High Redshift 3CR Sources: Spitzer Mid-infrared SEDs

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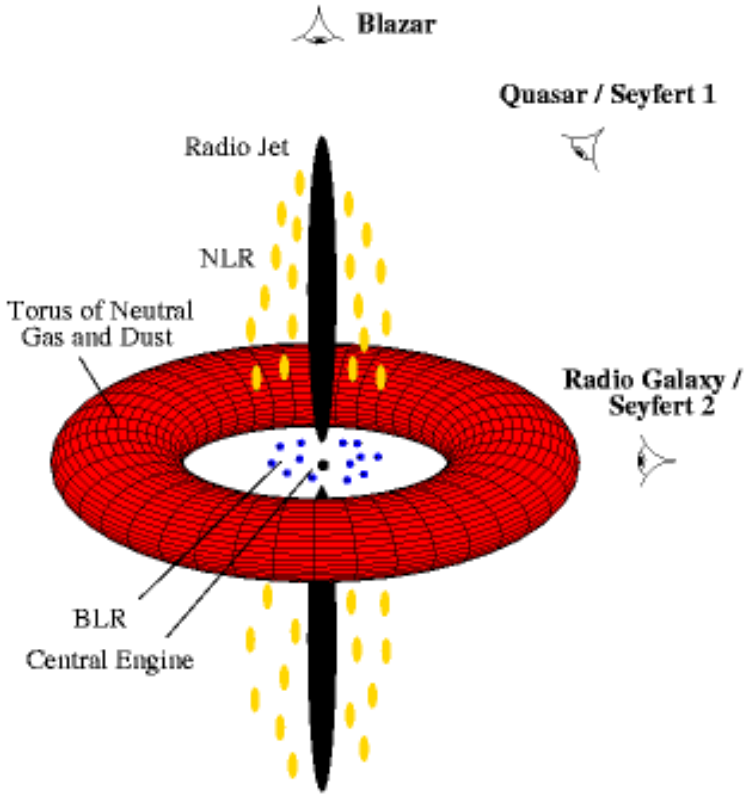
Related posters:

- Christian Leipski: Spitzer Mid-infrared Spectra
- Belinda Wilkes: Chandra Observations
- Frank Heymann: Cluster Signatures around 3C 270.1 (z=1.5)

