



International  
Centre for  
Radio  
Astronomy  
Research



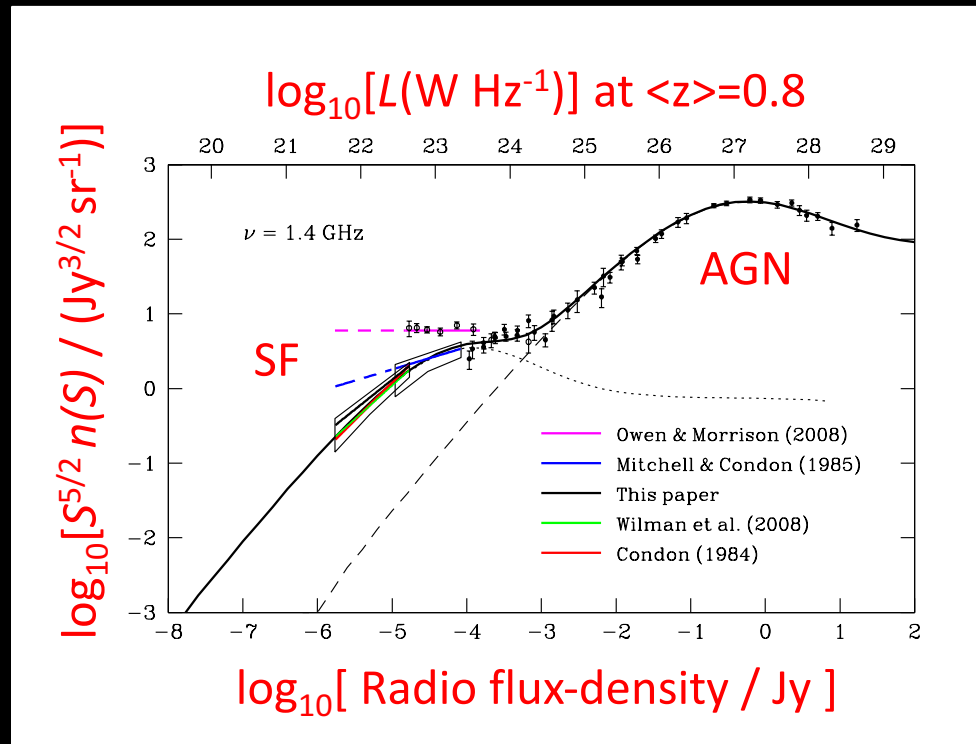
# Accretion and Star Formation in Radio-Quiet Quasars

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Martin Hardcastle, Aprajita Verma,  
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## Brightness-weighted number counts

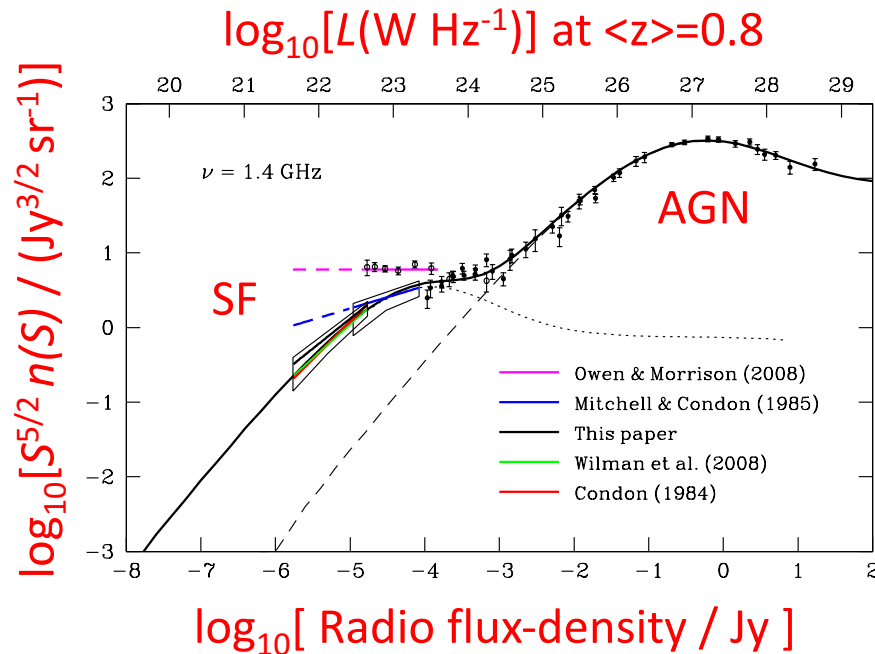


Condon et al. (2012)

