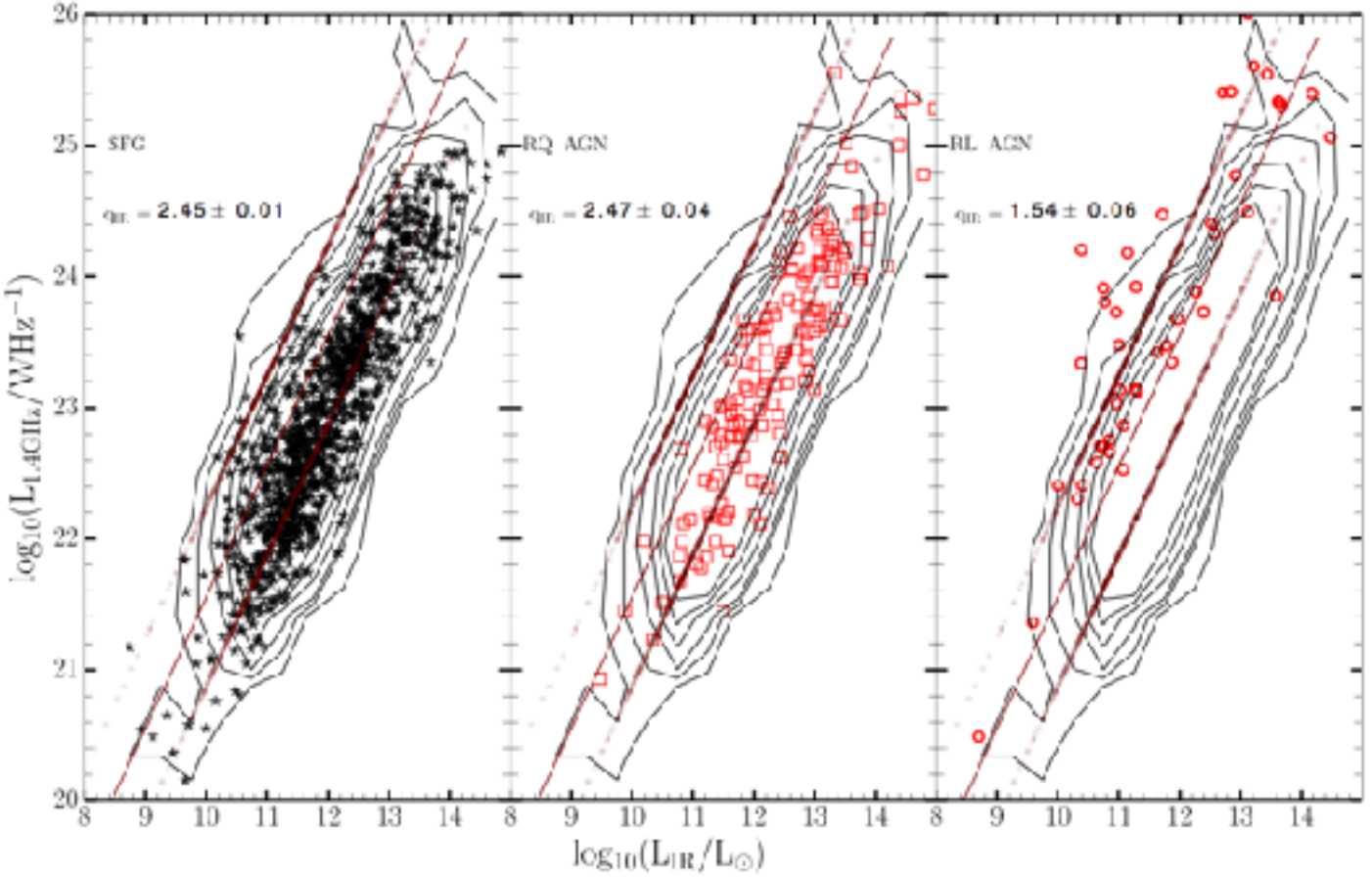




Star-forming galaxies at high redshift

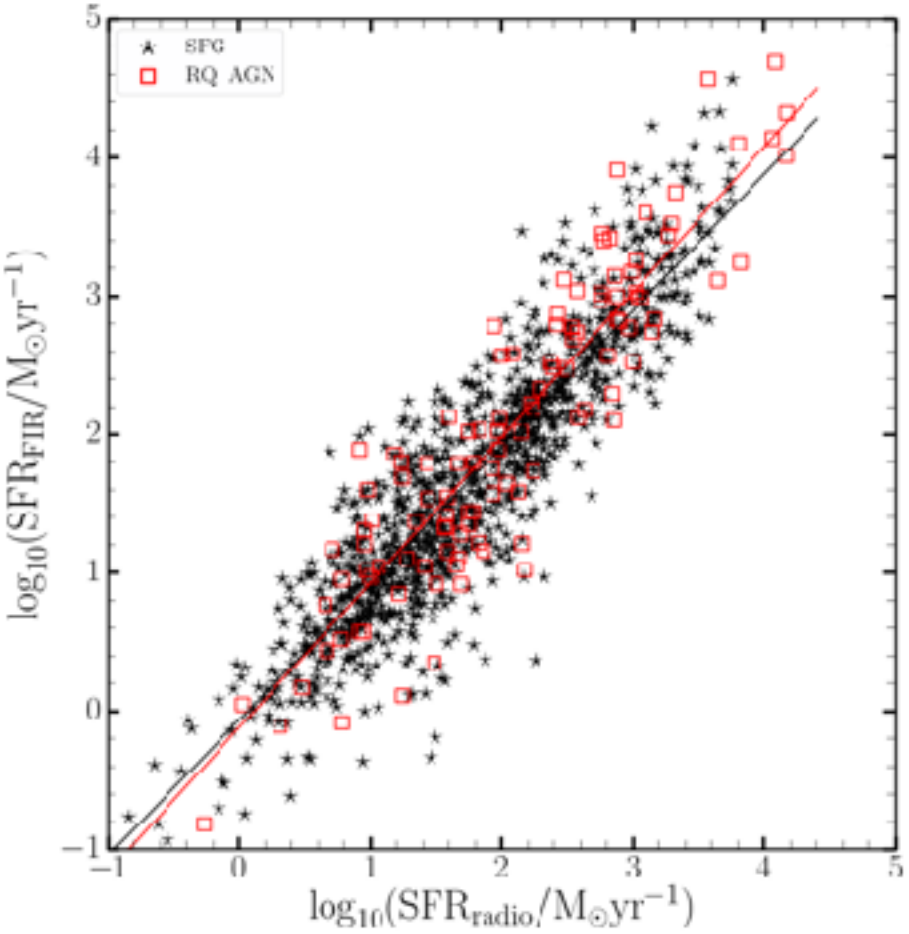
- Wang et al, 2012, presented a new color selection of extremely red objects (EROs) (i.e. most extreme dust-hidden high-redshift galaxies) with K_S and IRAC colors of K_S - 4.5μm > 1.6.
- This selection aims at galaxies at z > 2 whose extremely red colors are likely caused by large dust extinction, unlike some other selections for high-redshift red objects.

The Far-Infrared Radio Correlation



$$q_{\mathrm{IR}} = \log_{10}\left(\frac{L_{\mathrm{IR}}}{3.75\times10^{12}\,\mathrm{W}}\right) - \log_{10}\left(\frac{L_{1.4\,\mathrm{GHz}}}{\mathrm{W\,Hz^{-1}}}\right)$$

Radio Emission in SFG and RQ AGN



- ✓ Empirical conversion between the radio power at 1.4 GHz and the SFR of the galaxy from Murphy et al, 2011 is : SFR_{radio} [$M_\odot$ yr^{-1}] = $\log_{10}(L_{1.4\ GHz})$ - 21.20
- ✓ $\log_{10}(SFR_{FIR})_{ALL}$ = 0.95±0.02×log10(SFR_{radio})$_{ALL}$ - 0.02±0.03
- ✓ $\log_{10}(SFR_{FIR})_{SFG}$ = 0.98±0.02×log10(SFR_{radio})$_{SFG}$ - 0.07±0.03
- ✓ $\log_{10}(SFR_{FIR})_{RQ\ AGN}$ = 1.04±0.05×log10(SFR_{radio})$_{RQ\ AGN}$ - 0.12±0.11

Conclusion

- ✓ We have explored different AGN indicators from the radio, mid-infrared, optical and X-ray.
- ✓ We reaffirm that the ratio between the mid-infrared and radio flux parameterized by the $q_{24\mu m}$ value, demonstrated in Bonzini et al., 2013, is an important parameter to identify RL AGNs
- ✓ Our scheme expands on the one adopted by Bonzini et al., 2013 and combines radio, mid-infrared, optical and X-ray data to efficiently separate the radio source population with redshift associations into three classes: SFGs, RQ AGNs and RL AGNs.
- ✓ We have determined the relative contribution of the three classes of sources to the subsample with redshifts and we find that 86% are SFGs, 10% are RQ AGNs and 4% are RL AGNs.