Unified Scheme

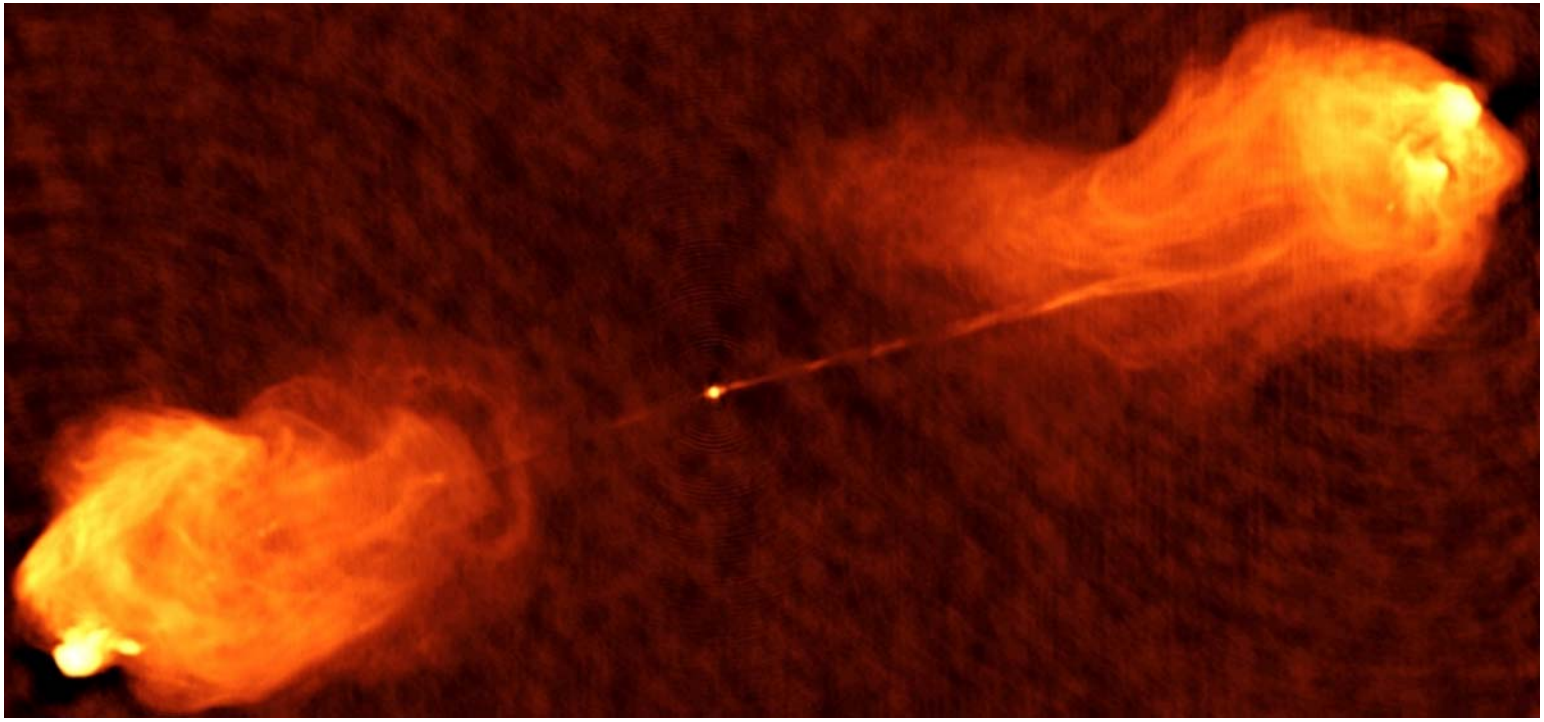


Jodrell Bank Observatory illustration

Posits that all AGN are alike except for luminosity and orientation