All radio sources,  $\langle z \rangle = 0.8$

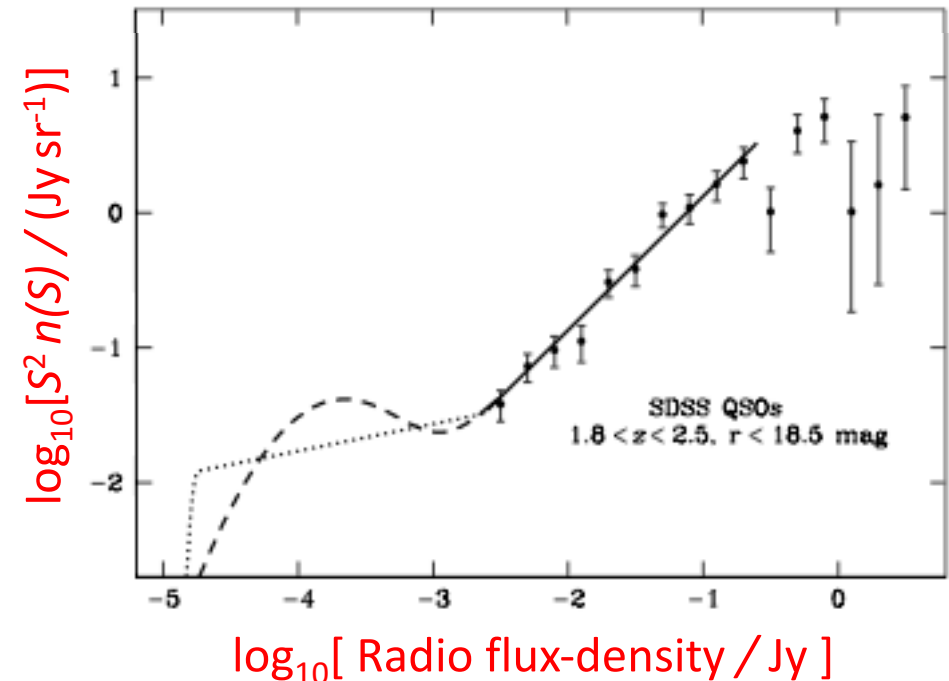
# Does SF dominate the radio emission in RQQs?

Brightness-weighted number counts



Condon et al. (2012)

