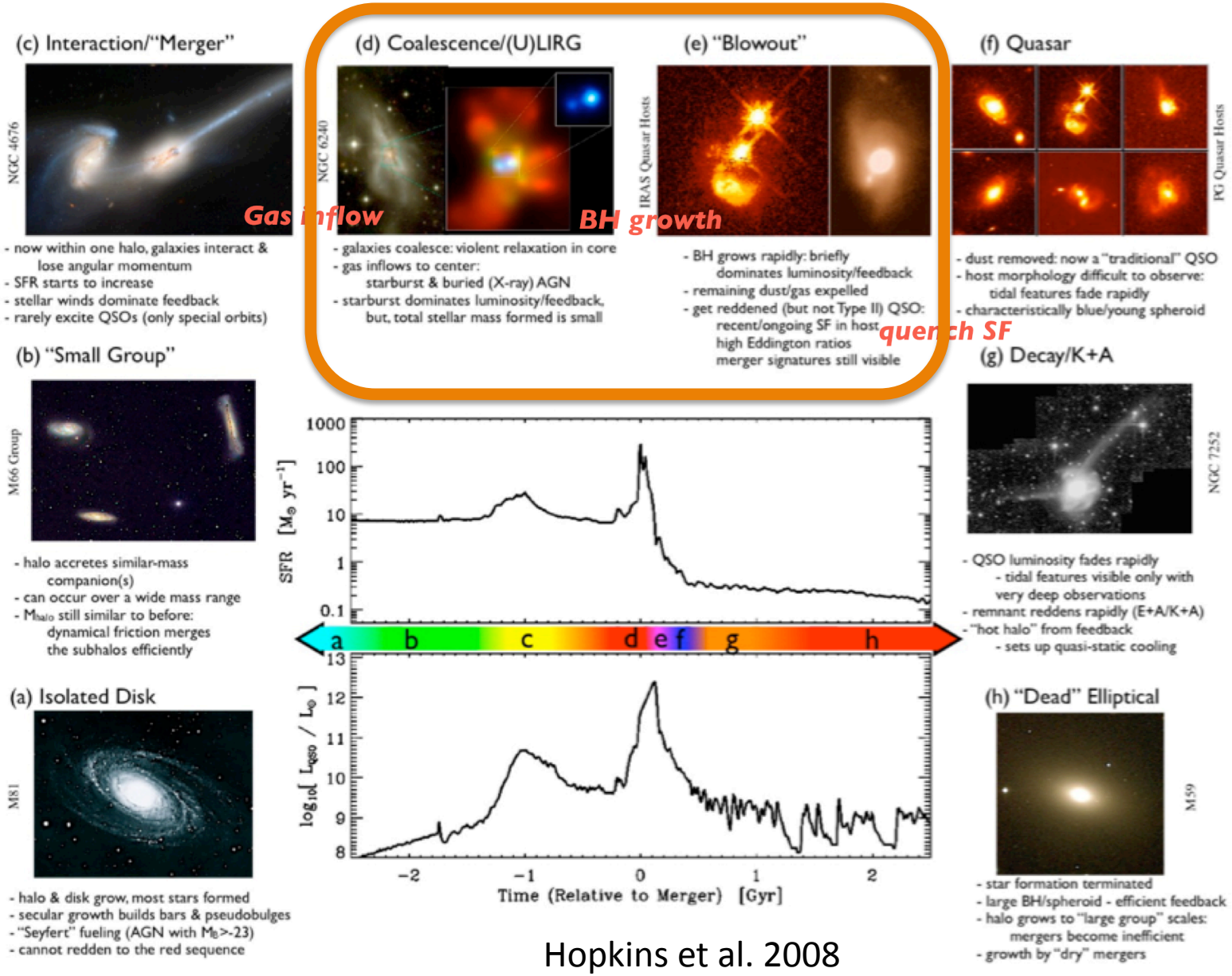
THE PROPERTIES OF AGN IN (ULTRA)LUMINOUS INFRARED GALAXY

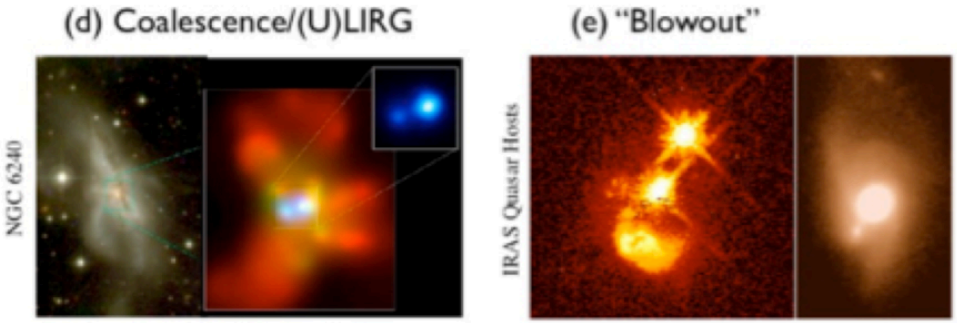
Ming-Yi, Lin
Supervisor: Yasuhiro Hashimoto ; Sébastien Foucaud
National Taiwan Normal University
TIARA winter school 2012 @ ASIAA

