The influence of AGN in the host galaxy: the sample

CDFS - Groth Strip – WHDF



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Introduction

- The role of AGN in the formation and evolution of galaxies = not well established yet.
- Correlation between bulge and SBH masses (Magorrian et al. 1998, Ferrarese & Merritt 2000) = galaxy bulges and SBH formed at same time in similar conditions ?
- Same correlation in starbursts between CMO & bulges (Ferrarese et al. 2006, Wehner & Harris 2006).
- Not clear if the AGN is an isolated episode in the life of galaxies, a random process (given that the SBH is already there) or a fundamental process.

Our Aims

- Quantify the amount of overlap between starburst/nuclear activity.
- Characterize the fraction of mergers and their level of nuclear activity.
- Study the relation between SBH/CMO mass and host galaxy luminosity and velocity dispersions.
- Determine the fraction of obscured AGNs and characterize their properties.

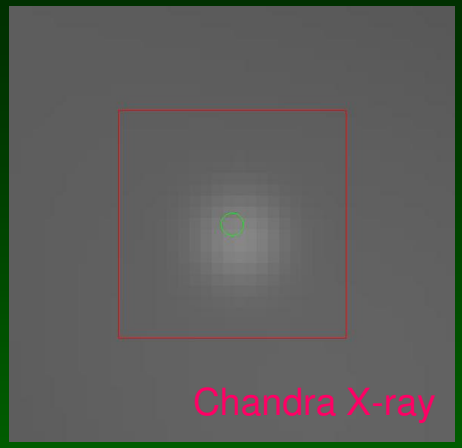
Sample selection: photometric data

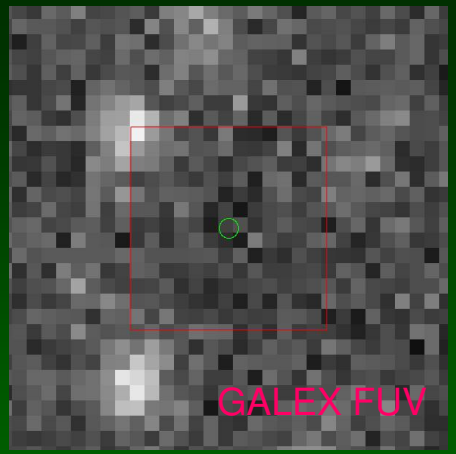
- **CDFS** (35 AGNs selected in X-rays and Mid-infrared).
- **Groth Strip** (43 AGNs selected in X-rays and Mid-infrared).
- **WHDF** (28 AGNs selected in X-rays).

TOTAL = 106 objects classified as AGNs with photometric data from hard X-rays to Mid-infrared.

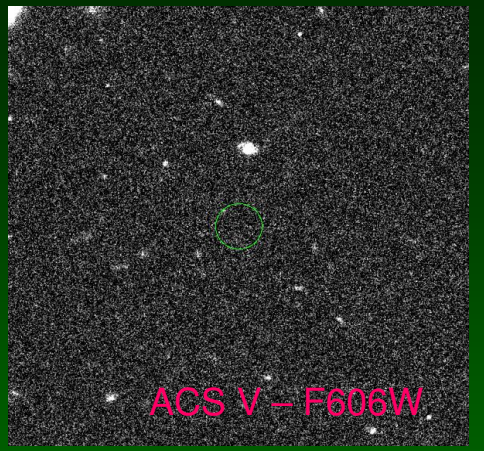
CDFS (3h 32m 28s -27º 48’ 30’’)

- 35 AGNs from the total sample of Alonso-Herrero et al. (2006).
- X-ray (Chandra) and Mid-infrared data (Spitzer) from Alonso-Herrero et al. (2006).
- Visible (MUSIC-ACS), UV (GALEX, WFI), and Near-infrared data (ISAAC) from G. Barro & J. Gallego CDFS database.