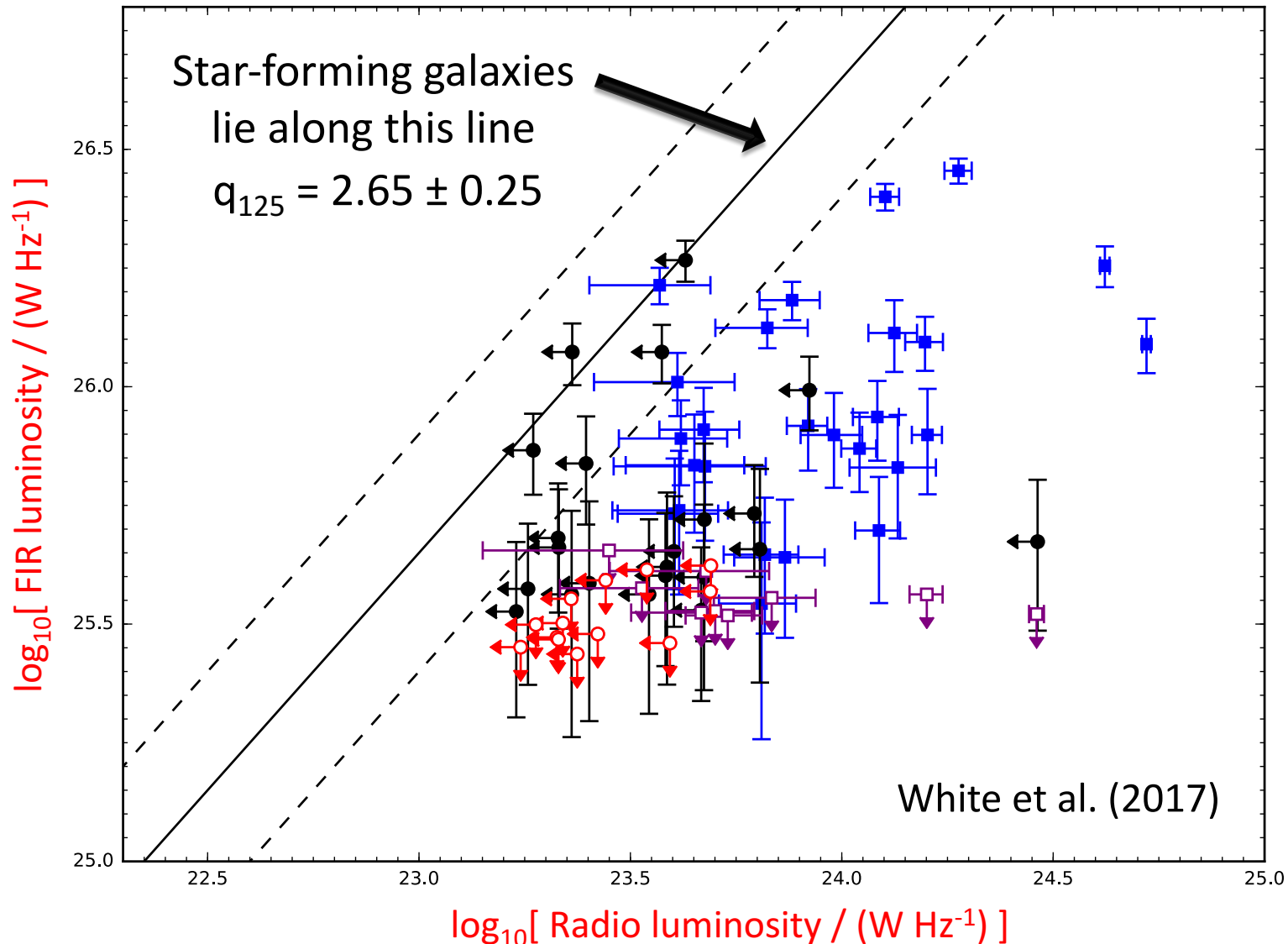
All radio sources,  $\langle z \rangle = 0.8$



Condon et al. (2013)

