X-ray properties of an X-ray-selected IR power-law sample

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Selection of **X-ray Sample**

150 sources

- **XMM-Chandra cross-correlation (411)** **(by Carrera, F.J.)**
- **High SNR:** PWXD_Signif > 8 sigma **(192)**
- **High Exposure time:** T_{exp} > 1Ms **(171)**
- **Have X-ray spectrum (159)**
- **Have redshift:** photometric or spectroscopic **(150)**

Selection **IR Sample**

- **Spitzer IRAC dataset (COSMOS field)**
- **Detected >5σ in all bands (3.6, 4.5, 5.8, 8 μm)**
- **~73000 sources**

Cross-correlation between both samples (using the method developed by Pineau+2008)

Final Sample: 143 X-ray sources with IRAC counterpart

(1 got lost)

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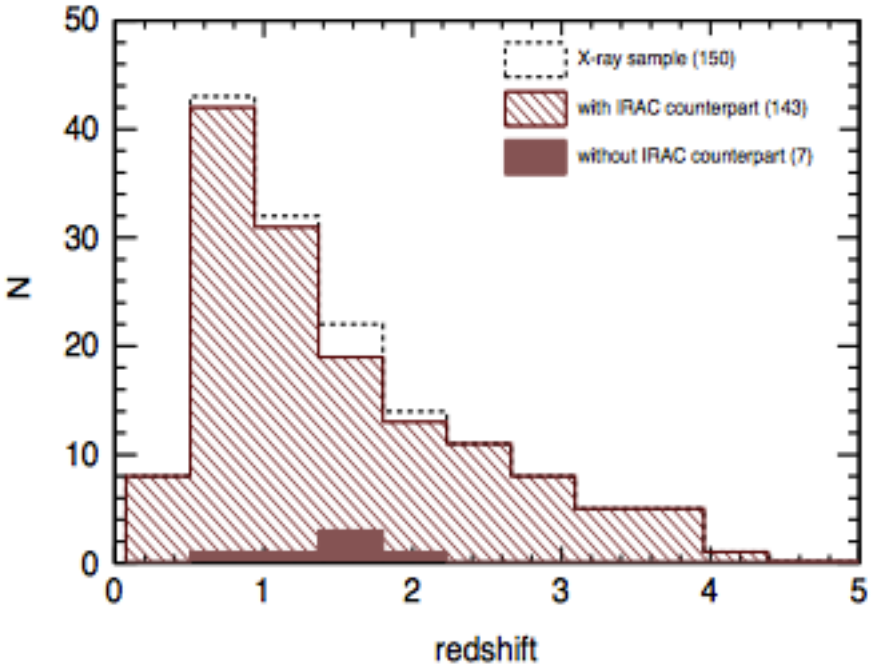
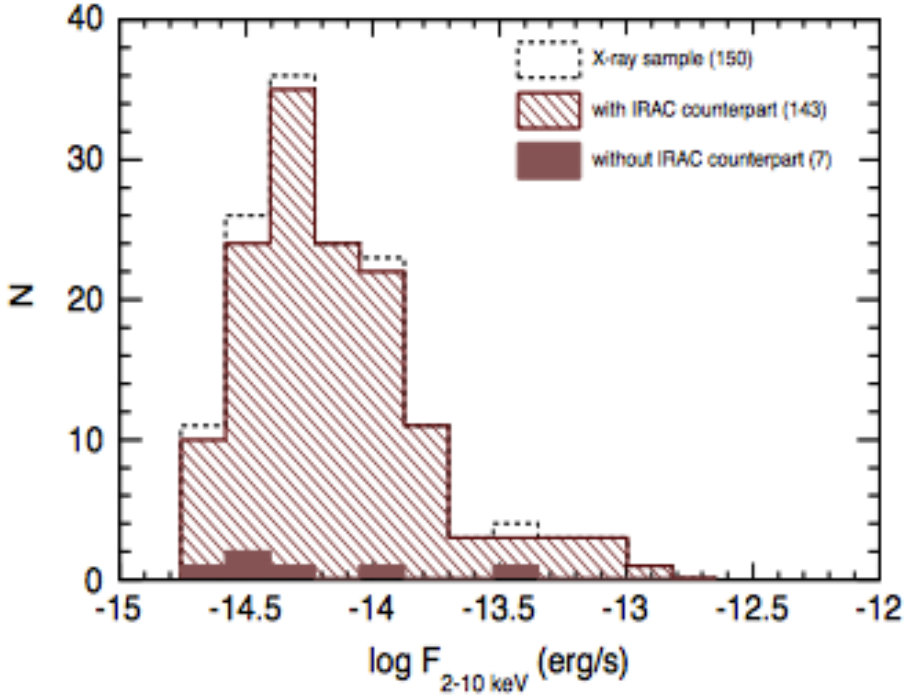
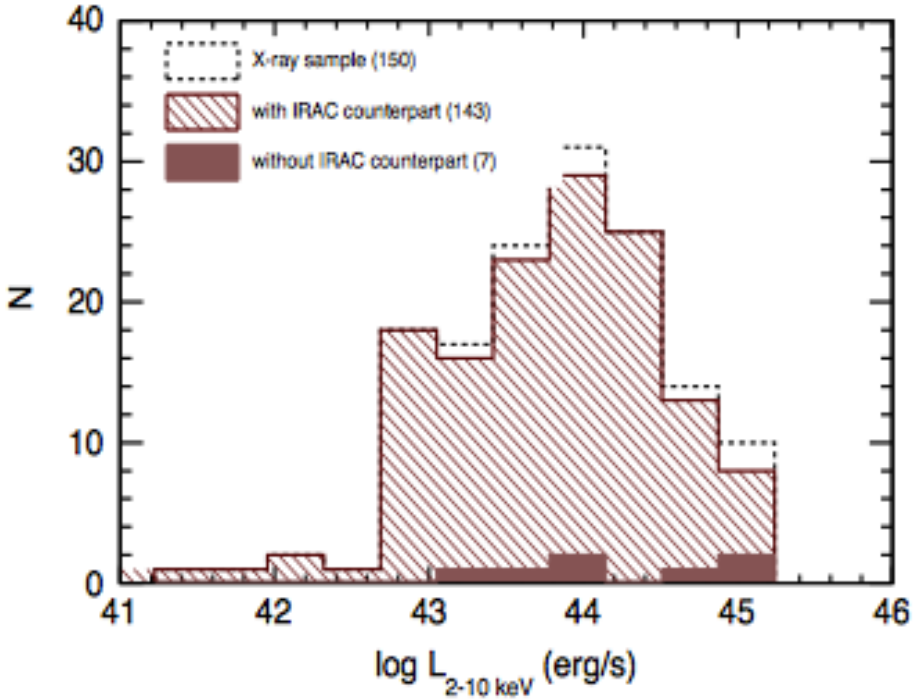
X-ray properties

