Infrared Excess sources: Compton Thick QSOs at z~2?

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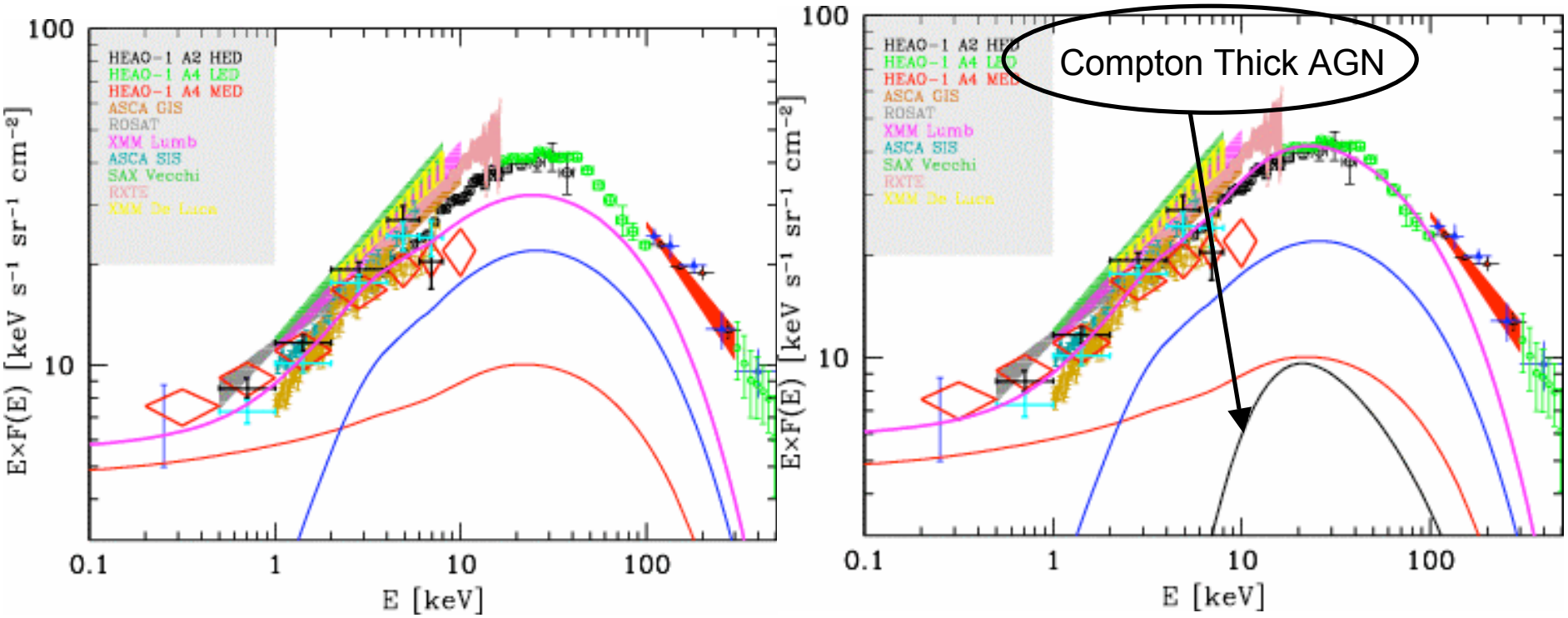
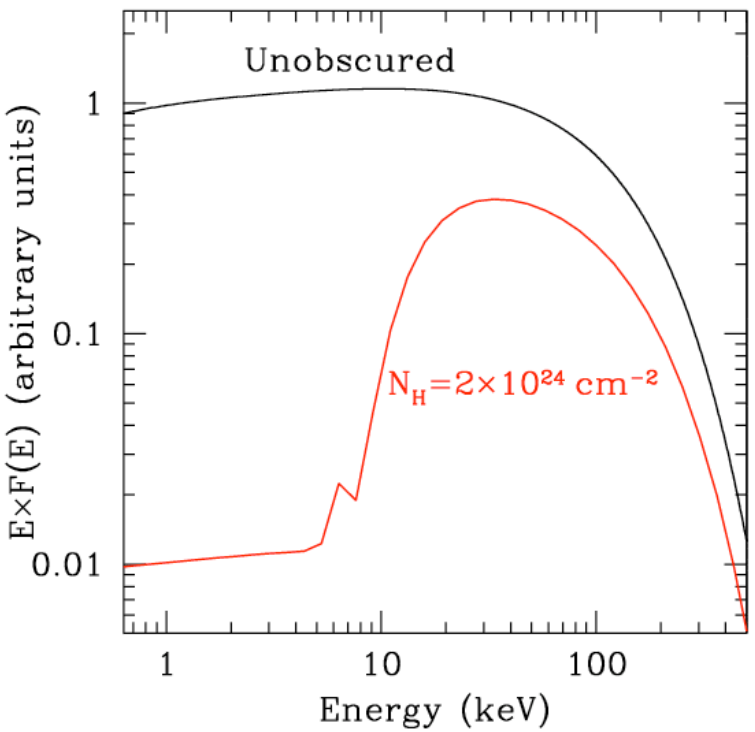
X-ray Background models