Merger scenario



Hopkins et al. 2008

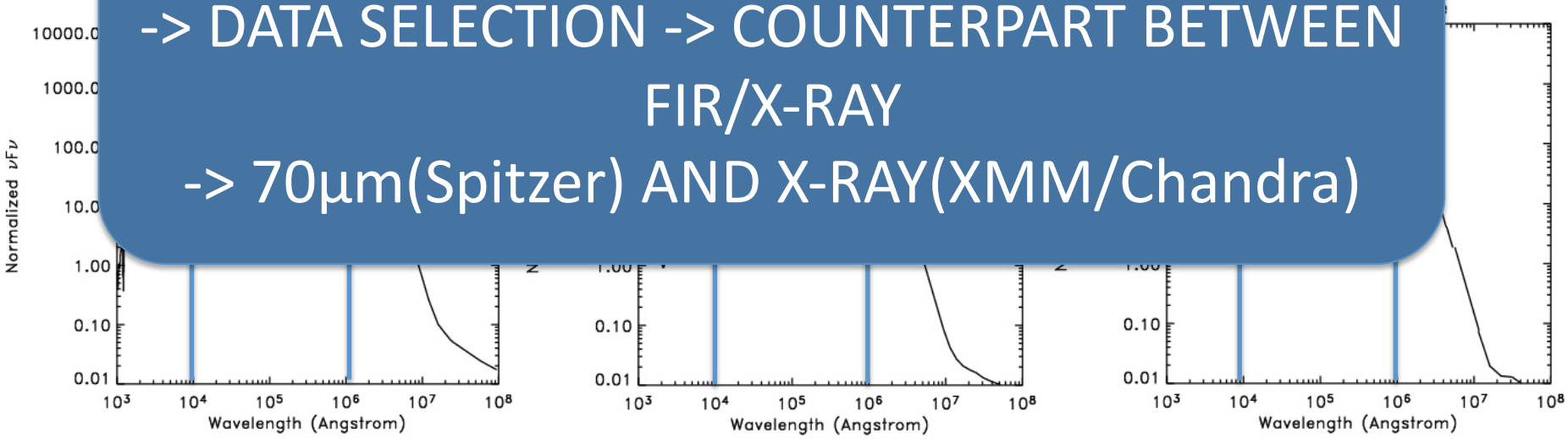
Merger scenario



SF dominated → AGN dominated

Arp 220	NGC 6240	Mrk 231

AGN FORMATION DURING ULIRG PHASE
-> DATA SELECTION -> COUNTERPART BETWEEN FIR/X-RAY
-> 70µm(Spitzer) AND X-RAY(XMM/Chandra)