Need **orientation-independent** observable to select samples!

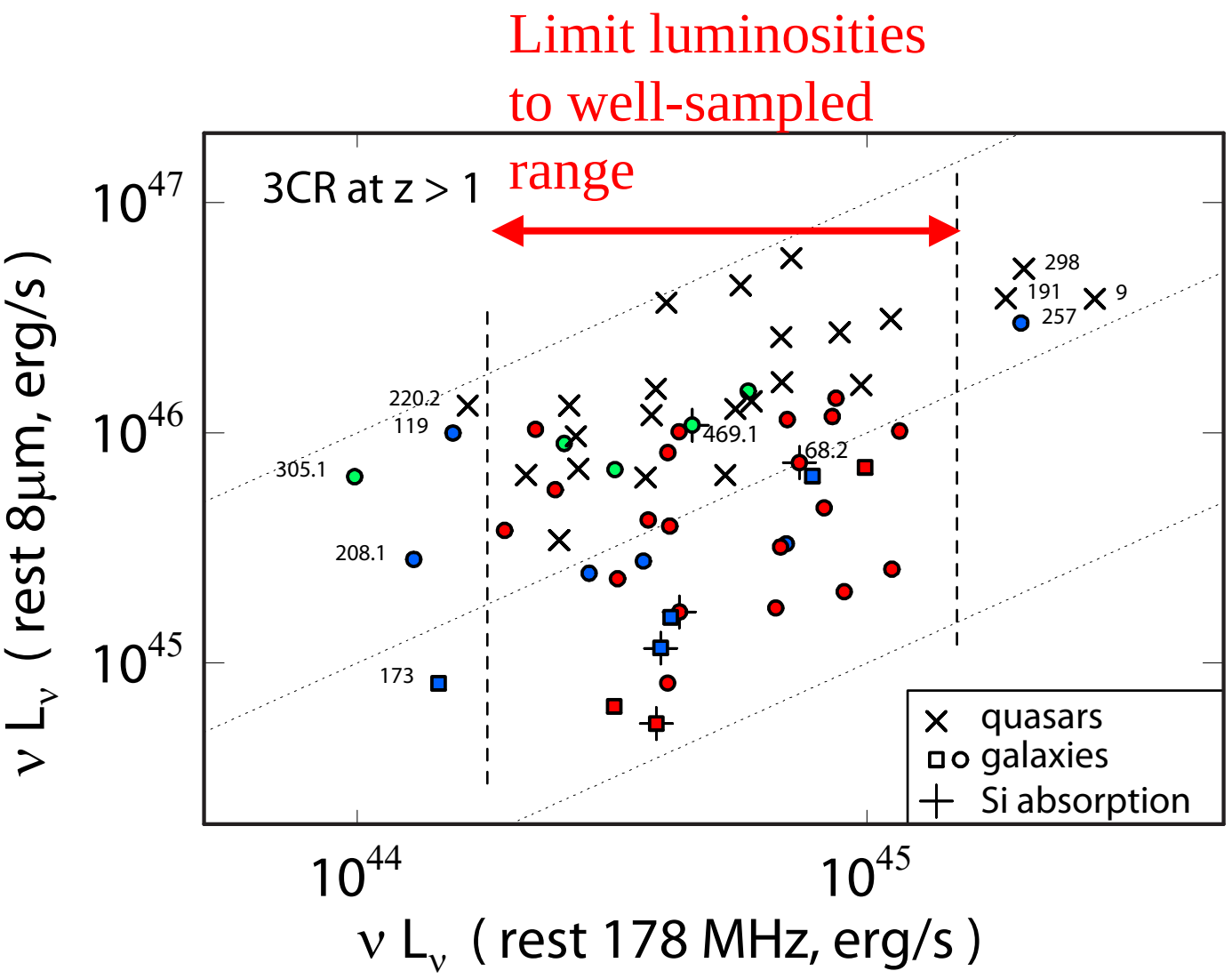
- Radio lobes emit almost isotropically - ideal for selecting samples
- Lobes are most prominent at low frequencies