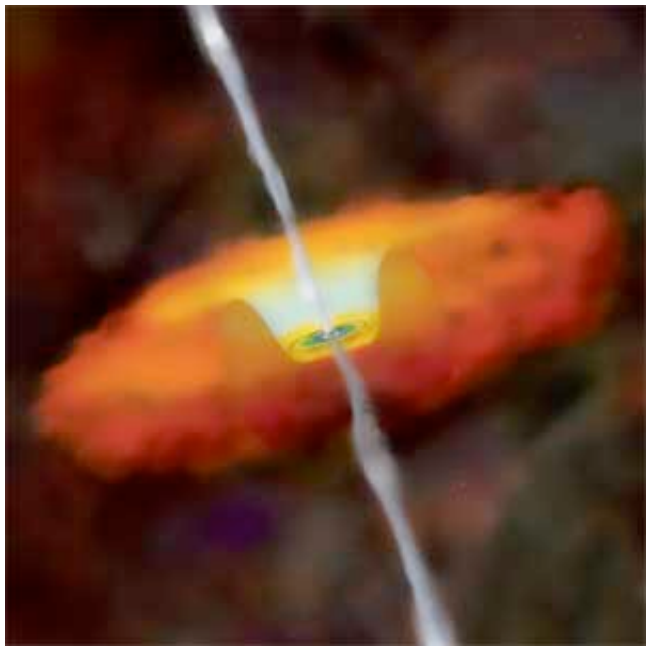


Compton Thick AGN (N_H>2×10^{24}cm^{-2}) required by models for the XRB

Finding Compton Thick AGN: X-ray vs mid-IR

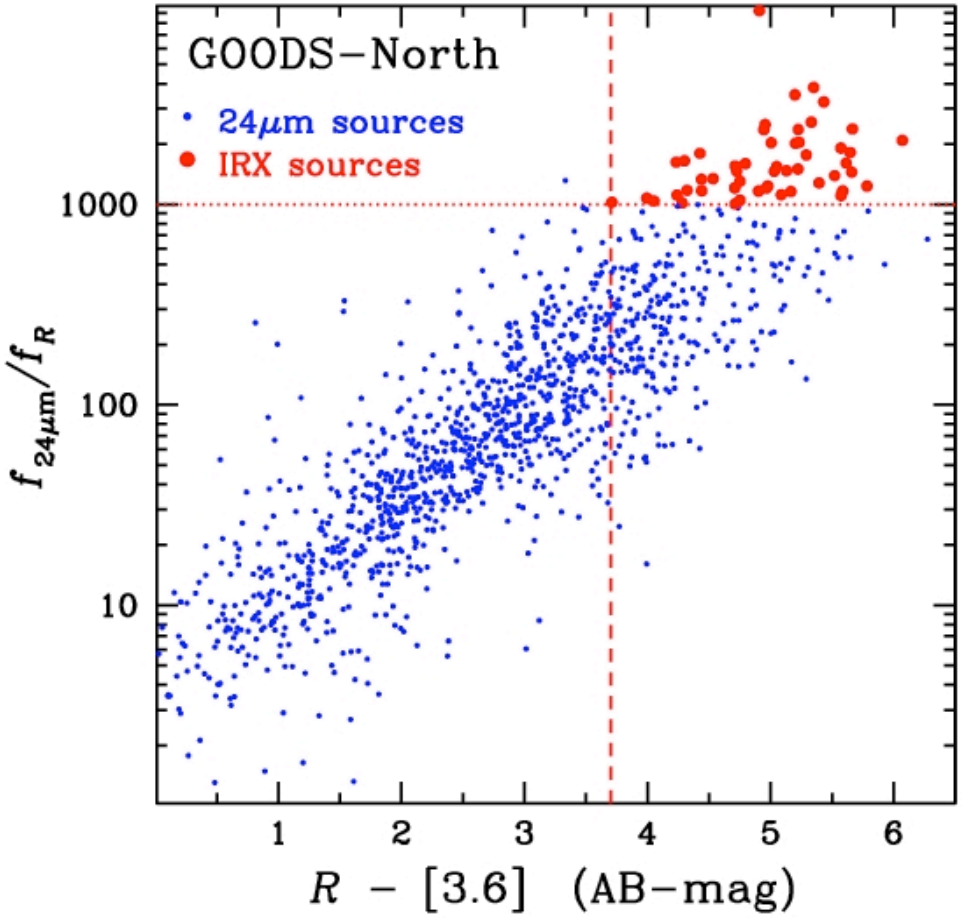


Hard to detect below ~10keV



mid-infrared (3-20μm): alternative wavelength regime for finding obscured AGN

Infra-Red EXcess source selection

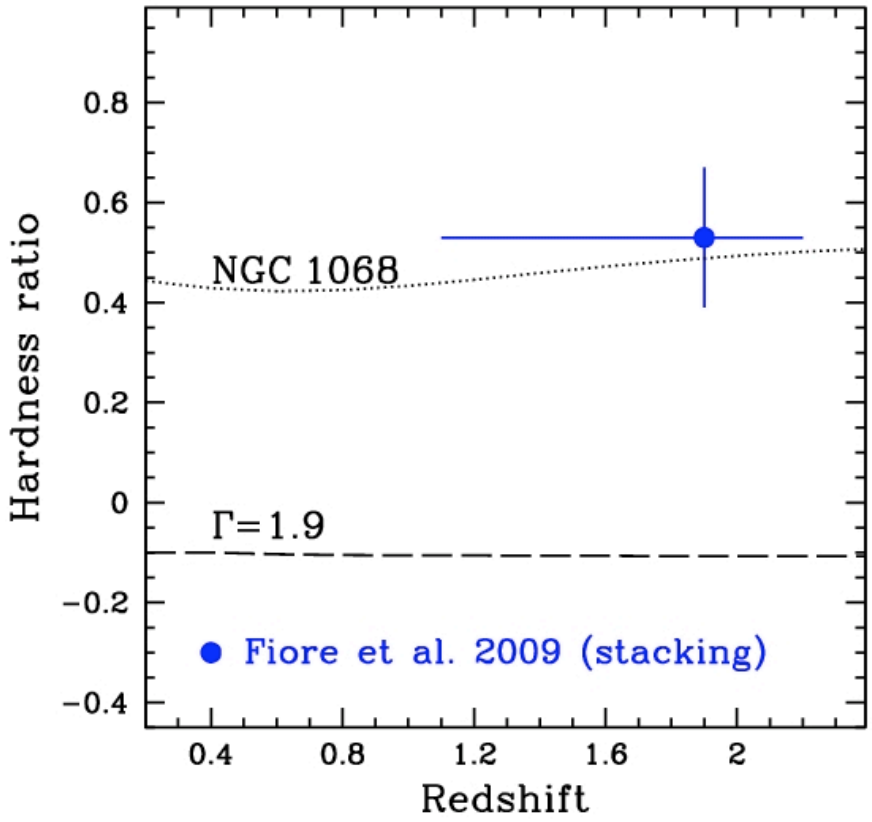


- $f_{24\mu m}/f_R$>1000
- R–[3.6]>3.7