F_X,L_X from Chandra if not XMM
(4 which have IRAC counterpart)







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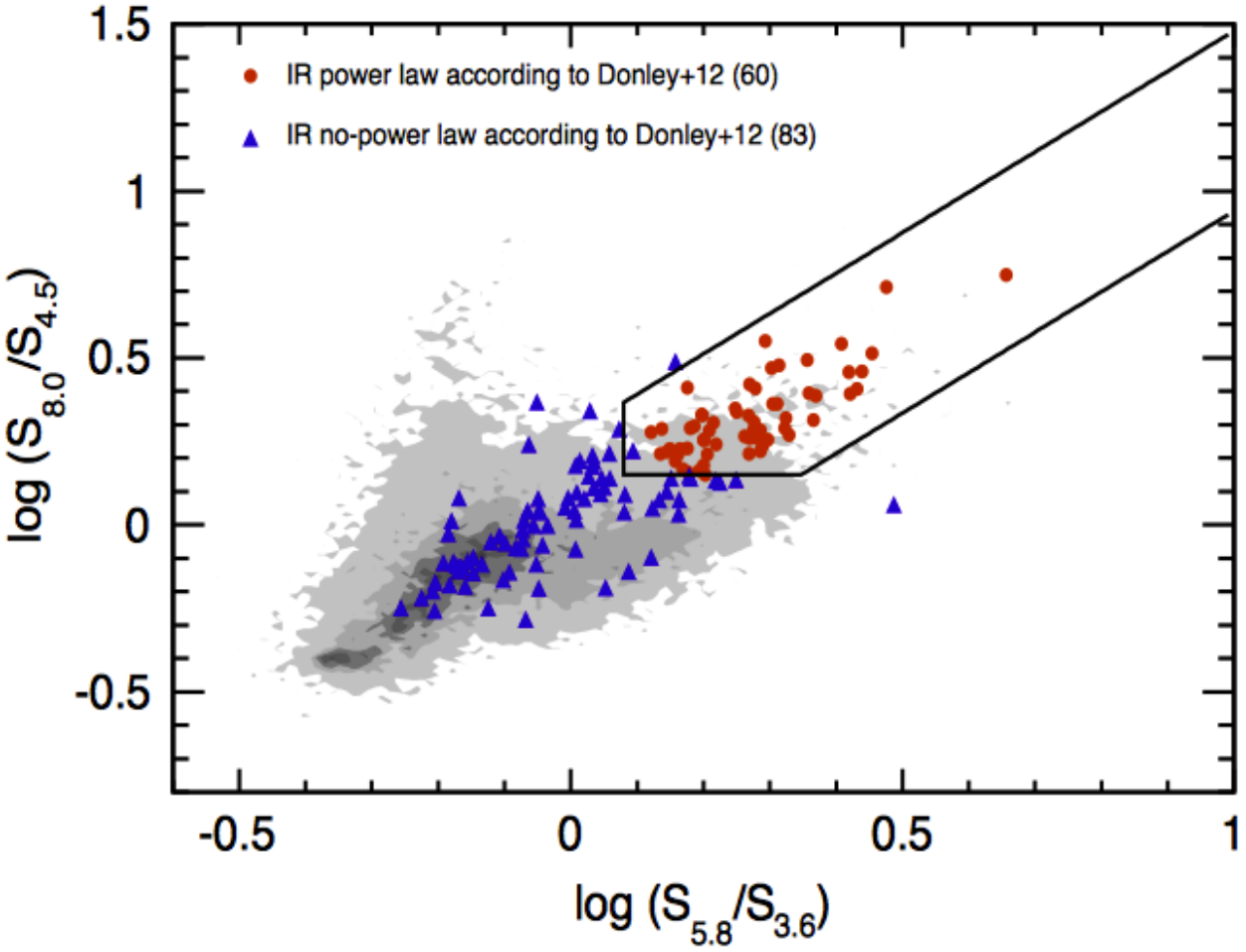
Selection of IR power-law galaxies: using the AGN-selection wedge presented by Donley+12

"When the **AGN** is **sufficiently luminous** compared to its host galaxy, the **superposition of blackbody emission from the AGN-heated dust** will fill in the dip in the galaxy's SED and **produce a red, power-law-like thermal continuum across the IRAC bands**."



IRAC-selection wedge:

$x = \log(S_{5.8\mu m}/S_{3.6\mu m}) \geq 0.08$
$y = \log(S_{8.0\mu m}/S_{4.5\mu m}) \geq 0.15$
$y \geq (1.21 \cdot x) - 0.27$
$y \leq (1.21 \cdot x) + 0.27$
$S_{3.6\mu m} > S_{4.5\mu m} > S_{5.8\mu m} > S_{8.0\mu m}$

(Donley et al. 2012)