Chandra X-ray

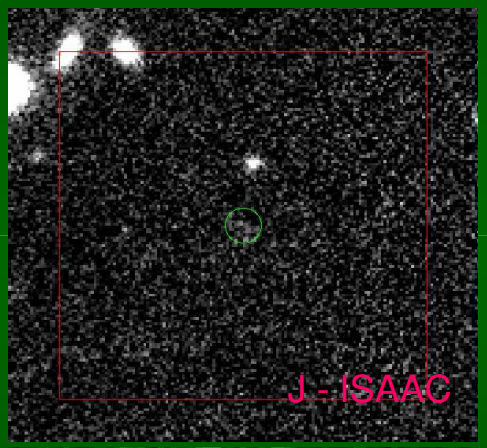

GALEX FUV

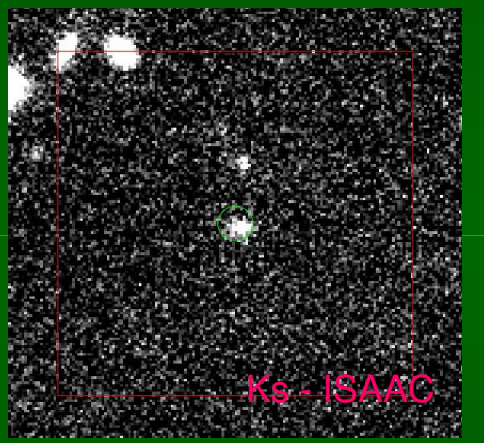

ACS B – F435W

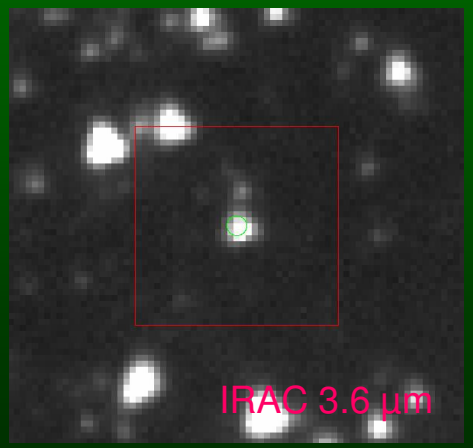

ACS V – F606W