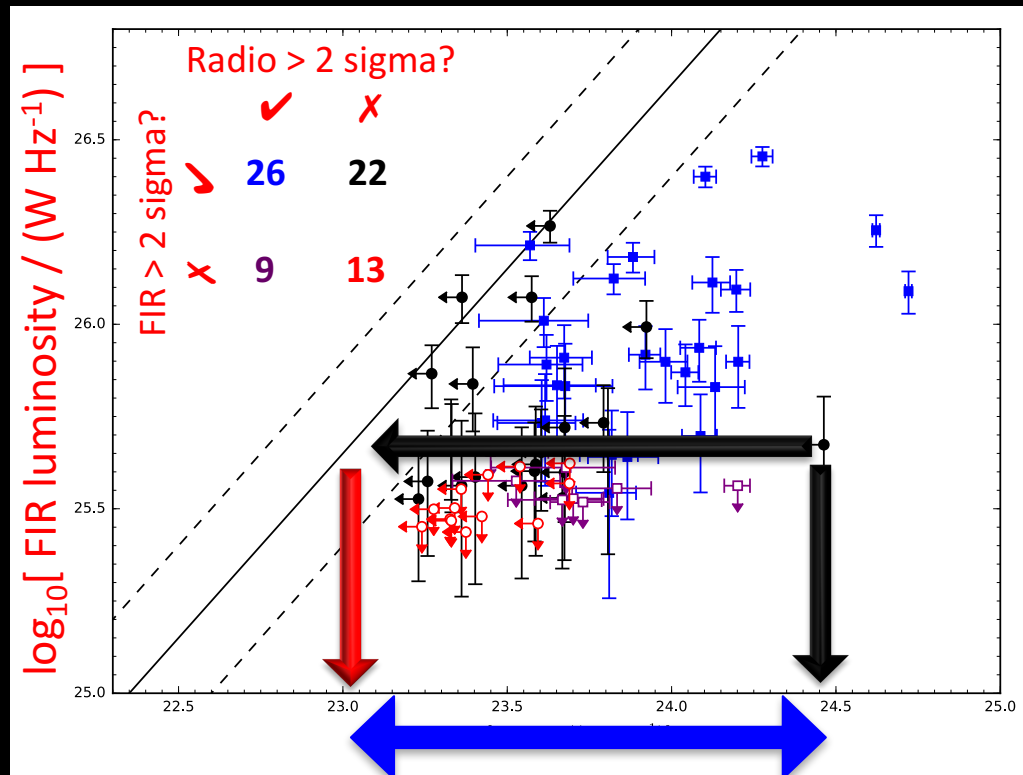
Optically-selected quasars,  $1.8 < z < 2.5$

# Exploiting the Far-Infrared to Radio Correlation



# The accretion-related radio emission

White et al. (2017)