Swire template

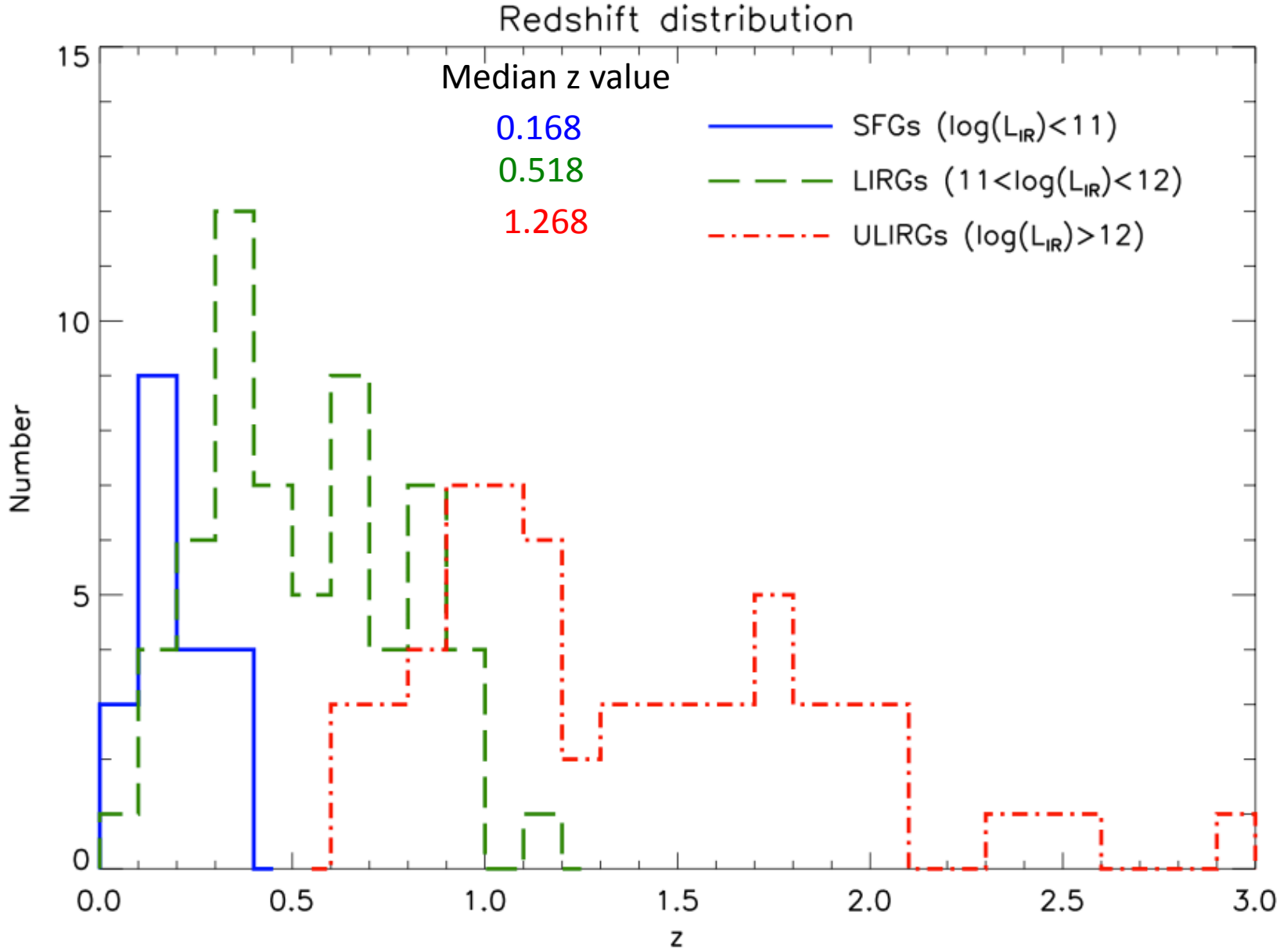
DATA – COSMOS FIELD

From Kartaltepe et al. 2010 70µm dataset, we found there are *142* sources have both 70µm/X-ray detection.

Wavelength - Telescope	**Band**
UV - GALEX	NUV, FUV
Optical – Subaru, CFHT, UKIRT	u*, B, V, g+, r+, I+, z+, J, Ks
Infrared – Spitzer IRAC Infrared – Spitzer MIPS	3.6, 4.5, 5.8, 8.0 µm 24, 70, 160 µm