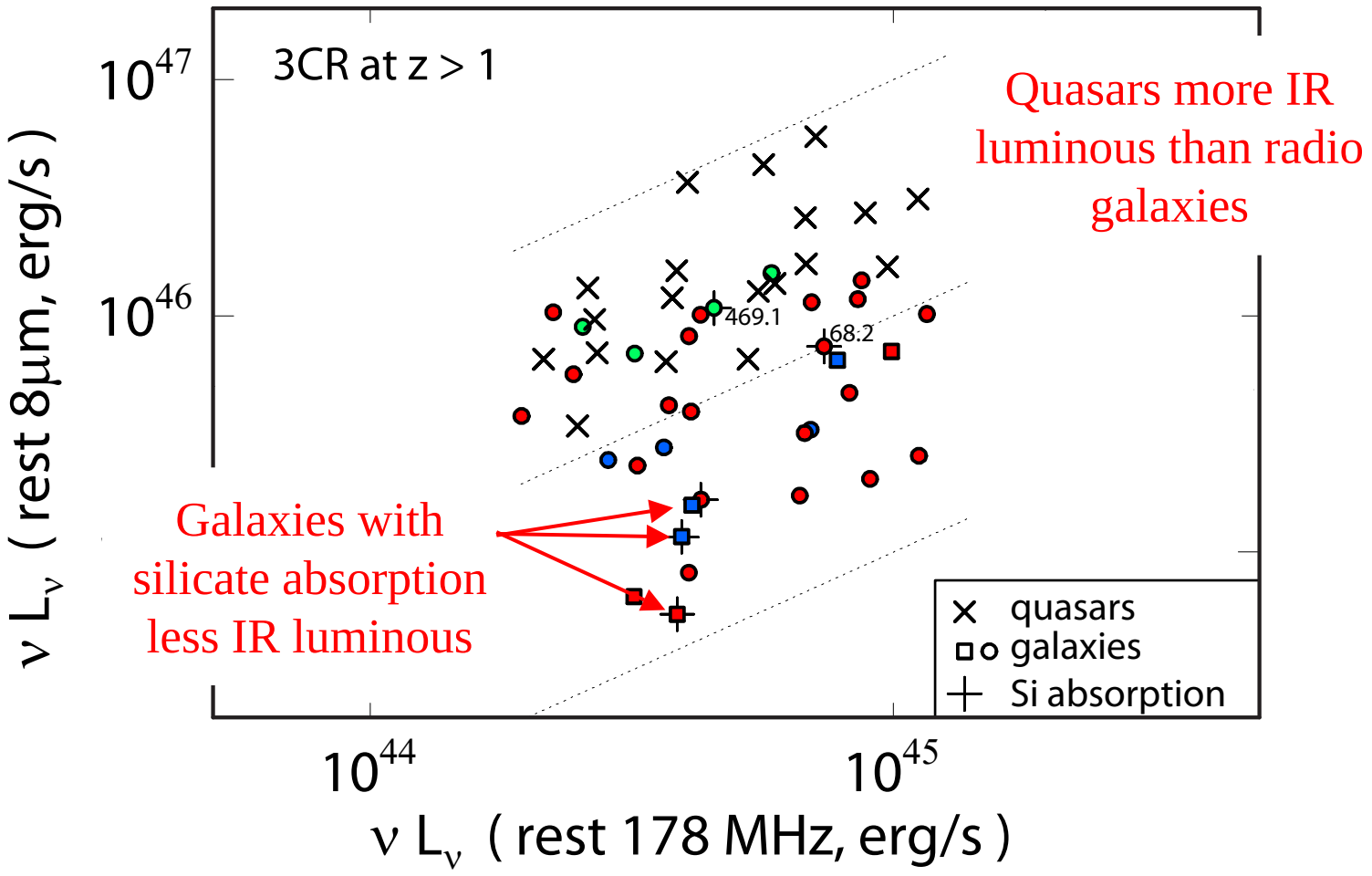


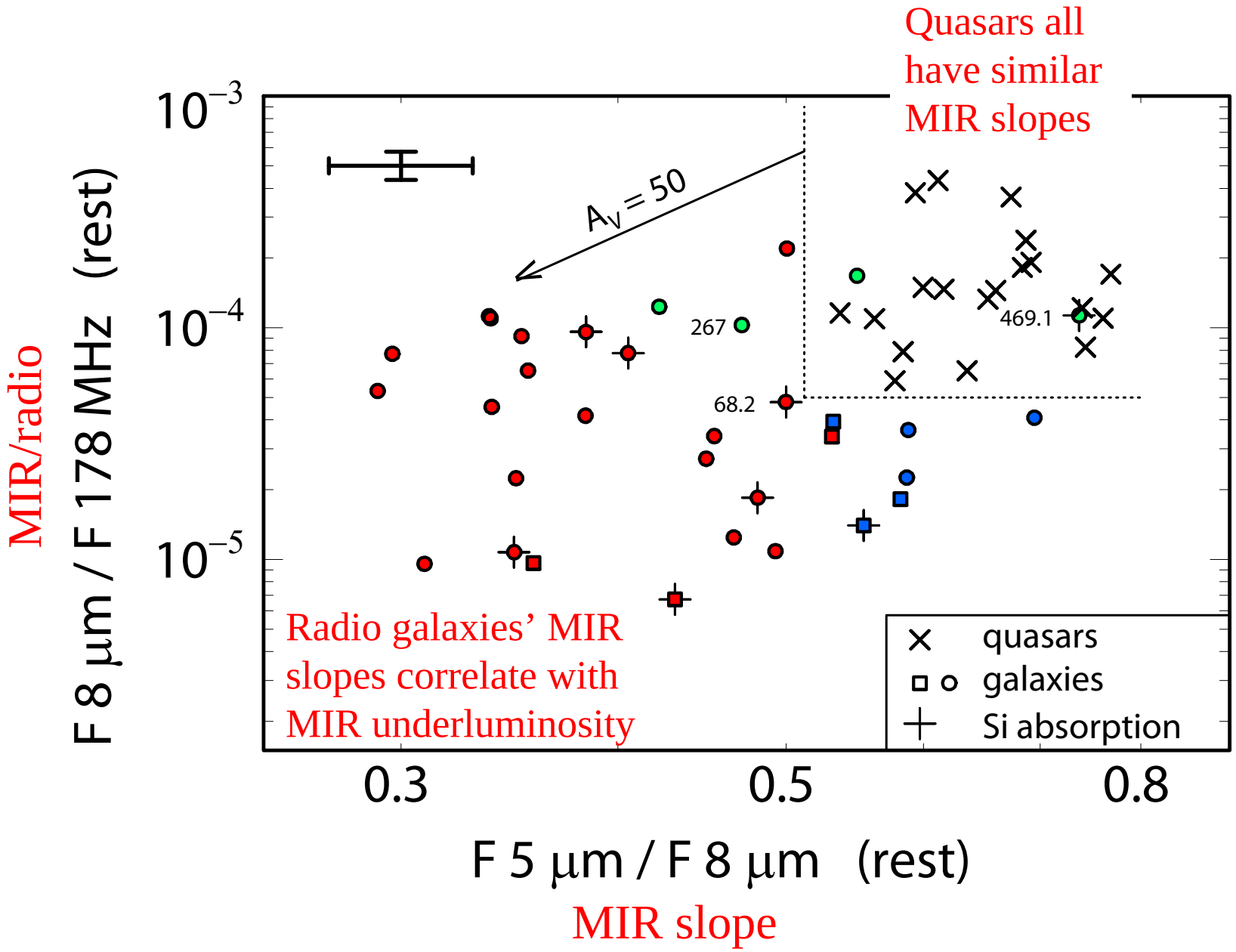
NRAO/AUI image, Cyg A @ 6 cm

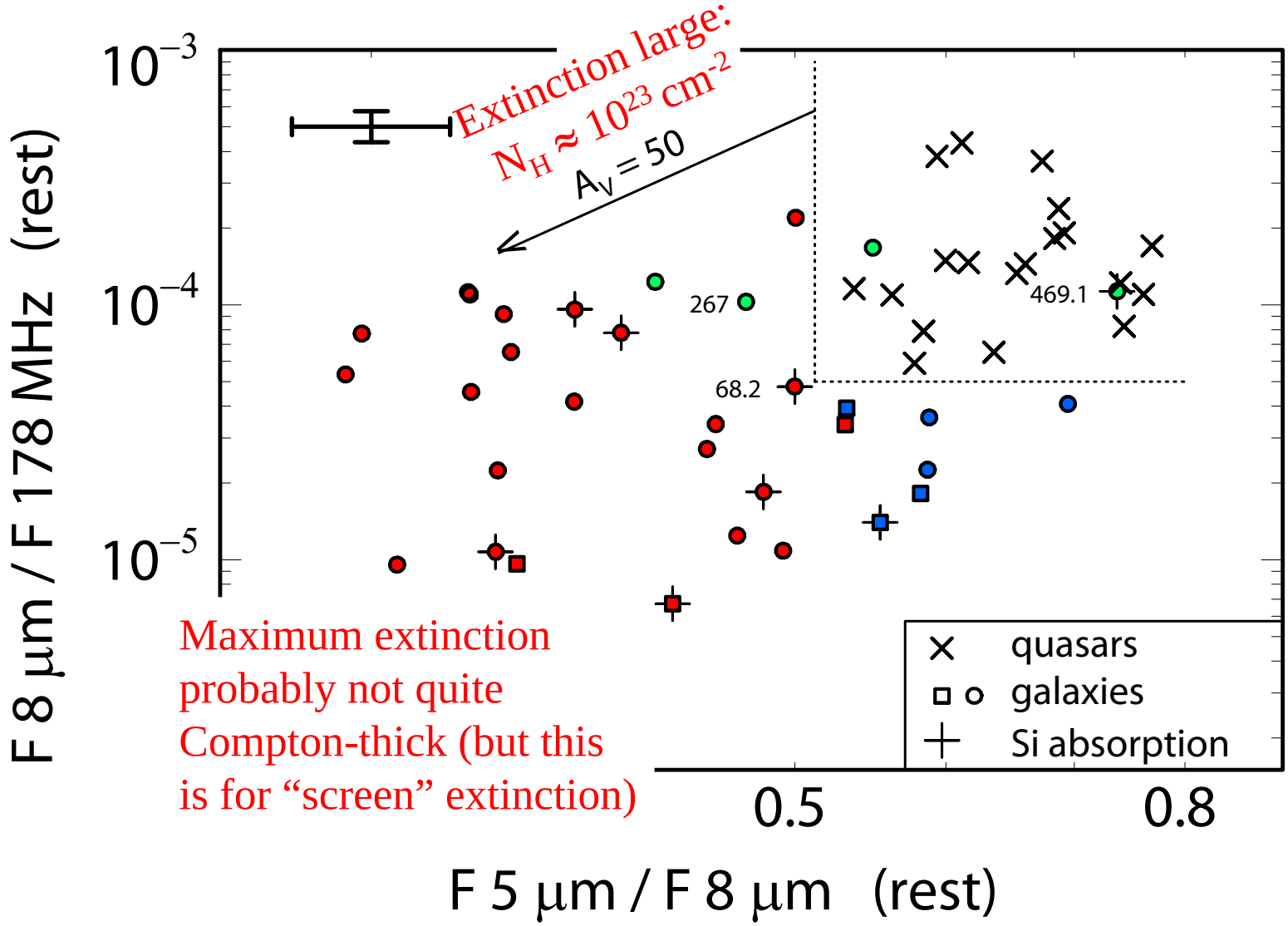
New Observations

- Select sample at 178 MHz (3CR)
- Limit to $1 < z < 2.5$, 64 sources
  - Spitzer 3.6, 4.5, 5.8, 8.0, 16, 24 μm photometry
  - 24 quasars, 38 radio galaxies observed so far
- Convert to rest-frame 1.6–10 μm flux densities