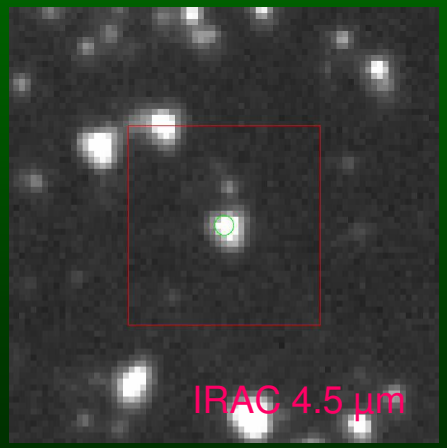

ACS I – F775W

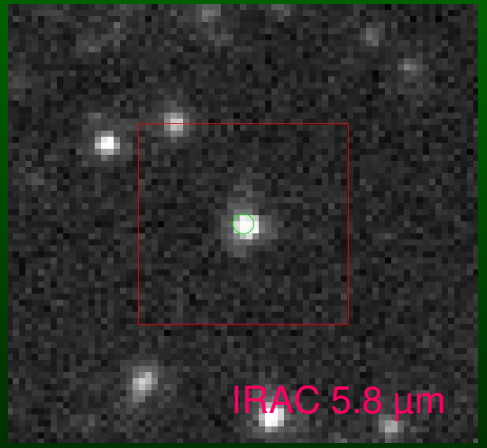

ACS Z – F850LP

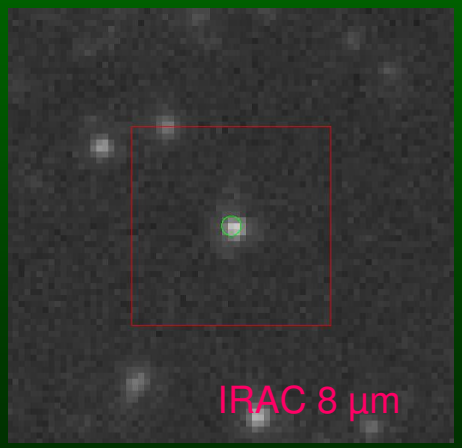

J - ISAAC