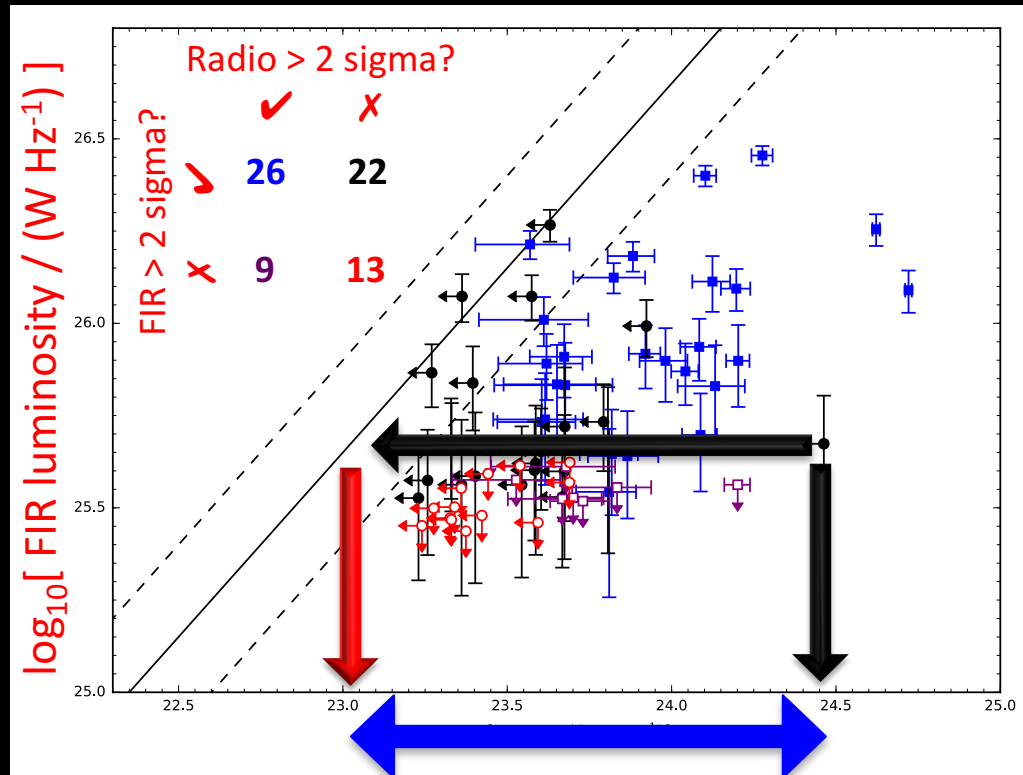


Star-formation  
radio luminosity

Accretion  
radio luminosity

# The accretion-related radio emission

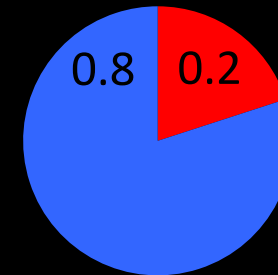
White et al. (2017)



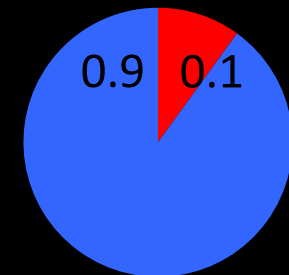
Star-formation  
radio luminosity

Accretion  
radio luminosity

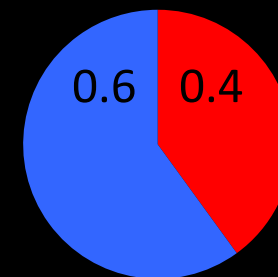
Radio-detection,  
FIR-detection



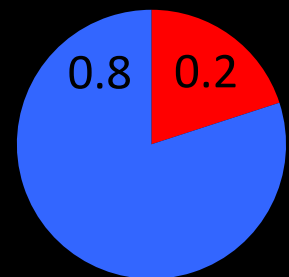
Radio-detection,  
FIR non-detection



Whole sample  
(lower limits)