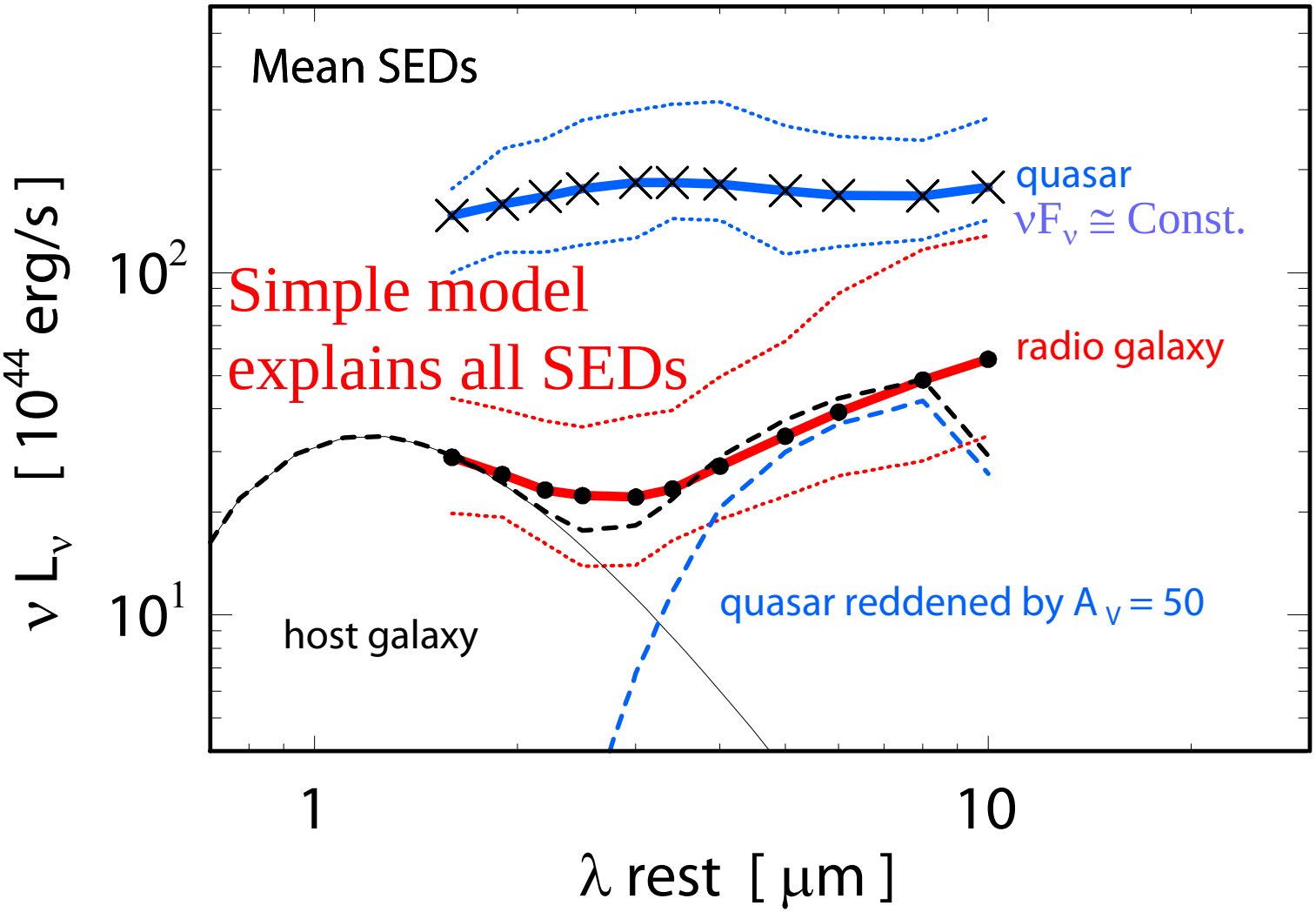

Limit luminosities
to well-sampled
range
3CR at z > 1
10^{47}
10^{46}
10^{45}
10^{44}
10^{45}
νL_ν (rest 8μm, erg/s)
νL_ν (rest 178 MHz, erg/s)
298
191
257
9
220.2
119
469.1
168.2
305.1
208.1
173
quasars
galaxies
Si absorption


3CR at z > 1
Quasars more IR luminous than radio galaxies
Galaxies with silicate absorption less IR luminous
469.1
468.2
quasars
galaxies
Si absorption
10^{47}
10^{46}
10^{44}
10^{45}
ν L$_ν$ (rest 8μm, erg/s)
ν L$_ν$ (rest 178 MHz, erg/s)