Ks - ISAAC

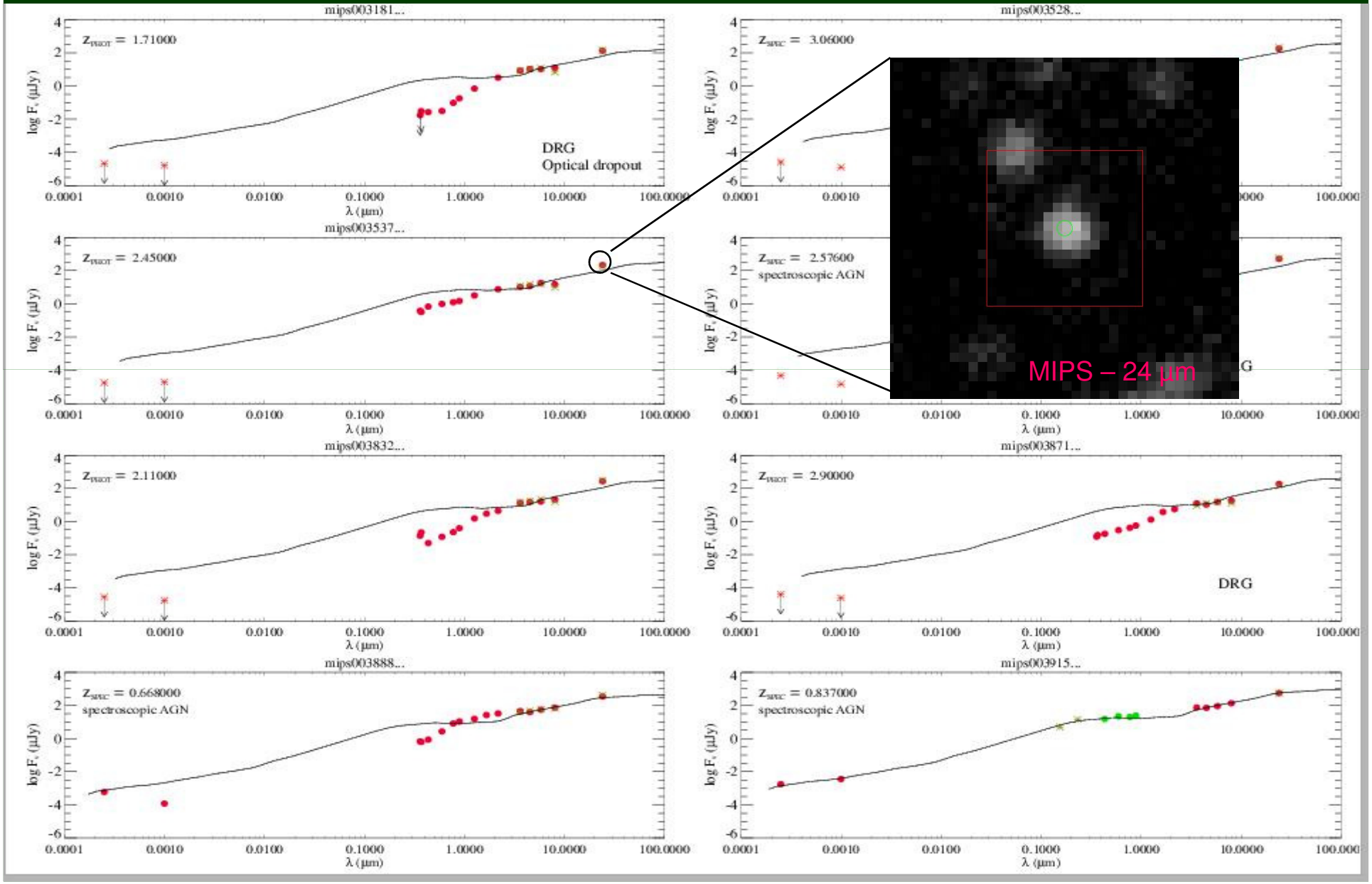

IRAC 3.6 µm


IRAC 4.5 µm


IRAC 5.8 µm

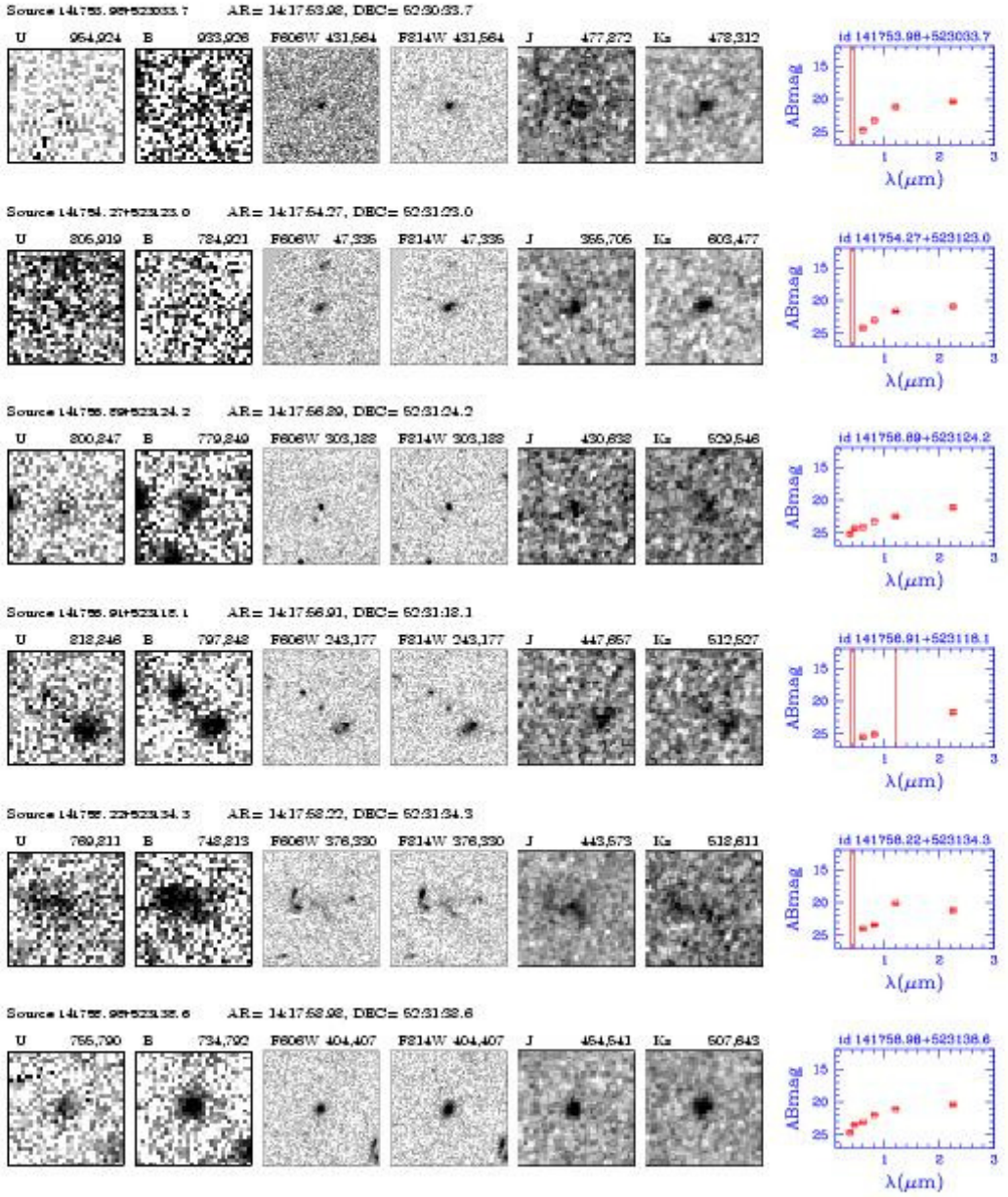

IRAC 8 µm

Spectral Energy Distributions.