X-ray – XMM X-ray – Chandra	Soft, Hard, Full

Redshift estimation	**Reference**
Spec-z ~ 60%	zCOSMOS, Magellan, SDSS Keck/DEIMOS
Photo-z ~ 40%	Ilbert et al. 2009 Salvato et al. 2009.

REDSHIFT DISTRABUTION



QUESTION

Part I - Which mechanism drives those objects? AGN or SF ?

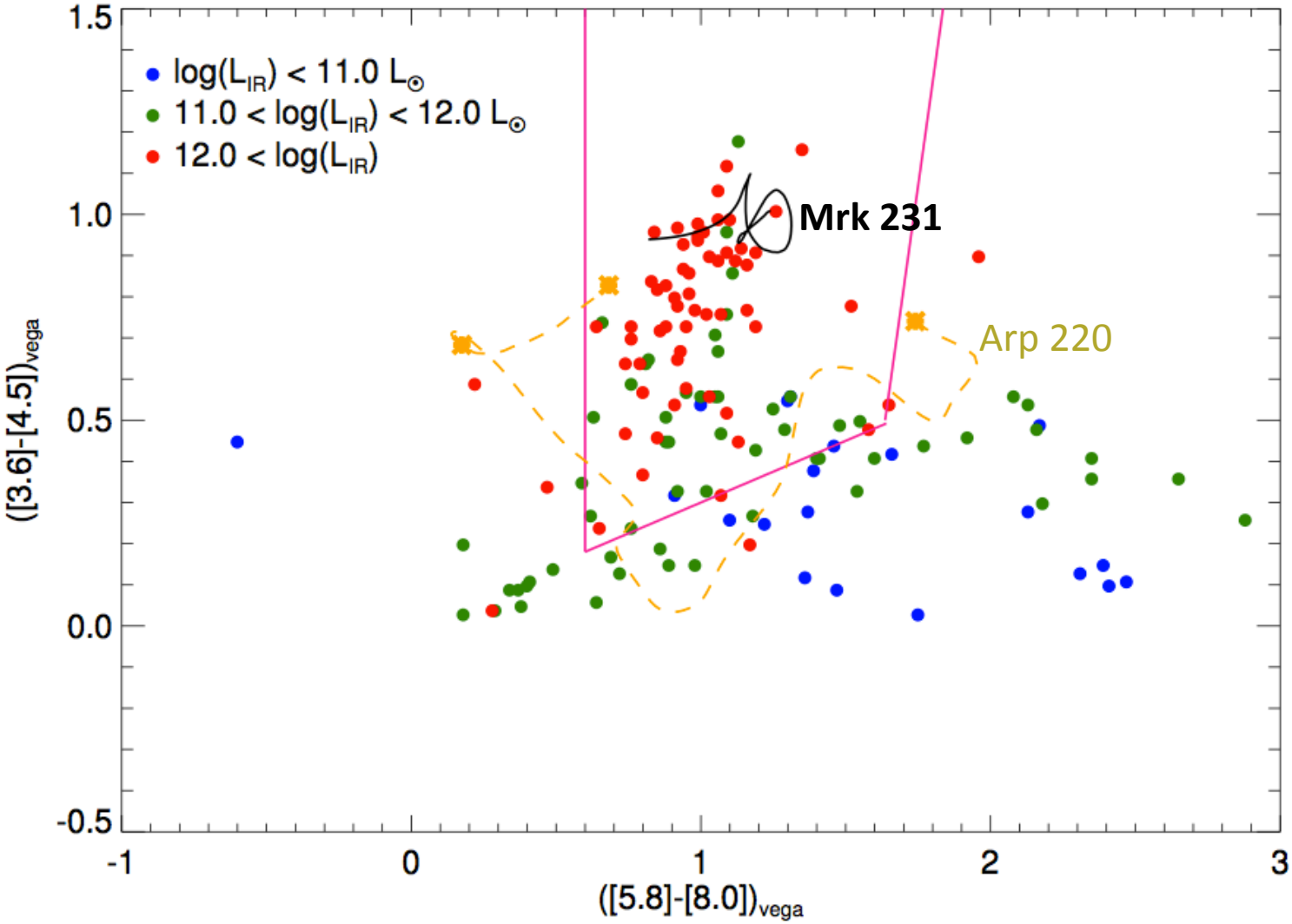
- AGN diagnosis from color-color selection
- LX_LIR relation
- SED fitting