- mean redshift, z~2

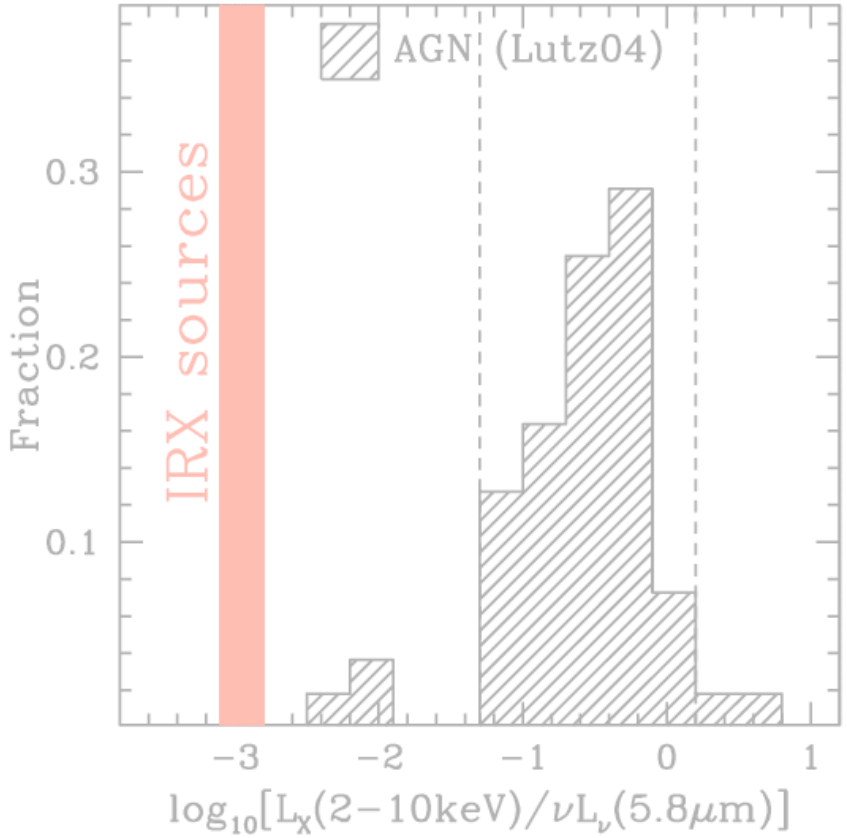
Daddi et al. 2007, Fiore et al. 2008, 2009 (IRX sources)

Dey et al. 2008 (DOGs)

IRX sources: Compton Thick QSOs?

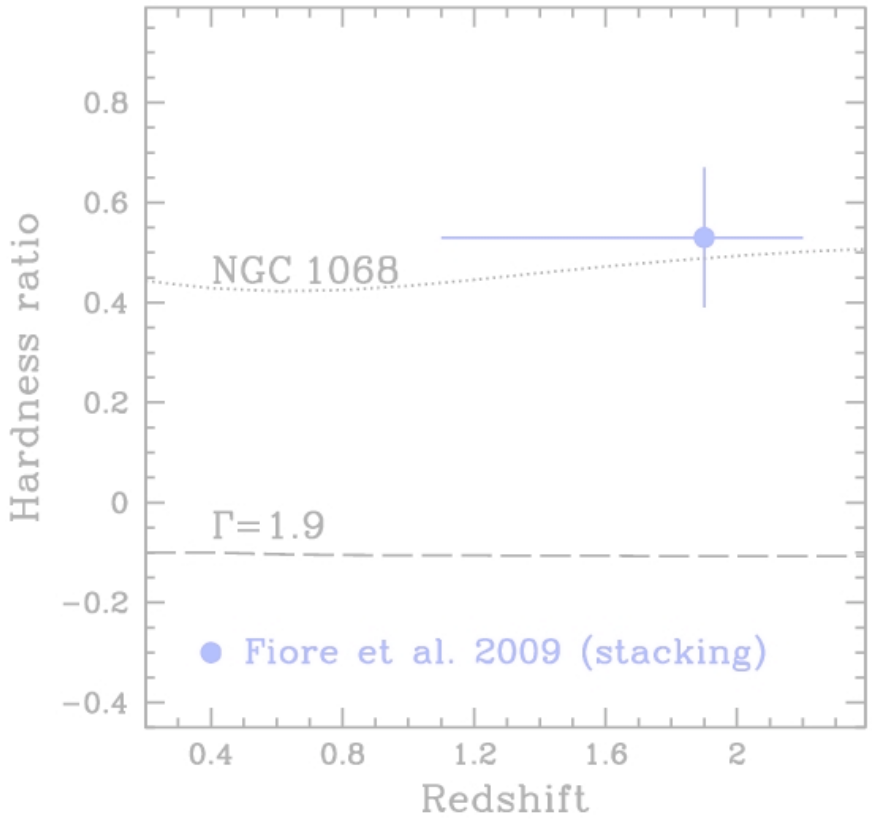


X-ray stacking: hardness ratio consistent with Compton Thick AGN (N_H>2×10^{24}cm^{-2}).



X-ray faint: 2-3dex fainter than typical AGN. Evidence for CT QSOs (L_X>>10^{43}erg/s).

IRX sources: Compton Thick QSOs?