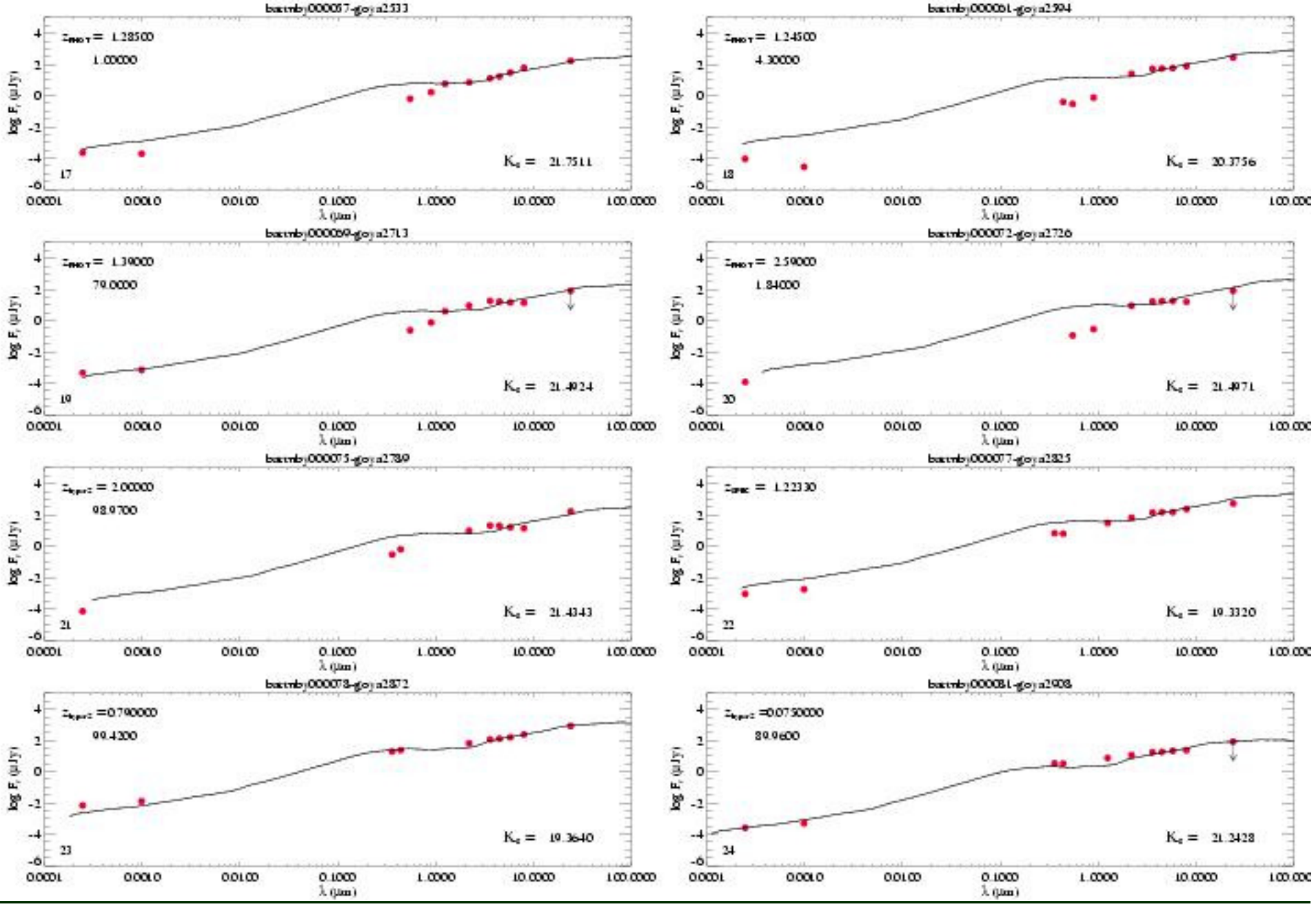


GROTH (14h 17m 43s +52º 28’ 25’’)

- 43 AGNs from the total sample of Barmby et al. (2006).
- Mid-infrared data (Spitzer) from Barmby et al. (2006).
- X-ray data (Chandra & XMM) from G. Barro & J. Gallego Groth database.
- U, B (WFC / INT), F606W, F814W (HST / ACS) and J, Ks (INGRID / WHT) data from GOYA database.