Part II - Would AGN influence host galaxy's property, and vice versa?

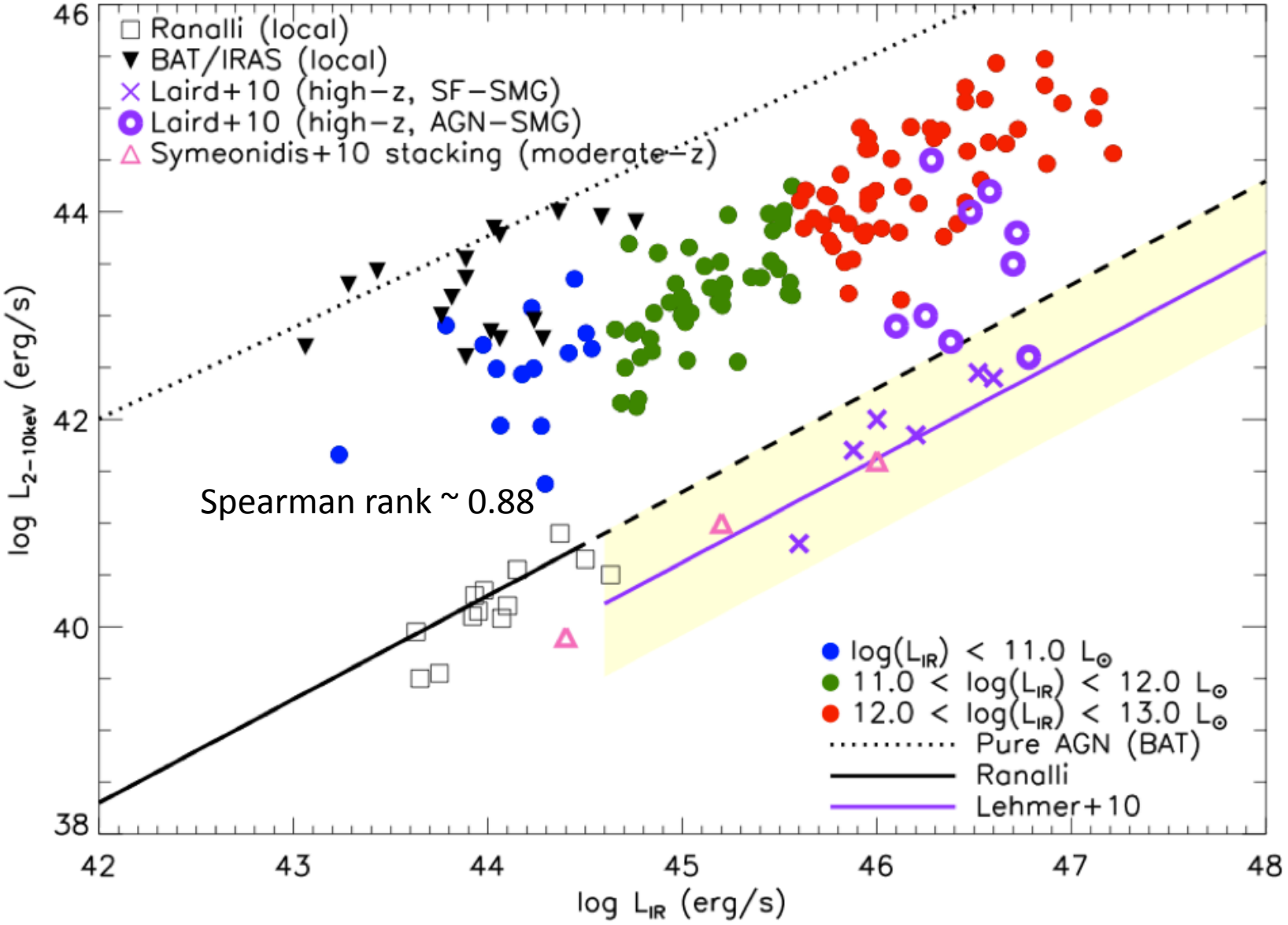
- Whether ISM in host galaxy heated by AGN? (Luminosity-Temperature diagram)
- Is there more neutral hydrogen absorption by host galaxy rather than torus component? (Hardness ratio)