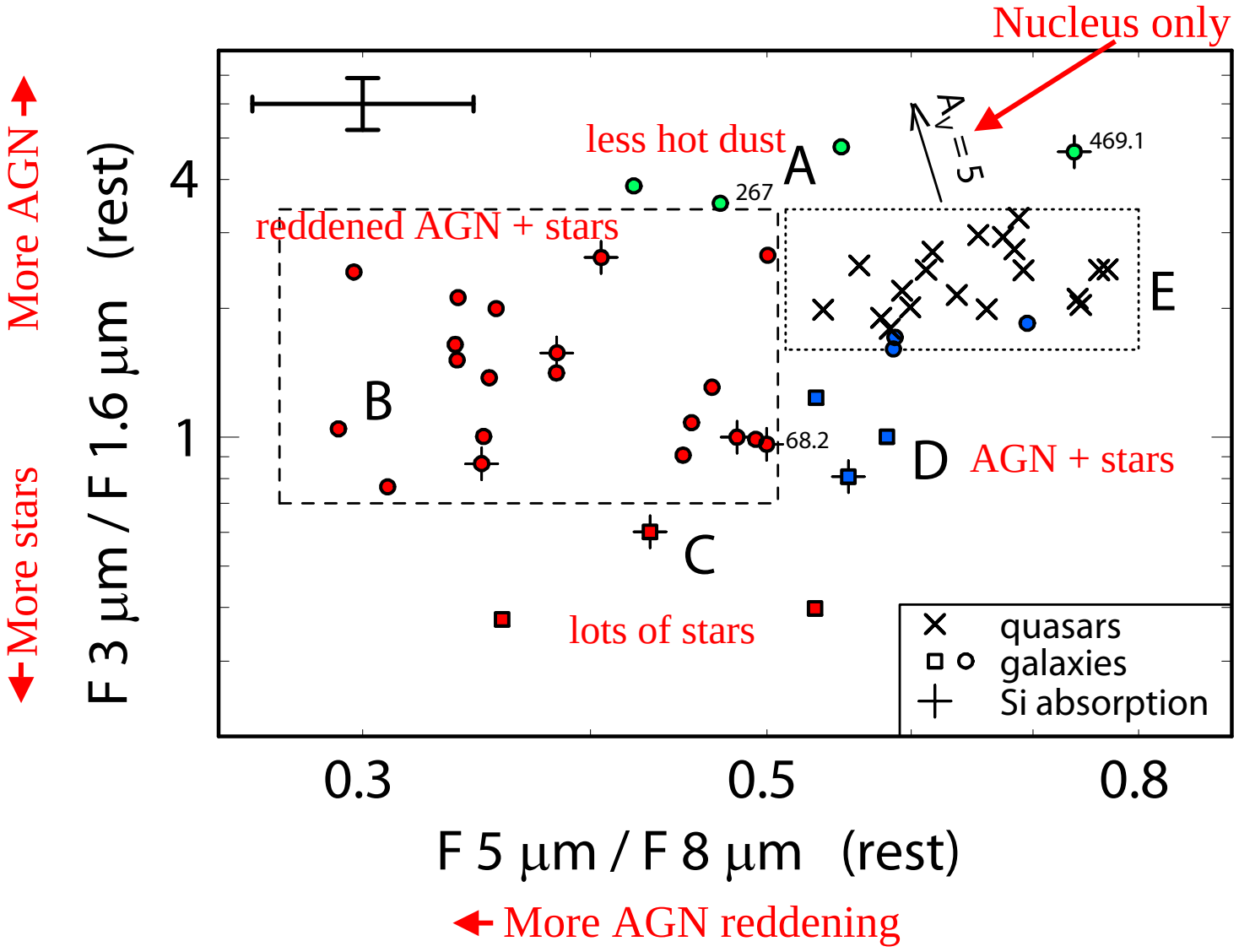

Quasars all have similar MIR slopes
MIR/radio
F 8 μm / F 178 MHz (rest)
10^{-3}
10^{-4}
10^{-5}
$A_V = 50$
267
469.1
68.2
Radio galaxies' MIR slopes correlate with MIR underluminosity
quasars
galaxies
Si absorption
0.3
0.5
0.8
F 5 μm / F 8 μm (rest)
MIR slope


Extinction large:
$N_H \approx 10^{23}$ cm^{-2}
$A_V = 50$
10^{-3}
10^{-4}
10^{-5}
F 8 μm / F 178 MHz (rest)
267
469.1
68.2
Maximum extinction probably not quite Compton-thick (but this is for "screen" extinction)
quasars
galaxies
Si absorption
0.5
0.8
F 5 μm / F 8 μm (rest)