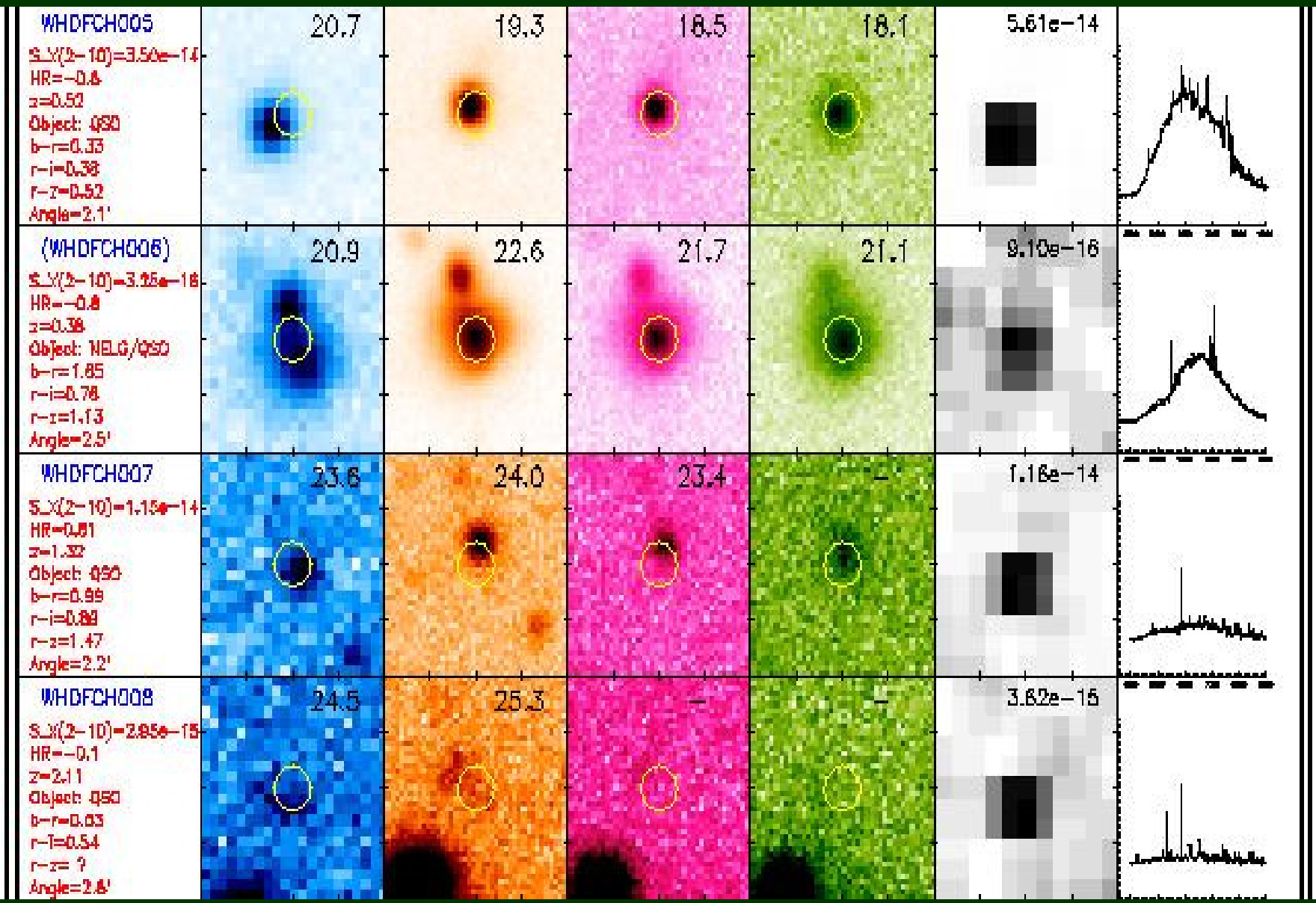

Source 141755.98+523033.7 AR= 14:17:53.98, DEC= 52:30:33.7
U 954,924 B 933,926 F606W 431,564 F814W 431,564 J 477,272 Ks 478,312
id 141753.98+523033.7
ABmag
λ(μm)
Source 141754.27+523123.0 AR= 14:17:54.27, DEC= 52:31:23.0
U 806,919 B 784,921 F606W 47,335 F814W 47,335 J 366,705 Ks 603,477
id 141754.27+523123.0
ABmag
λ(μm)
Source 141756.89+523124.2 AR= 14:17:56.89, DEC= 52:31:24.2
U 800,247 B 779,249 F606W 303,182 F814W 303,182 J 430,632 Ks 529,548
id 141756.89+523124.2
ABmag
λ(μm)
Source 141756.91+523118.1 AR= 14:17:56.91, DEC= 52:31:18.1
U 818,246 B 797,248 F606W 243,177 F814W 243,177 J 447,867 Ks 512,527
id 141756.91+523118.1
ABmag
λ(μm)
Source 141756.22+523134.3 AR= 14:17:56.22, DEC= 52:31:34.3
U 769,211 B 748,213 F606W 376,330 F814W 376,330 J 443,573 Ks 512,811
id 141756.22+523134.3
ABmag
λ(μm)
Source 141756.98+523138.6 AR= 14:17:56.98, DEC= 52:31:38.6
U 755,790 B 734,792 F606W 404,407 F814W 404,407 J 464,541 Ks 507,843
id 141756.98+523138.6
ABmag
λ(μm)

Spectral Energy Distributions.



WHDF (0h 22m 33s +0º 20’ 57’’)

- 28 AGNs from the total sample of M. Vallbé’s thesis work.
- X-ray (Chandra) and B, R, I and Z (PFIP/WHT) data from M. Vallbé’s thesis.
- Near-infrared data (UKIRT&CTIO) not-public yet available soon for this sample.


WHDFCH005
S_X(2-10)=3.50e-14
HR=-0.8
z=0.52
Object: QSO
b-r=0.33
r-i=0.38
r-z=0.52
Angle=2.1'
20.7
19.3
18.5
18.1
5.61e-14
(WHDFCH006)
S_X(2-10)=3.65e-16
HR=-0.8
z=0.38
Object: NELG/QSO
b-r=1.85
r-i=0.78
r-z=1.13
Angle=2.5'
20.9
22.6
21.7
21.1
9.10e-16
WHDFCH007
S_X(2-10)=1.15e-14
HR=0.81
z=1.32
Object: QSO
b-r=0.99
r-i=0.89
r-z=1.47
Angle=2.2'
23.6
24.0
23.4
1.16e-14
WHDFCH008
S_X(2-10)=2.85e-15
HR=-0.1
z=2.11
Object: QSO
b-r=0.03
r-I=0.54
r-z= ?
Angle=2.6'
24.5
25.3
3.62e-15

Planned observations

- **CDFS** z = [0.54, 3.6] to be observed with Flamingos-II / VLT (November 2007).
- **GROTH** z = [0.43, 1.26] to be observed with LIRIS / WHT (April 2008).
- **WHDF** z = [0.21, 1.32] to be observed with LIRIS / WHT (September 2007).

First analysis

Photometric data allow to determine SEDs slopes: $f_U = U^{\alpha}$

- red power-law SEDs ($\alpha < 0$)
- blue power-law SEDs ($\alpha > 0$)

High X-ray-to-optical ratio sources = redder power-law slopes.