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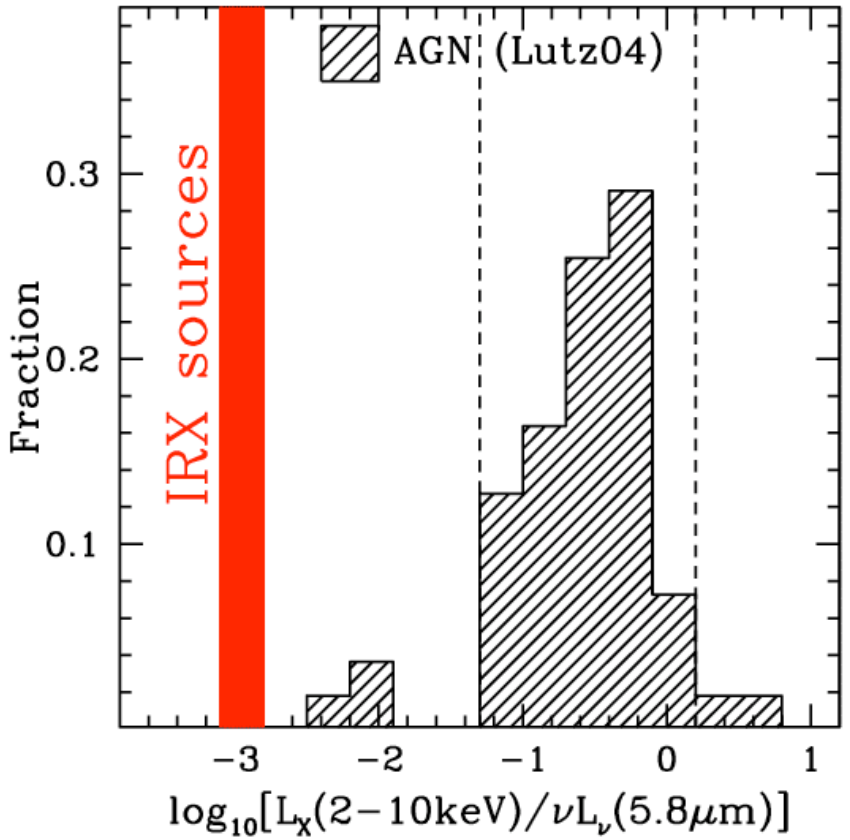

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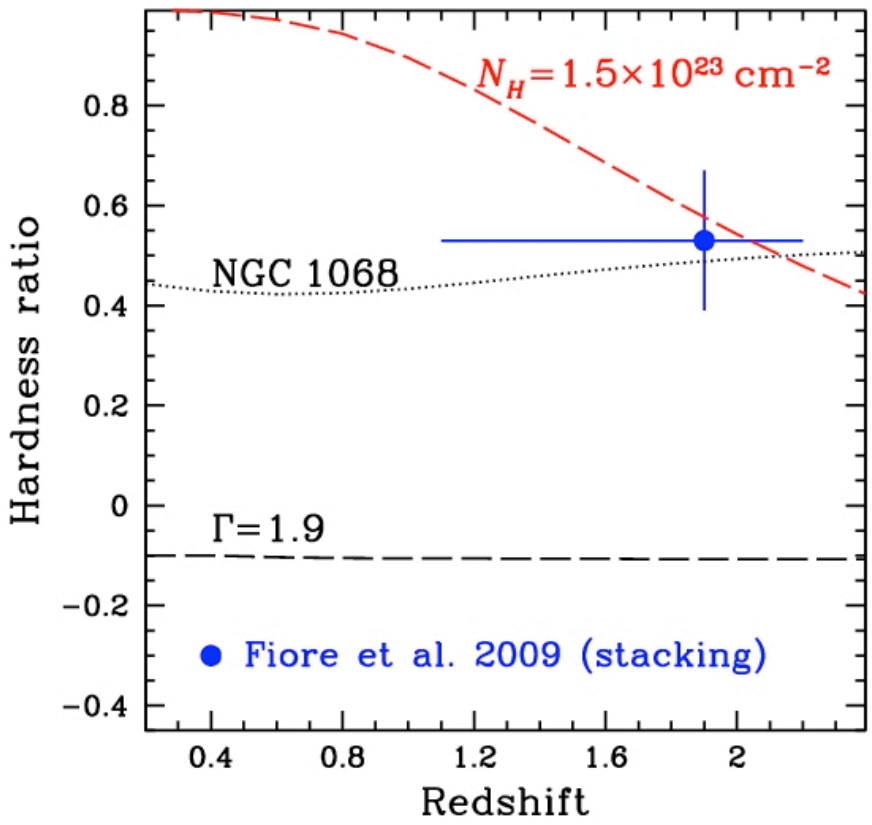
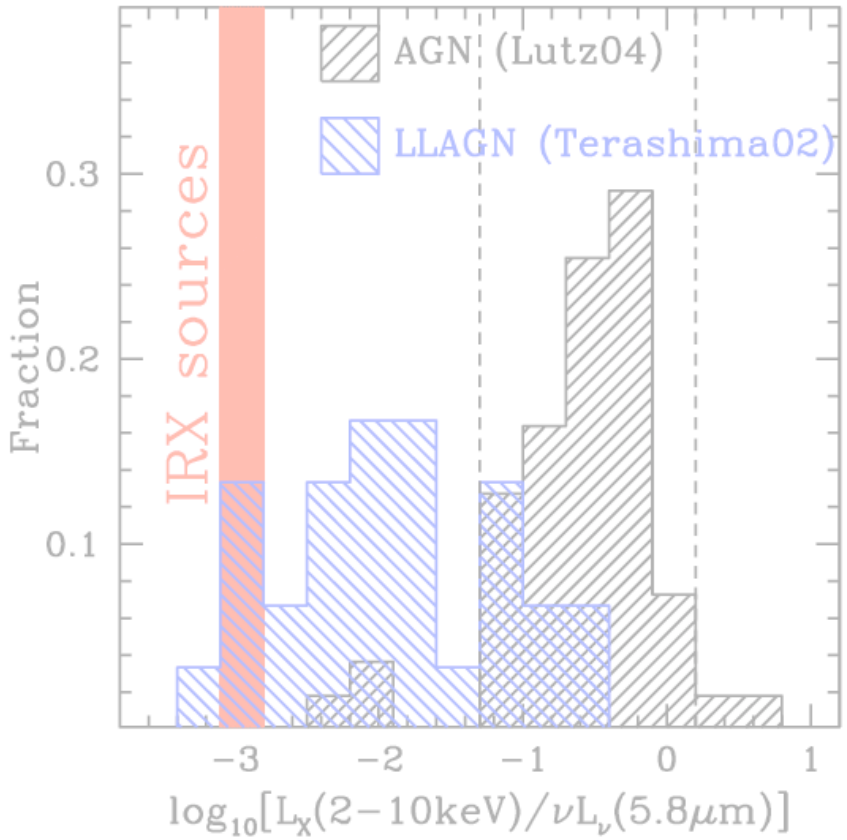
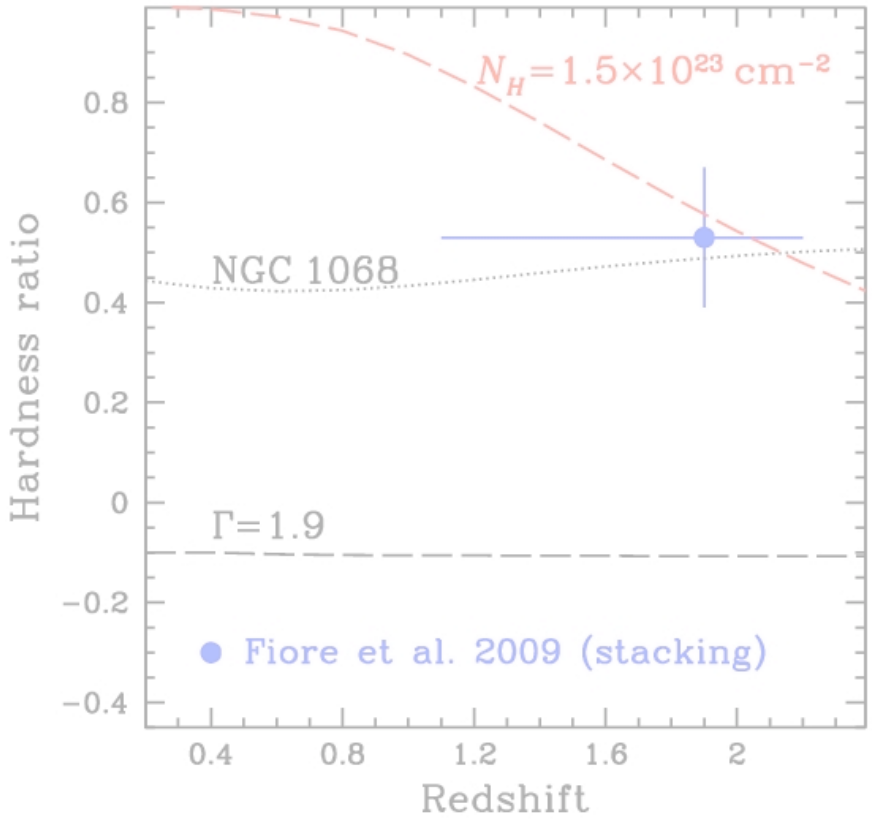