60 IR pl AGNs
83 IR no-pl AGNs

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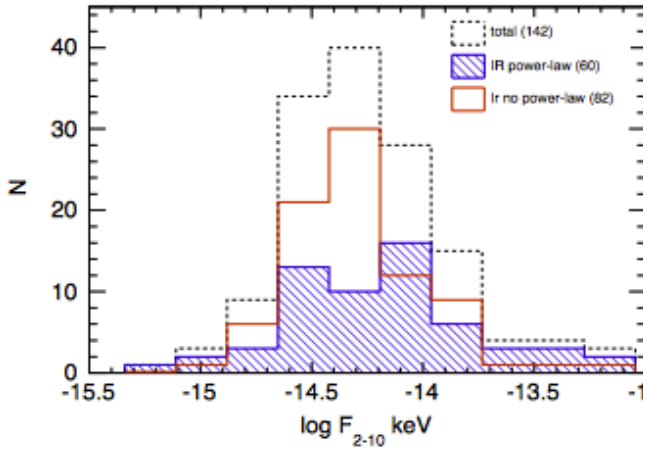
X-ray spectral fitting (142)

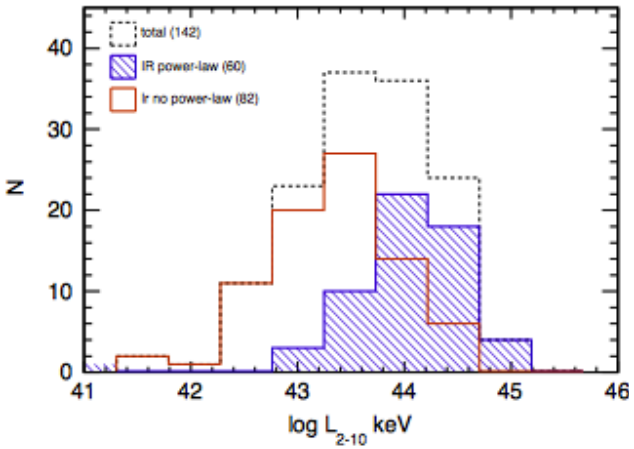
- F-test > 95% (some ul)
- F-test < 95% & Γ<1: Γ ≡ 1.9 N_H ul (~97%)

Best fitted model	N IR pl [frac]	N IR pl [frac]	N IR no-pl [frac]	N IR no-pl [frac]
PL	20 [34(24-44) %]	21[35(26-45)%]	33 [40(32-49)%]	33[40(32-49)%]
PL + SOFT-BB	1 [2(0.1-6) %]		0 [0(0-3)%]	
Abs. PL	35 [58(48-68) %]	39[65(55-74)%]	45 [55(46-64)%]	46[56(47-65)%]
Abs. PL+SOFT-BB	1 [2(0.1-6) %]		2 [3(0.5-6)%]	
partial covering comp.	3 [5(2-11) %]		2 [3(0.5-6)%]	