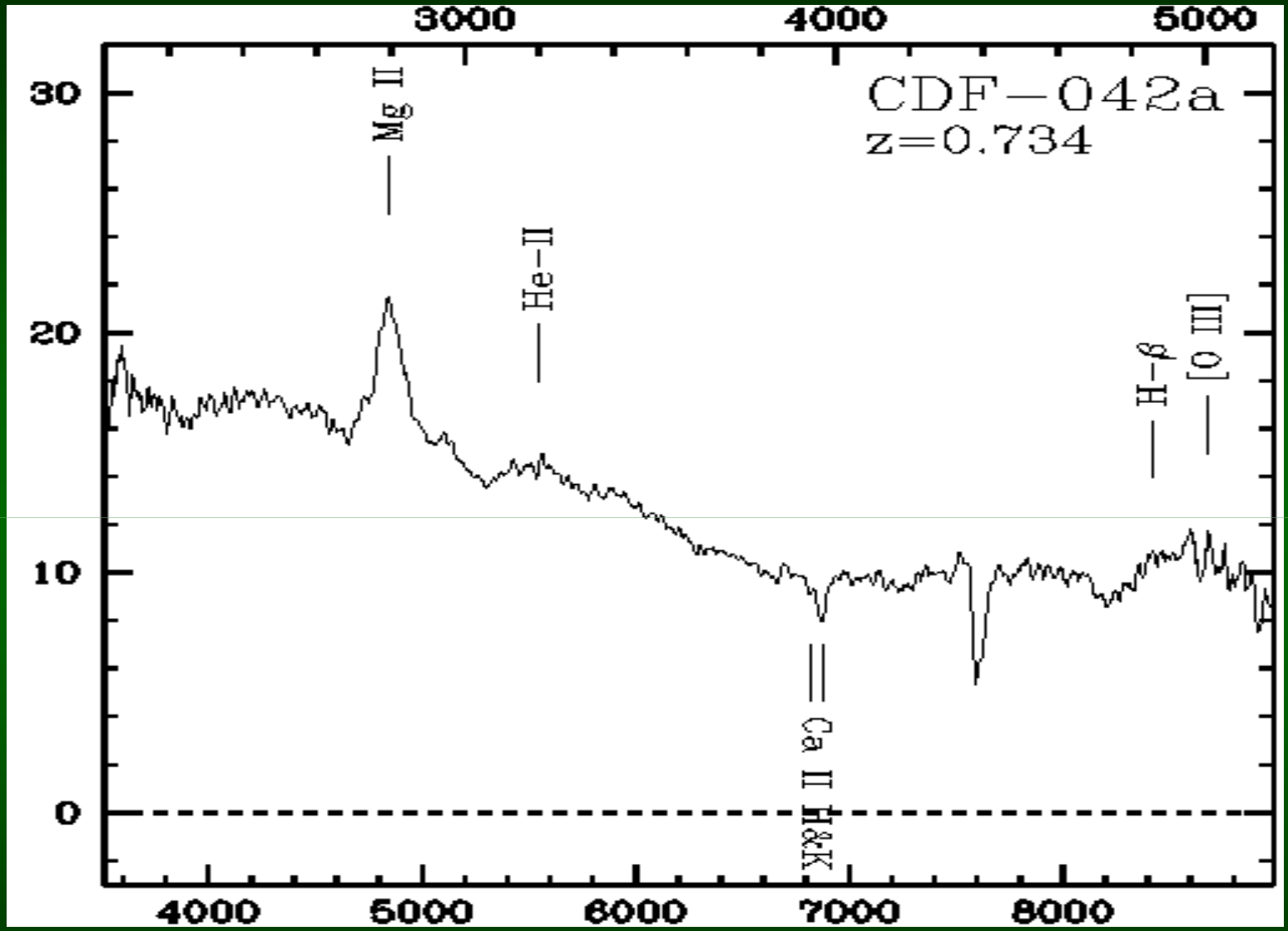
- **CDFS** : IRAC slopes obtained by Alonso-Herrero et al. (2006), $\alpha = [-2.8, -0.5]$.

  Optical slopes obtained through our SEDs, $\alpha = [-4.6, -0.1]$
- **Groth** : IRAC slopes obtained by Barmby et al. (2006), $\alpha = [-2.0, 1.9]$.