AGN DIAGNOSIS

- Applying Stern et al. 2005 color-color selection.

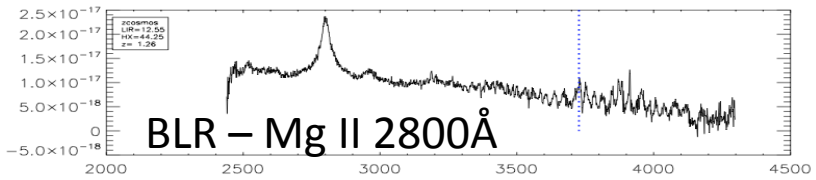


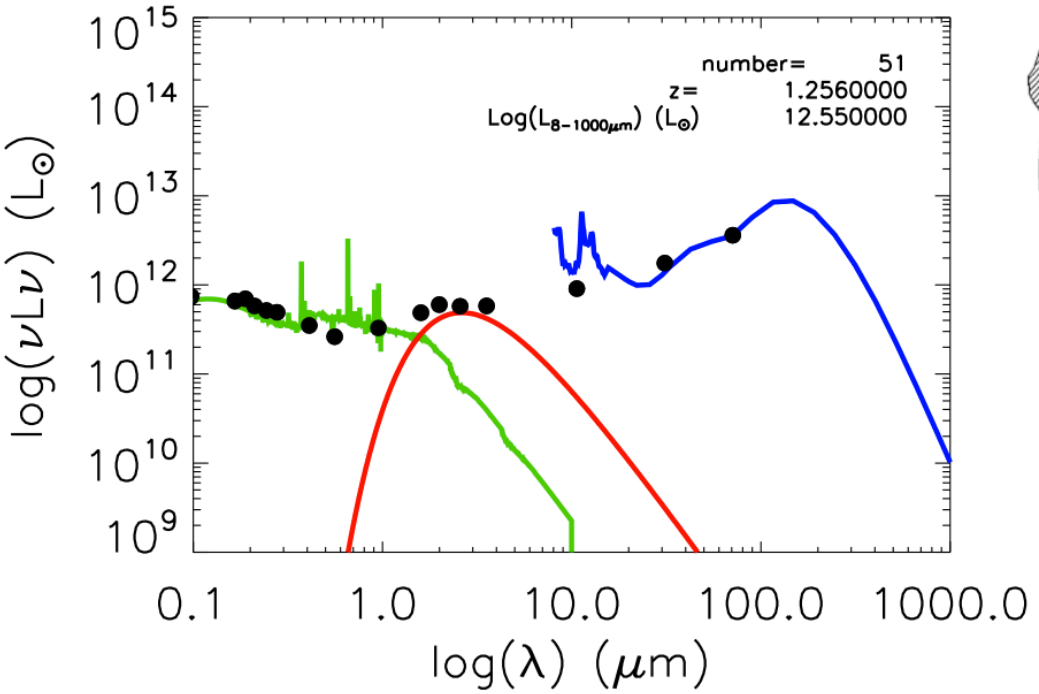
LX_LIR RELATION

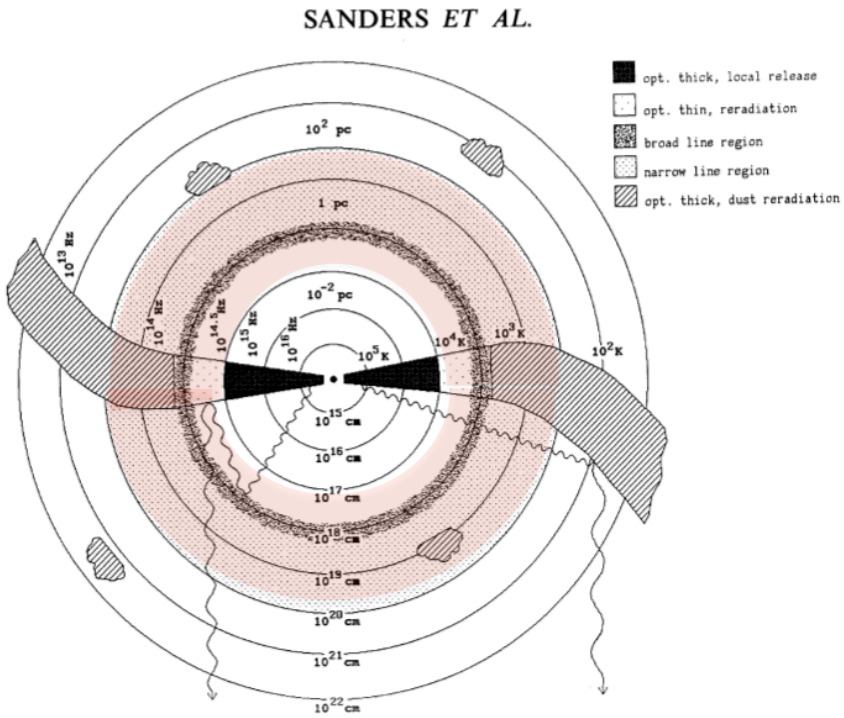


SED FITTING

VIMOS spectroscopy from VLT







Stellar component.

MIR bump ~ 1500K -> dust in NLR heated by AGN

Cold dust component from host galaxy.

QUESTION

Part I - Which mechanism drives those objects? AGN or SF ?

- AGN diagnosis from color-color selection
- LX_LIR relation
- SED fitting

AGN dominated significantly!!!

Part II - Would AGN influence host galaxy's property, and vice versa?

- Whether ISM in host galaxy heated by AGN? (Luminosity-Temperature diagram)
- Is there more neutral hydrogen absorption by host galaxy rather than torus component? (Hardness ratio)

QUESTION

Part I - Which mechanism drives those objects? AGN or SF ?

- AGN diagnosis from color-color selection
- LX_LIR relation
- SED fitting

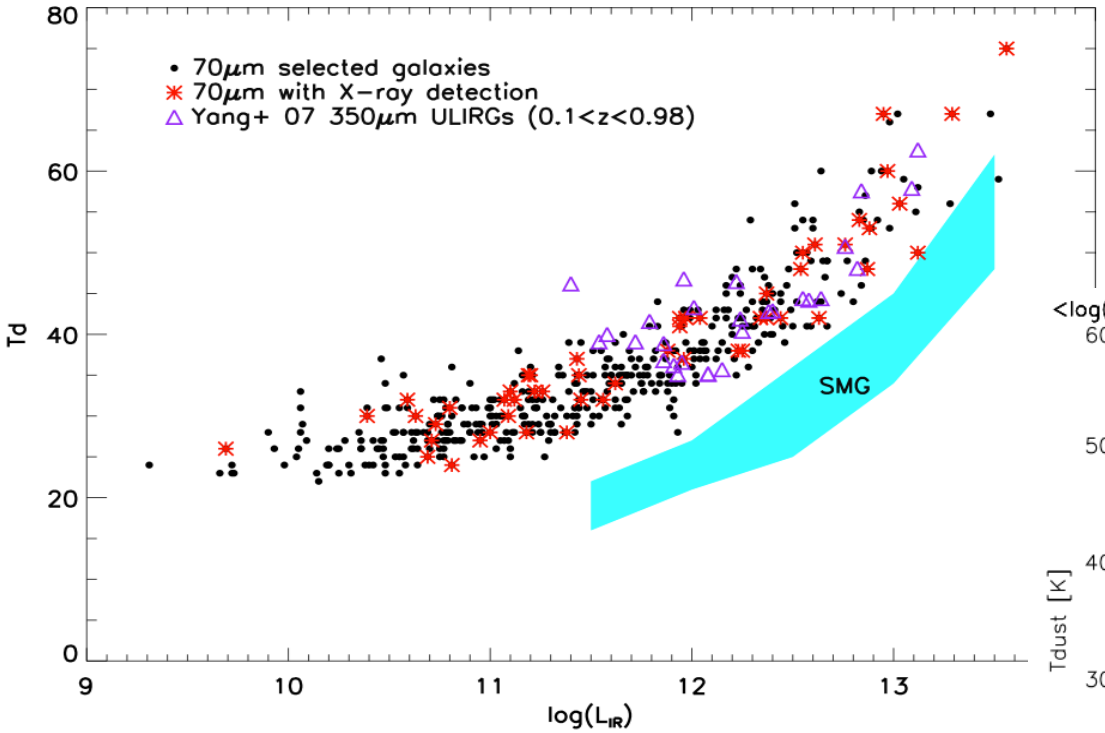
AGN dominated significantly!!!

Part II - Would AGN influence host galaxy's property, and vice versa?