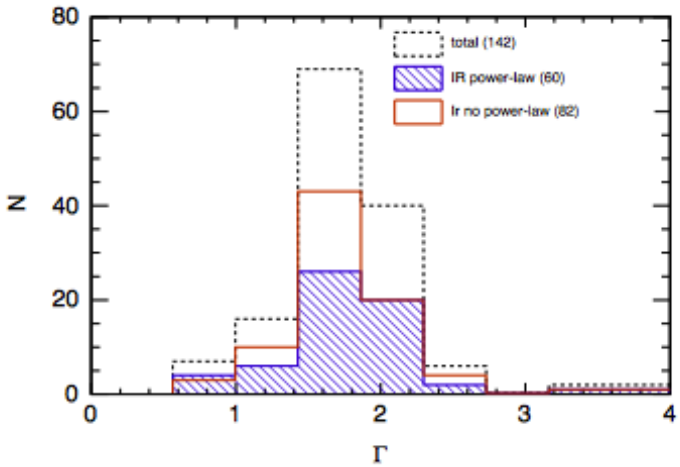
Hard X-ray flux



Hard X-ray luminosity



spectral index



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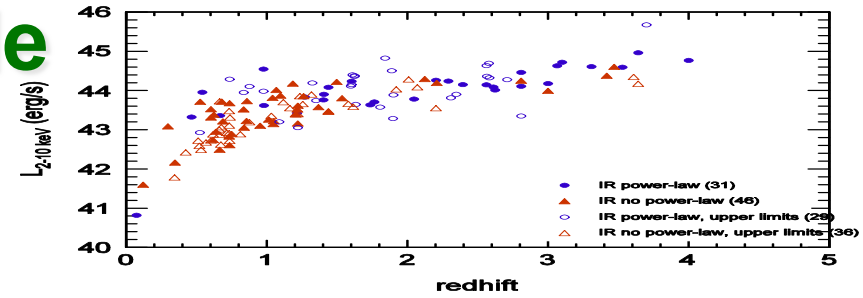
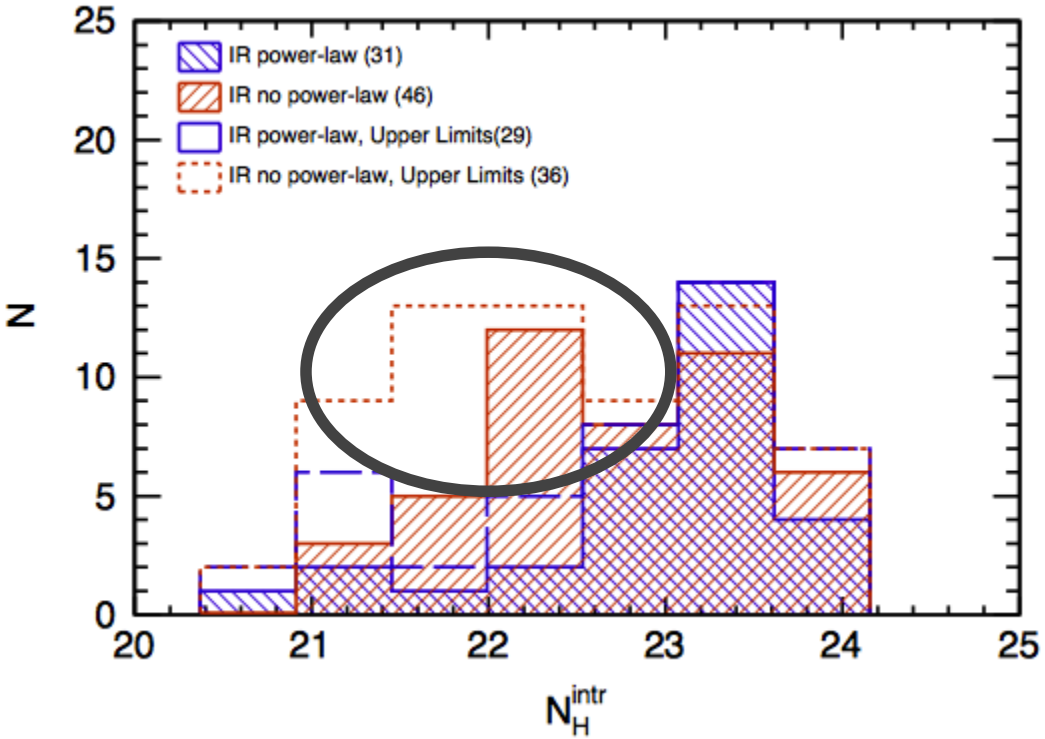
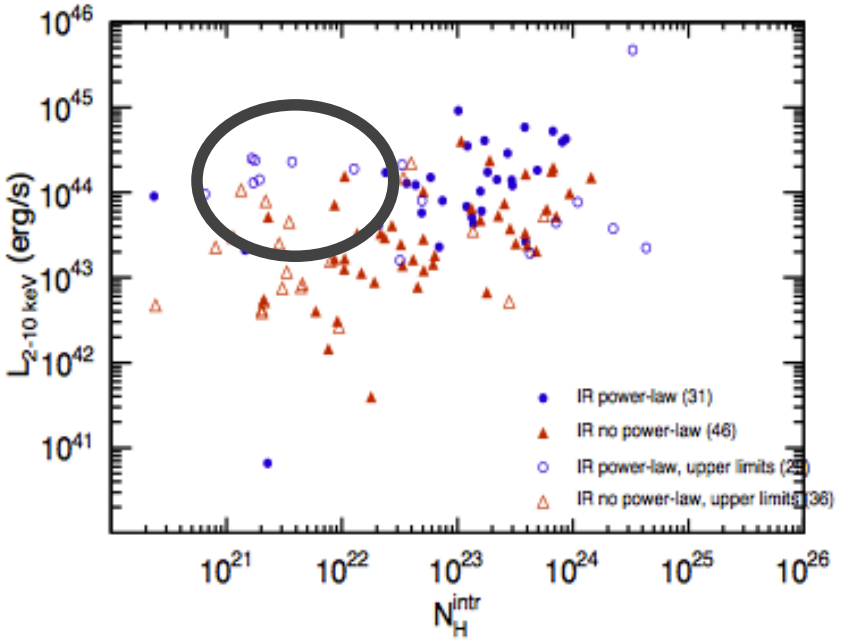