CDFS

ID Alonso	IRAC slope	Optical slope	HR	z	Dropout	DRG	AGN	K_S mag
mips000243	-0.55	-3.38	0.42	1.56*	yes	yes	-	21.99
mips000309	-0.62	-0.51	0.16	0.73	no	no	BLAGN	18.41
mips000314	-0.82	-1.35	0.71	-	yes	no	-	<26.01
mips002613	-0.51	-1.24	0.73	-	no	no	-	<23.25
mips003068	-2.00	-2.11	0.81	-	yes	no	-	<26.98
mips003108	-0.50	-2.52	0.39	3.61	no	no	BLAGN	21.40
mips003133	-0.63	-1.13	0.70	1.33*	no	no	-	22.97
mips003149	-0.92	-1.65	0.74	2.06*	no	yes	-	22.06
mips003181	-0.44	-2.69	0.68	1.71*	yes	yes	-	22.66
mips003528	-0.94	-0.59	0.79	3.06	no	no	-	22.43
mips003537	-0.55	-1.06	0.57	2.45*	no	no	-	21.71
mips003618	-1.25	-1.07	0.86	2.58	no	yes	BLAGN	22.01
mips003832	-0.54	-2.82	0.73	2.11*	no	no	-	22.30
mips003871	-0.57	-1.55	0.73	2.9*	no	yes	-	22.06
mips003888	-0.70	-3.64	0.92	0.67	no	no	NLAGN	20.10
mips003915	-0.78	-0.54	-0.02	0.84	no	no	BLAGN	<20.93
mips003938	-1.26	-1.85	0.68	2.22	no	no	-	20.81
mips004196	-2.15	-3.70	0.72	1.98*	yes	yes	-	23.00
mips004258	-0.92	-1.78	0.23	1.61	no	no	BLAGN	20.93
mips004281	-1.14	-3.20	0.67	0.54	no	no	NLAGN	<21.54
mips009708	-0.64	-0.97	0.25	1.92	no	no	NLAGN	21.47
mips009757	-1.09	-3.08	0.95	1.22	no	no	NLAGN	22.08
mips010694	-0.95	-2.17	0.77	2.11*	yes	yes	-	22.87
mips010697	-1.91	-2.04	0.19	1.60	no	no	BLAGN	20.59
mips010785	-2.82	-2.05	0.64	2.29	no	yes	NLAGN	21.88
mips010787	-0.73	-3.35	0.09	1.62	no	no	BLAGN	21.05
mips010818	-0.91	-2.24	0.64	-	no	no	-	<25.02
mips010823	-1.08	-0.94	0.46	1.61	no	no	-	<23.08
mips012310	-0.79	-3.32	0.94	-	yes	no	-	<25.93
mips013087	-1.28	-0.60	-0.04	1.03	no	no	BLAGN	<19.60
mips013611	-0.79	-1.38	0.21	0.54	no	no	NLAGN	<18.48
mips014635	-0.72	-0.10	0.25	1.22	no	no	-	20.20
mips003485	-1.36	-2.32	0.72	2.73*	yes	yes	-	22.85
mips010760	-0.71	-4.60	0.74	2.21*	yes	yes	-	22.95
mips013065	-1.04	< -0.43	0.76	1.73*	yes	yes	-	23.66

Table 2: Id from Alonso-Herrero et al. (2006), IRAC slope, optical slope, hardness ratio (H-S)/(H+S), with H=hard X-Ray flux and S=soft X-ray flux, spectroscopic redshift (except when is labeled by an asterisk, which means photometric redshift), optical dropout classification, DRG classification, AGN type, and K_S magnitud (AB magnitudes).



GOODS public available optical spectra - CDFS

GROTH

ID Barmby	IRAC slope	Hardness ratio	Redshift	K_S mag
barmby007	-1.47	-0.52	0.23*	19.35
barmby015	1.89	0.23	2.69*	15.29
barmby017	-1.80	-0.04	1.06*	17.80
barmby018	-0.42	-0.36	1.13*	18.50
barmby020	-0.13	0.12	2.00*	17.03
barmby025	0.83	-0.18	1.46*	19.70
barmby026	0.46	0.75	0.81	19.41
barmby027	-0.49	0.69	3.65*	19.33
barmby029	-0.18	-0.26	0.81	18.80
barmby031	-0.78	-	2.36*	19.25
barmby034	-0.74	-	1.30*	20.31
barmby035	-0.38	-0.56	0.50*	18.52
barmby036	-0.37	0.84	4.00*	17.33
barmby037	-0.30	0.51	0.79*	19.41
barmby047	1.48	-	1.57*	18.00
barmby052	-0.98	-0.33	1.26	21.29
barmby057	-2.00	0.07	1.28*	21.75
barmby061	-0.48	0.53	1.24*	20.38
barmby069	0.36	-0.20	1.39*	21.49
barmby072	0.04	-	2.59*	21.50
barmby075	0.51	-	2.00*	21.43
barmby077	-0.60	-0.32	1.22	19.33
barmby078	-0.90	-0.31	0.79*	19.36
barmby081	-0.41	-0.32	0.07*	21.24
barmby086	0.48	-	1.03*	21.07
barmby087	0.64	-	1.15	19.85
barmby090	-1.54	-0.16	1.15	18.30
barmby091	-0.68	0.78	0.87	19.85
barmby092	-0.30	-0.21	0.43	20.25
barmby093	-1.05	0.17	0.99	19.40
barmby099	1.29	0.43	1.00	19.24
barmby100	0.42	-0.05	1.09*	20.46
barmby105	0.89	-0.31	1.00	21.43
barmby106	0.15	-	1.19*	20.65
barmby107	1.00	-	0.62*	19.57
barmby109	-0.54	-0.08	1.00	20.40
barmby110	0.26	-0.40	0.50*	20.93
barmby113	-0.98	-0.05	1.11*	21.11
barmby114	-0.01	-	2.61*	21.68
barmby117	0.62	-	0.48*	21.18
barmby118	0.13	-0.04	0.64	20.39
barmby122	1.15	-	0.99*	20.56
barmby128	1.41	-	2.86*	19.34

Conclusions

- AGN sample completely characterized from X-ray to Mid-infrared + optical spectra, if available.

- Selection of three subsamples to do Near-infrared spectroscopy: recombination lines plus other prominent transitions, as [O III], allow us to infer BH masses, SFR, extinction and ionization parameters.