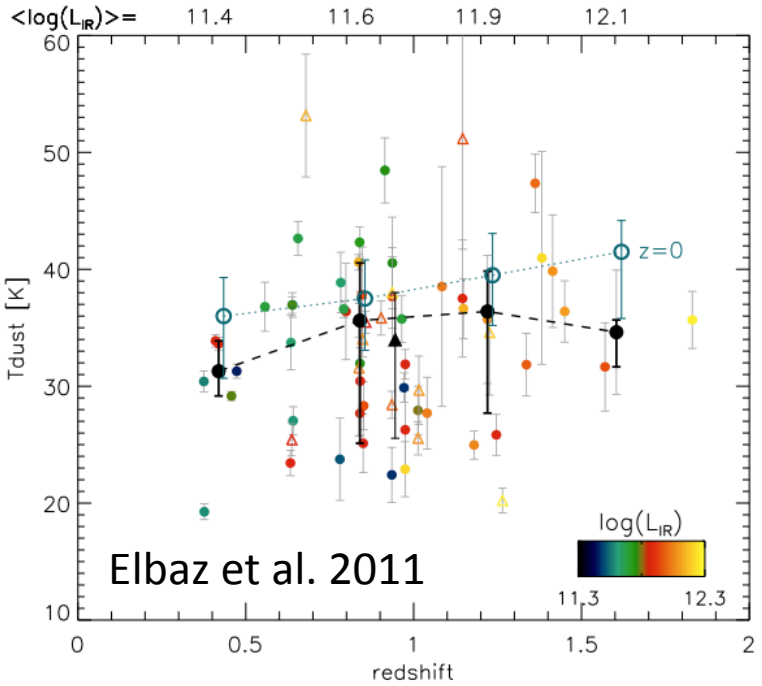
- Whether ISM in host galaxy heated by AGN? (Luminosity-Temperature diagram)
- Is there more neutral hydrogen absorption from host galaxy rather than torus component? (Hardness ratio)

L-T DIAGRAM

- Using simple graybody-fit by assuming a constant emissivity β = 1.5 with equation: $F_\nu = \nu^\beta B_\nu(\nu, T).$



Existence of AGN is not affect the cold dust temperature of host galaxy in our samples.



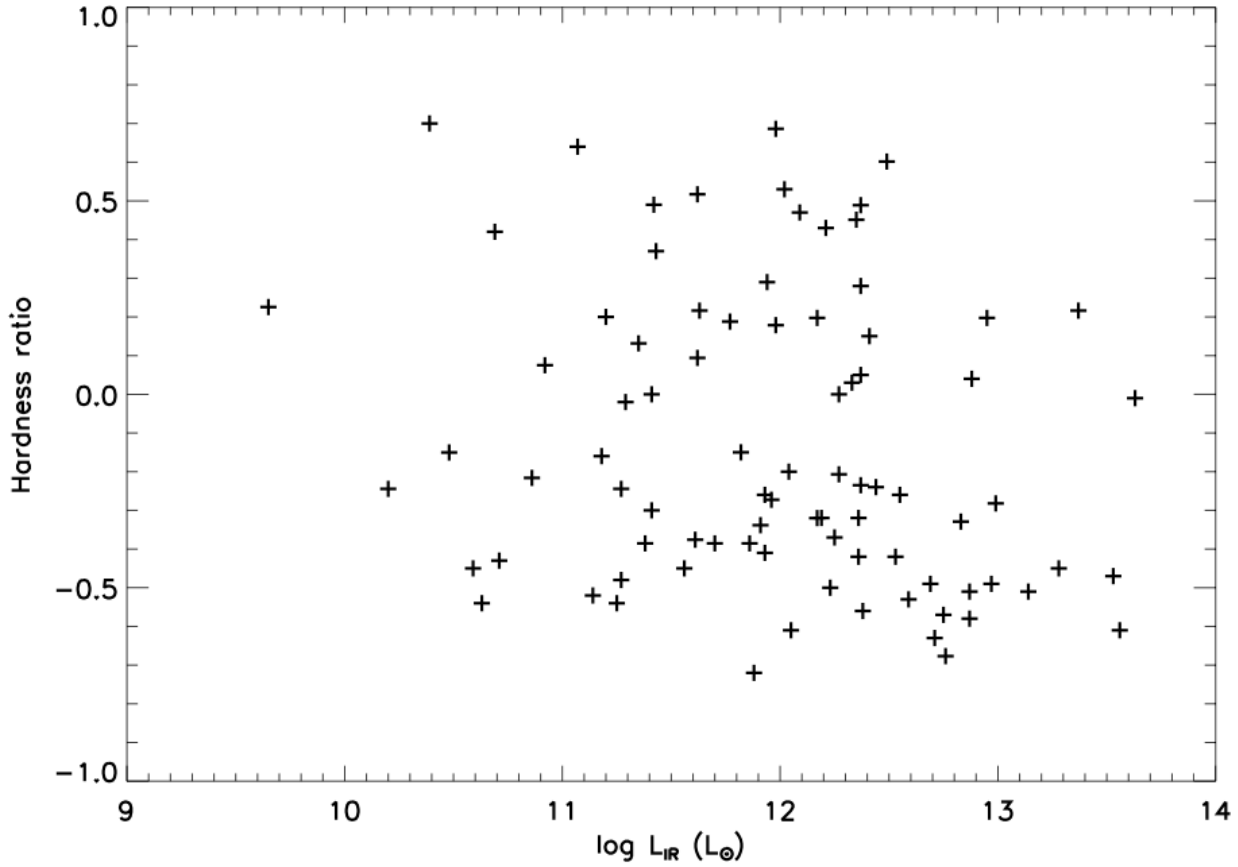
Elbaz et al. 2011

HARDNESS RATIO

- Central Engine obscuration indicator :