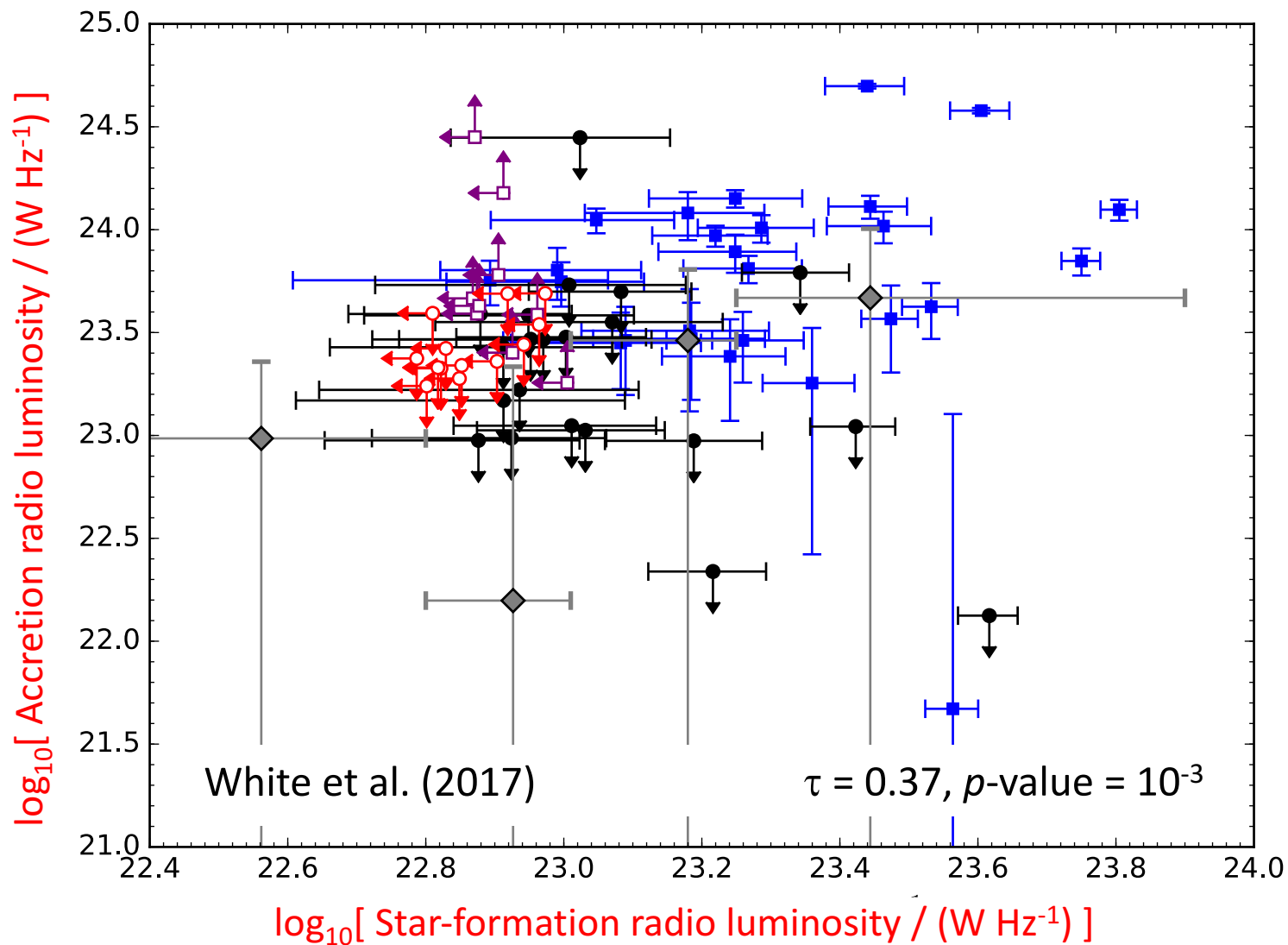


Whole sample  
(upper limits)



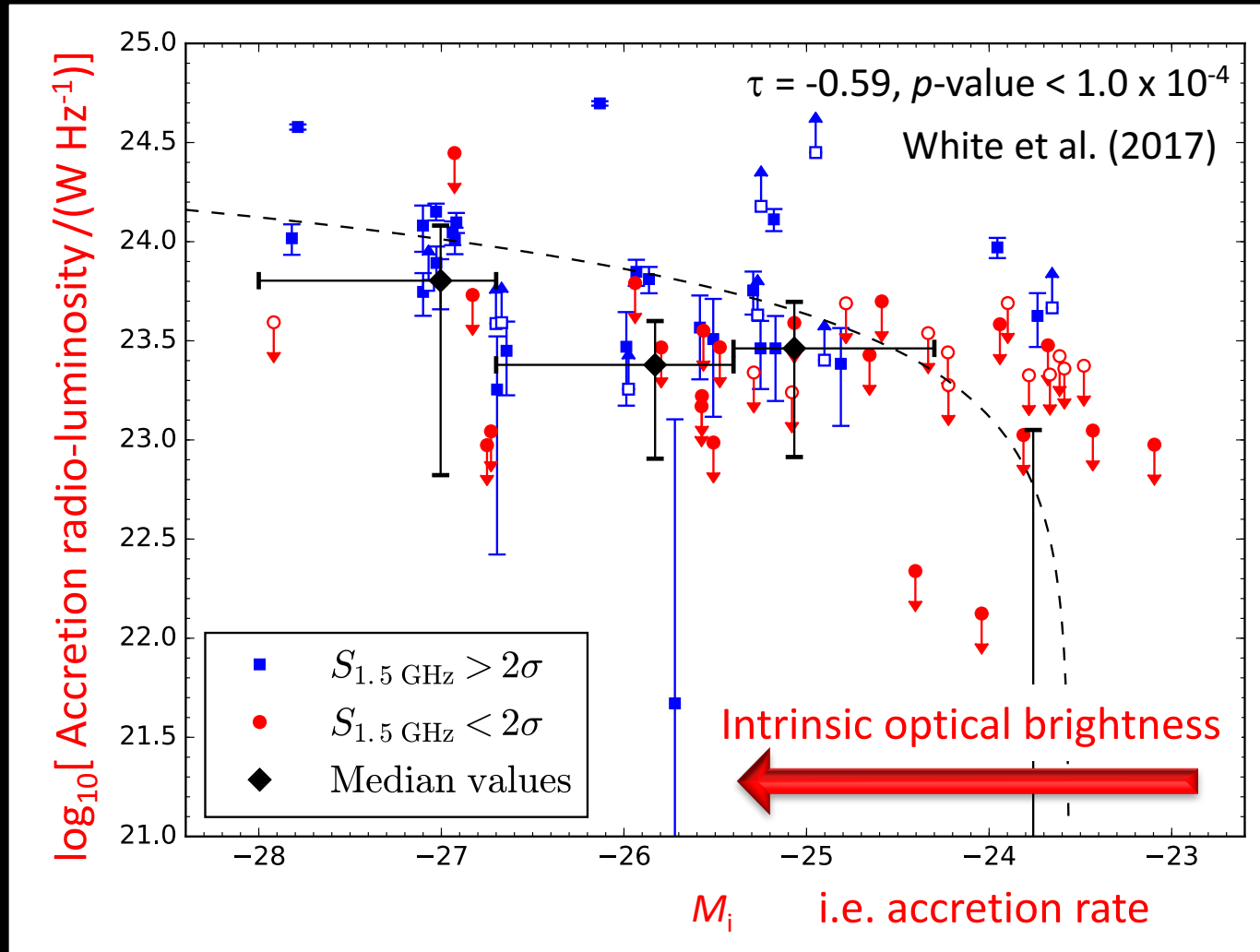
See also Wong et al. (2016)