X-ray spectral fitting Results

Intrinsic absorption: the sources with only Upper limit for the N_H are reflected by the dotted/dashed-line histograms





This **lack of sources with low absorption at high z** may be because the absorption is redshifted below 0.5 keV: **low absortion at high luminosity** is very difficult to measure.

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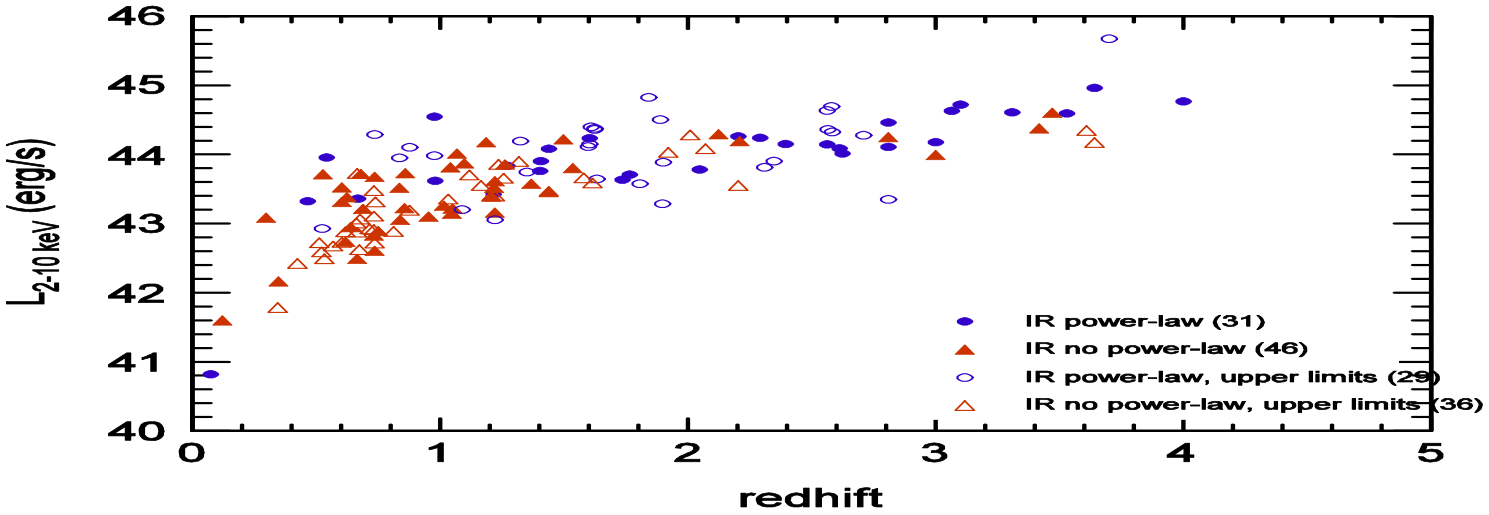
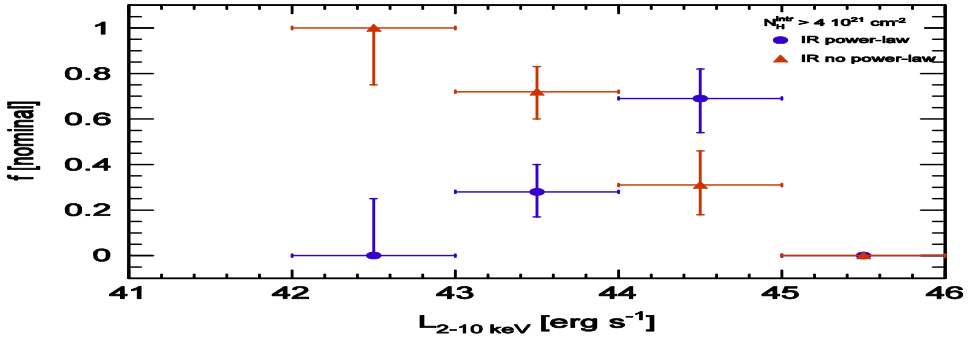
Looking for a dependence on X-ray luminosity