X-ray stacking: hardness ratio also consistent with moderate obscured AGN (N_H~10^{23}cm^{-2}).



X-ray faint: also consistent with moderate/low luminosity AGN.

IRX sources: Compton Thick QSOs?



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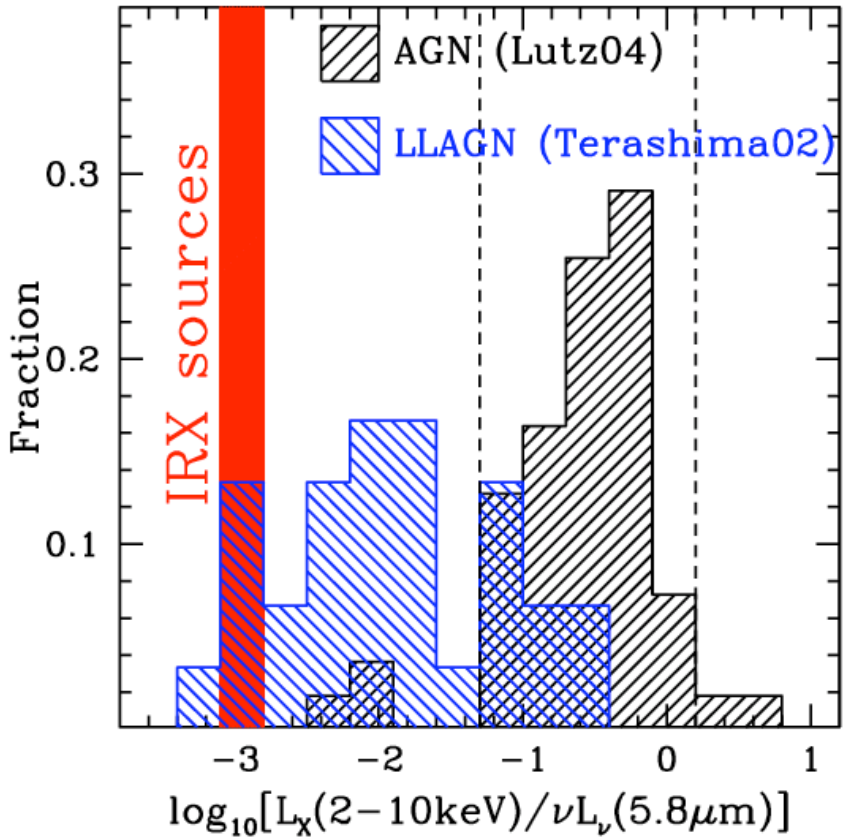

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IRX sources: Compton Thick QSOs?