# Accretion vs. star formation



# Accretion radio-emission vs. absolute magnitude

Kendall- $\tau$  test provides evidence of a correlation



Scatter due to magnetic fields, timescale, or environmental density?



# Summary

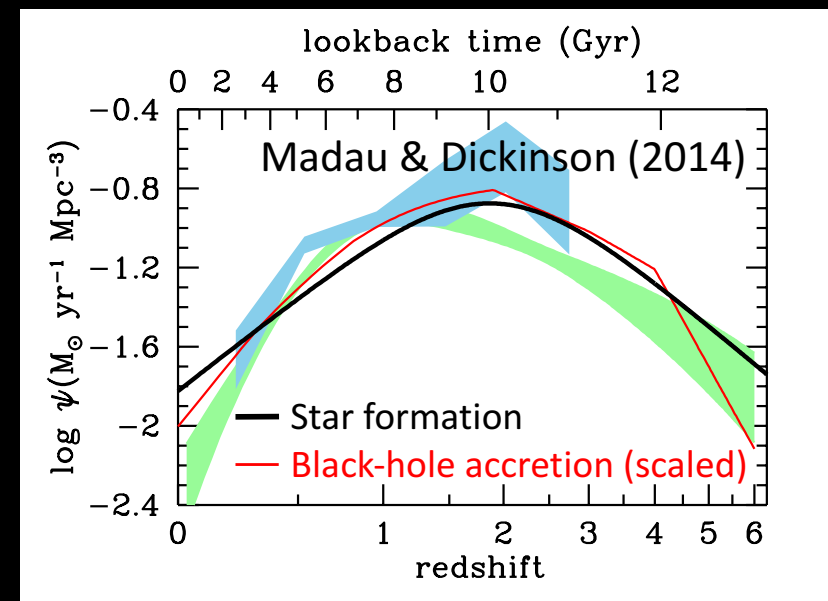
Radio observations – unbiased tracer of both accretion and star formation

FIR data from *Herschel* + radio data from JVL A + FIR-to-radio correlation

-> separate radio emission from SF and that from the AGN

(White et al. 2017, arXiv:1702.00904)

**Black-hole accretion dominates the faint radio emission of ‘radio-quiet’ quasars** -> History of star formation may be over-estimated, whilst accretion may be under-estimated



Statistical evidence of correlation between accretion-related radio emission and optical luminosity (proxy for accretion rate)