X-ray properties of an X-ray-selected IR power-law sample

X-ray spectral fitting Results

 # (fraction) absorbed sources in luminosity ranges



absorbed AGN: $\log(N_H) > 21.6$
(Caccianiga+08)

$\log(L_X)$	IR pl			IR no-pl		
	nominal	UL	f (nominal)	nominal	UL	f (nominal)
42-43	0	1	0.00 (0.00 - 0.25)	7	5	1.00 (0.75 – 1.00)
43-44	11	12	0.28 (0.17 - 0.40)	29	17	0.72 (0.60 – 0.83)
44-45	18	15	0.69 (0.54 – 0.82)	8	13	0.31 (0.18 – 0.46)
>45	0	1	0	0	1	0

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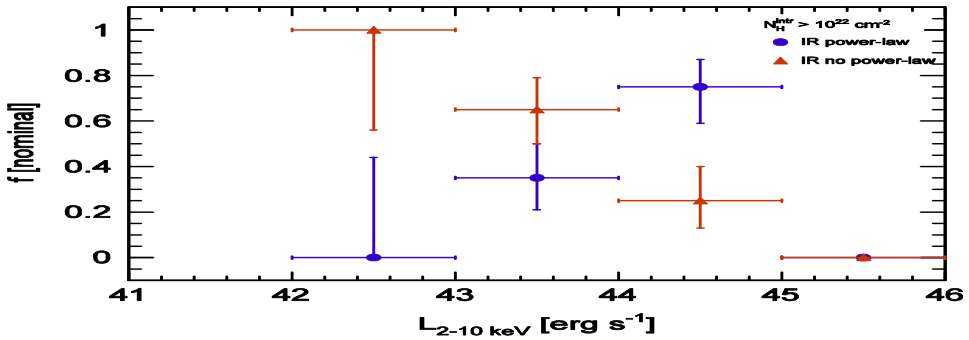
X-ray spectral fitting Results

 # (fraction) absorbed sources in luminosity ranges



absorbed AGN: $\log(N_H) > 22$

$\log(L_X)$	IR pl			IR no-pl		
	nominal	UL	f (nominal)	nominal	UL	f (nominal)
42-43	0	1	0.00 (0.00 - 0.44)	3	9	1.00 (0.56 – 1.00)
43-44	9	10	0.35 (0.21 - 0.50)	17	13	0.65 (0.50 – 0.79)
44-45	18	14	0.75 (0.59 – 0.87)	6	4	0.25 (0.13 – 0.40)
>45	0	1	0	0	0	0

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Conclusions

- **The fraction of both absorbed and unabsorbed AGN inside and outside the IRAC-selection wedge is nearly the same.**
- **The fraction of QSO-2 is higher in the IRAC-selection box (as expected by Donley+12)**
- **Among the MIR-detected sources inside the IRAC-selection box which are not detected in X-rays, we would expect a high fraction of QSO-2 ($L_X > 10^{44}$ erg/s $N_H > 10^{22}$ cm^{-2}), highly suppressed in X-rays but not enough in MIR**