The nature of IRX sources is controversial:

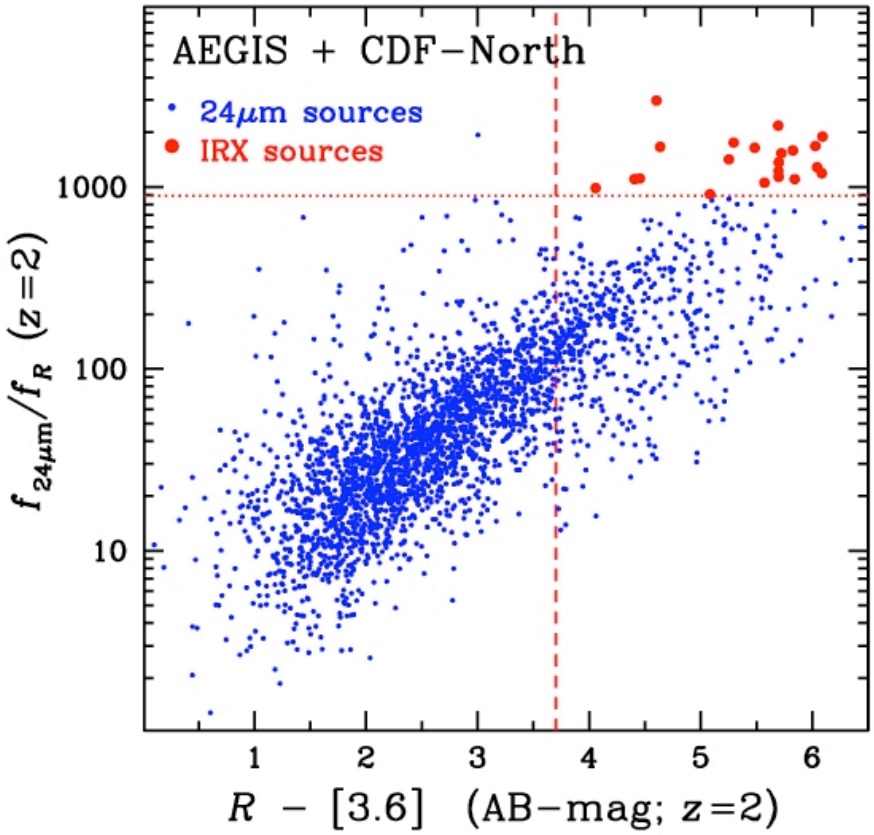
Compton *Thick* QSOs at z~2 (Daddi07, Fiore08, 09)?

OR

Compton *Thin* moderate-L_X AGN
(Georgantopoulos08, Donley08, Pope09)?

Selection of z~1 sources with IRX SEDs

- AEGIS + CDF-North
- UV to far-IR photometry: **RAINBOW*** Database
- Select z~1 sources with SEDs that satisfy the IRX selection criteria at z=2:
  - $f_{24\mu m}/f_R$>1000
  - R–[3.6]>3.7mag