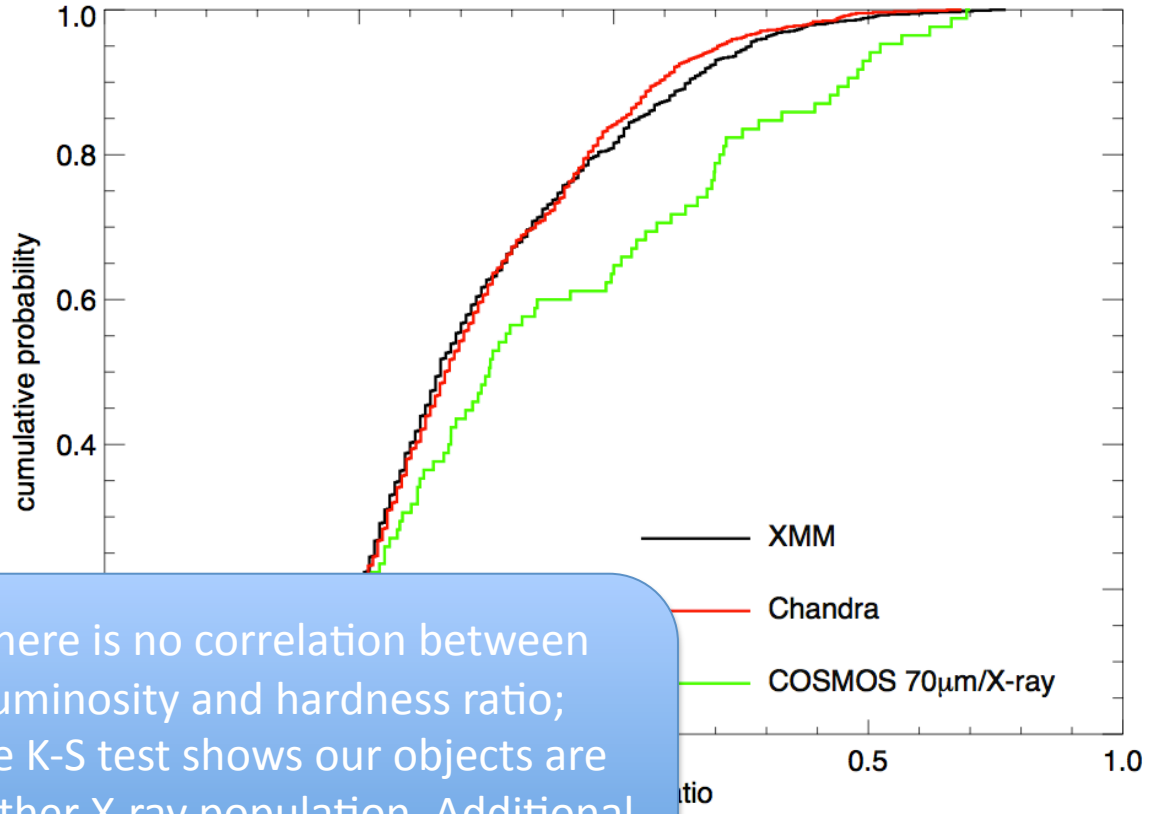
$$HR = (H - S) / (H + S)$$

S : 0.5 – 2 keV
H : 2.0 – 10.0 keV



HARDNESS RATIO

- K-S Test Hypothesis : Samples come from same population.



ant level	Hypothesis: same
	Can not reject (99% CL)
	Reject (99% CL)
	Reject (99% CL)

Although there is no correlation between infrared luminosity and hardness ratio; however the K-S test shows our objects are different to other X-ray population. Additional neutral hydrogen generate by mergers could produce more X-ray obscuration.

SUMMARY

- ★ AGN diagnosis shows the AGN fraction increases as LIR increases; LX-LIR indicates that although the HMXB/ULX could contribute to hard X-ray, AGN dominates the hard X-ray significantly.

- ★ SED fitting exhibits the evidence of hot gas component, which is considered be heated by AGN. Co-existence of AGN and star formation is common in our samples.

- ★ Although Infrared luminosity does not apparently affect hardness ratio, a K-S test indicates that at 99%CL the 70μm/X-ray targets have larger obscuration than the whole X-ray population.

- ★ Disregarding the presence of AGN, the temperature of galaxy do not differ from pure star-forming galaxy, which is consistent with recent Hershel results but in contrast of our HR K-S test result.

♪ THANKS FOR YOUR LISTENING ♪