More detailed look at SEDs

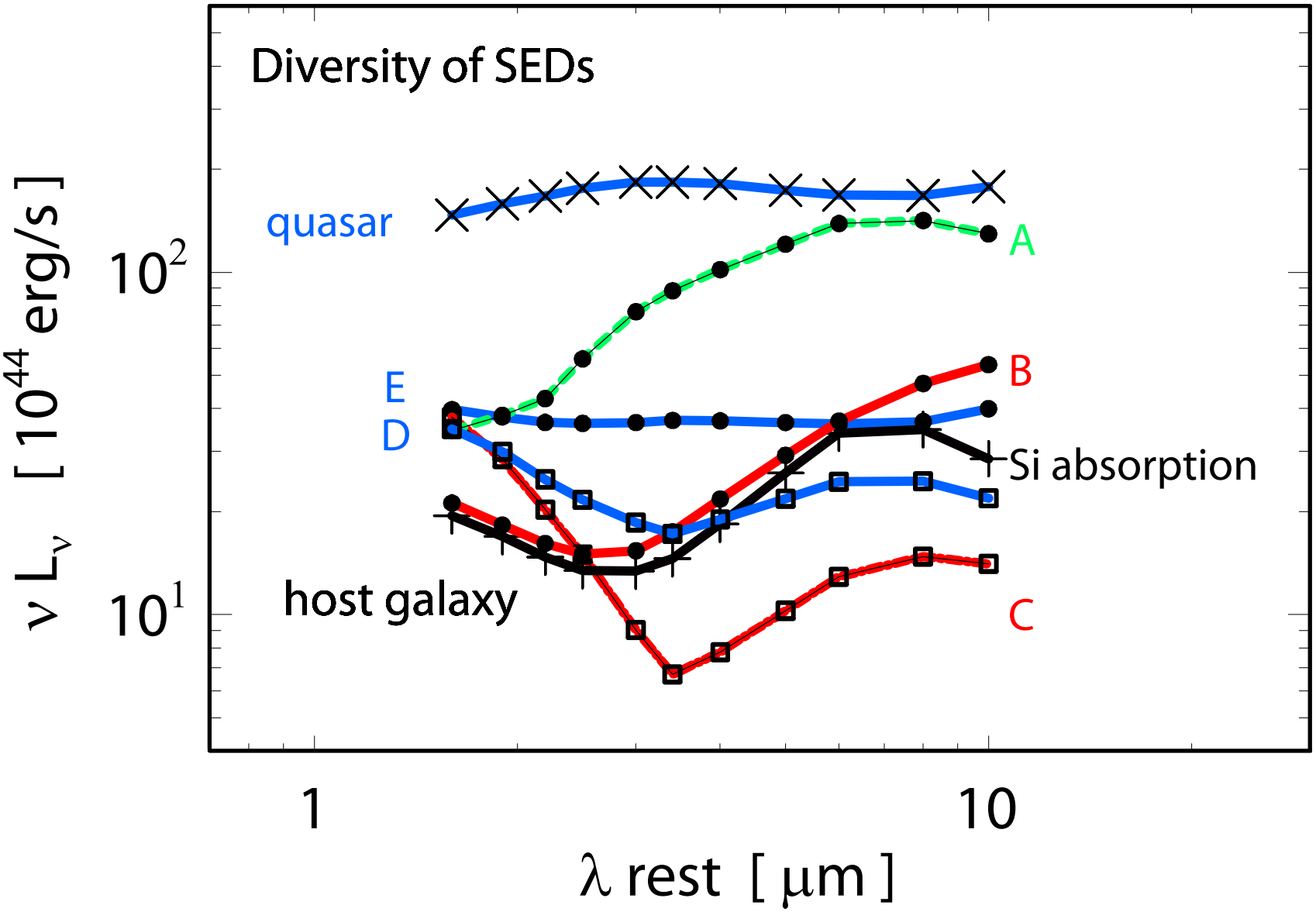


Starlight Contribution



Conclusions

- Rest 1.6–10-μm SEDs *consistent* with unification
  - Quasars (almost) all have similar SEDs
  - Radio galaxies look like reddened quasar plus host galaxy contribution
- Suggested extinctions imply $N_H \approx 10^{23}$ cm^{-2}.
- Because of extinction, MIPS 24-μm surveys biased in favor of Type 1 (unreddened) AGN


Diversity of SEDs
quasar
A
B
E
D
Si absorption
host galaxy
C
10^2
10^1
νL_ν [10^{44} erg/s]
1
10
λ rest [μm]