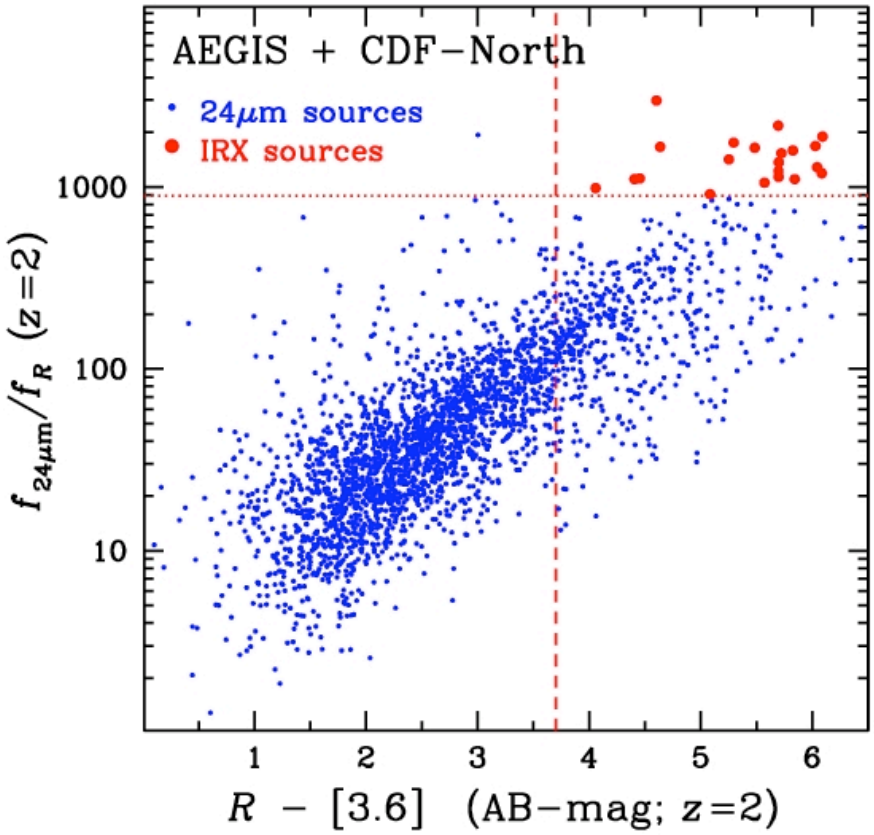


*http://guaix.fis.ucm.es/rainbow

Perez-Gonzalez et al. 2008

Selection of z~1 sources with IRX SEDs

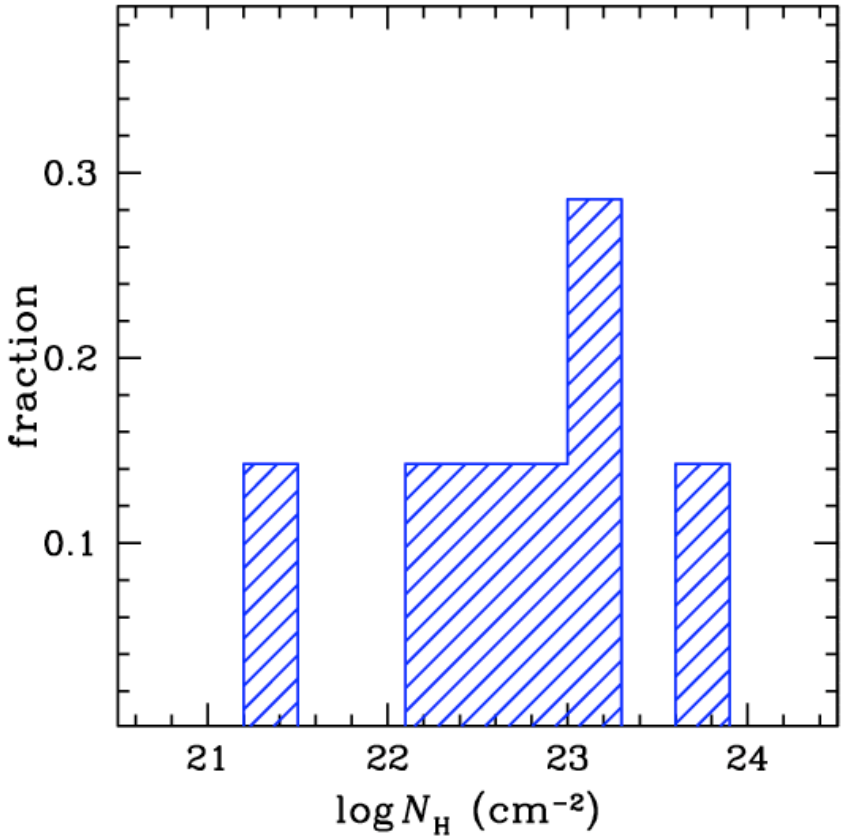
- AEGIS + CDF-North
  - Total of 21 sources with far-UV to 70μm SEDs
  - 2-10keV counterparts for 9/21 sources



X-ray detected IRX sources: X-ray spectral analysis

9 IRX sources have 2-10keV counterparts

- N_H~10^{21}–5×10^{23}cm^{-2}
- L_X~10^{42}–2×10^{44} erg/s



X-ray detected IRX sources: SED fits

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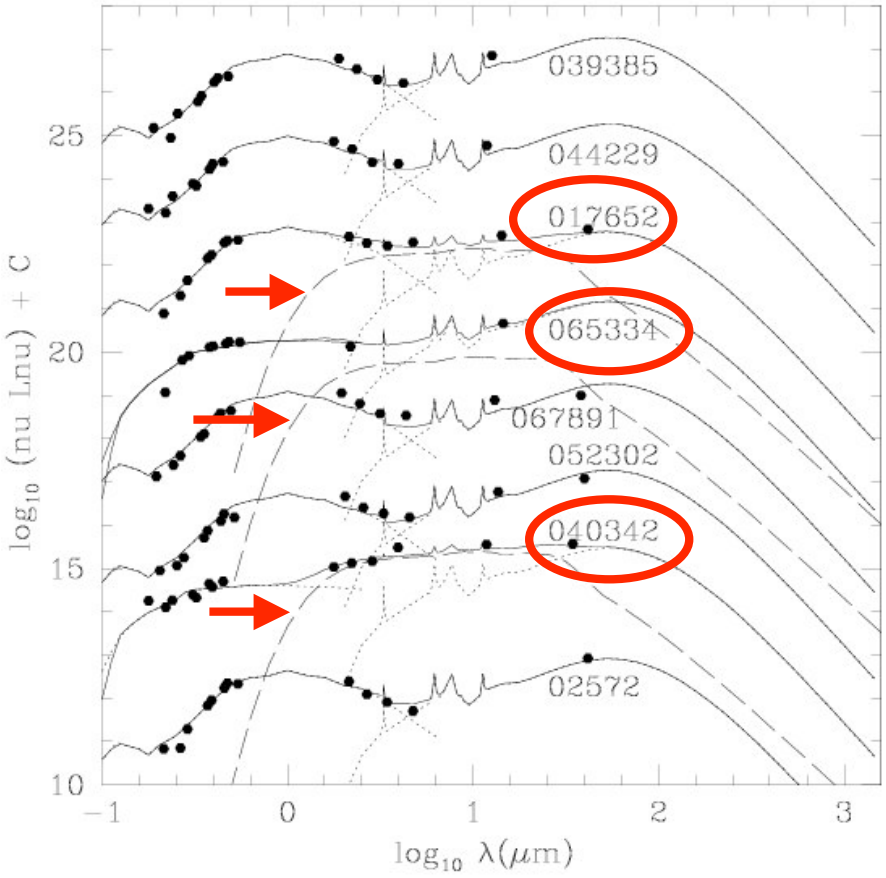
- star-formation contributes to mid-IR
- AGN torus component is required for *all* X-ray detected IRXs with $L_X > 10^{43}$erg/s



Fit models to SED: Rowan-Robinson et al. 2005, 2008

X-ray detected IRX sources: SED fits

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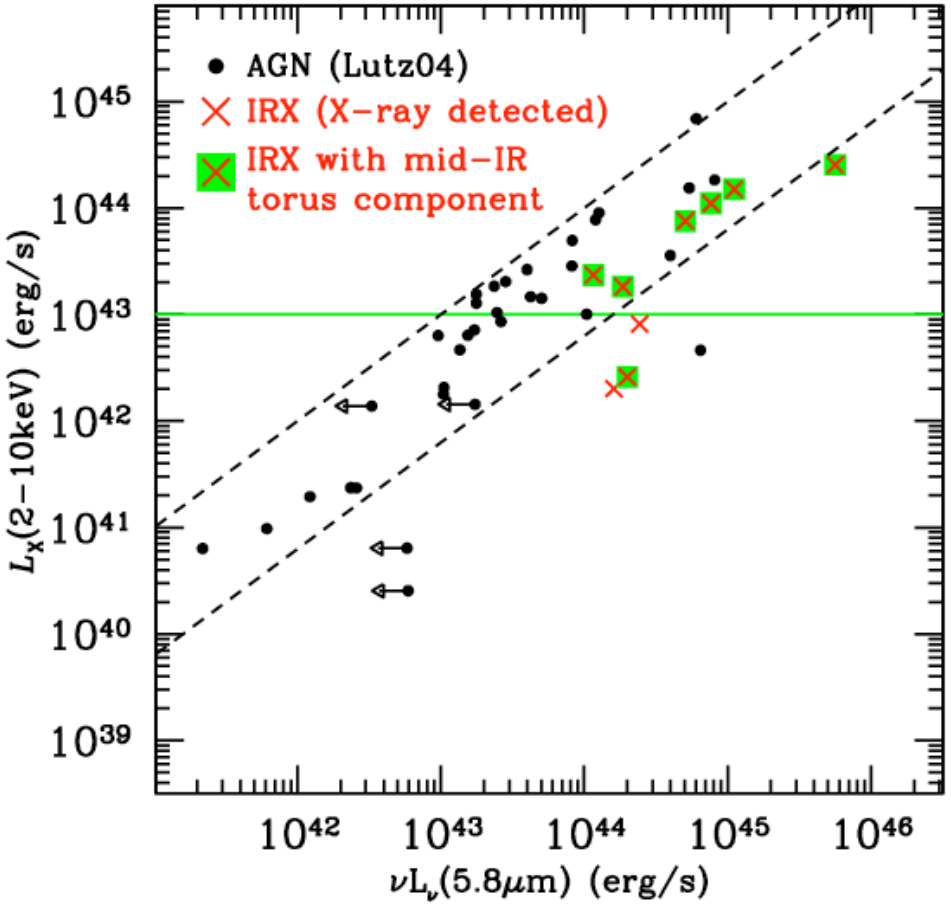
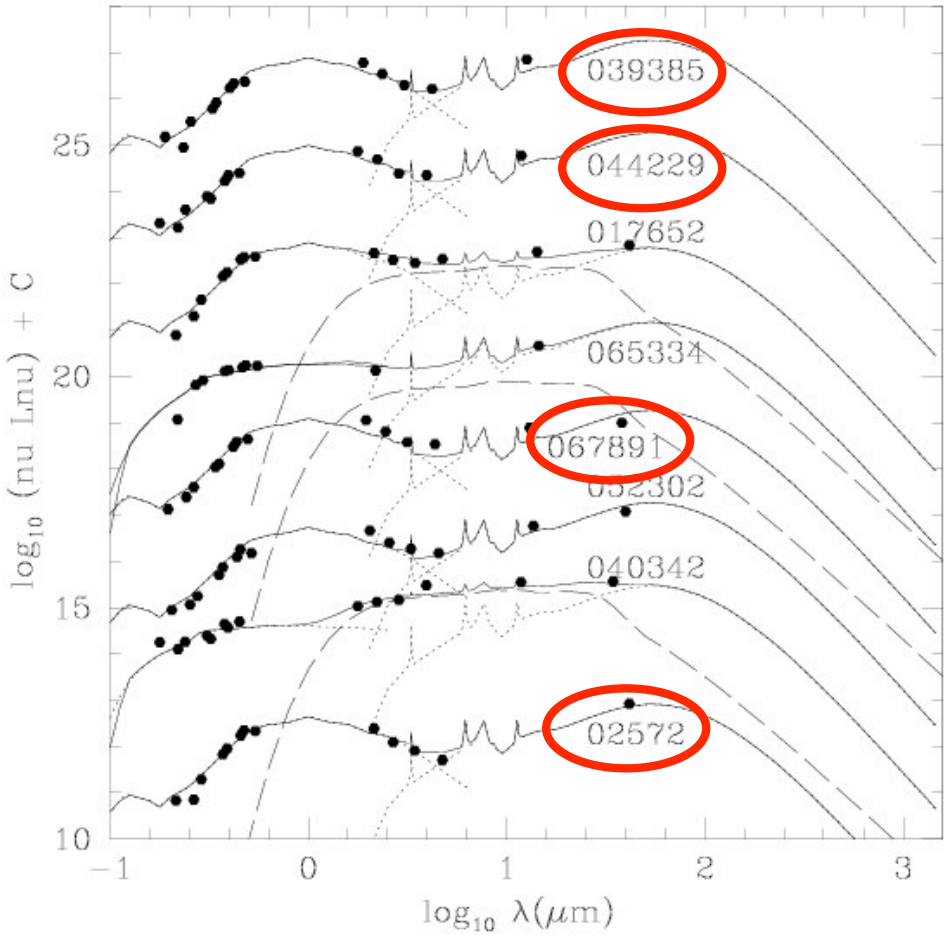


IRX sources w/o X-ray counterparts

12 IRX sources w/o X-ray detection

- SEDs consistent with starburst activity
- No evidence for AGN component at mid-IR
- AGN intrinsic luminosity <10^{43}erg/s



Conclusions

- z~1 sources with IRX SEDs: no evidence for luminous (L_X>10^{43}erg/s) Compton Thick (N_H>2×10^{24}cm^{-2}) AGN.
  - X-ray spectra consistent with moderate column densities (N_H~10^{23}cm^{-2})
  - Star-formation contributes/dominates the mid-IR.
- The population of IRX sources at z~2 is likely to be dominated by Compton thin, moderate/low luminosity AGN.