



AGN-enhanced outflows of low-ionization gas in star-forming galaxies at $1.7 < z < 4.6$

Talia et al. 2017, MNRAS

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In collaboration with:

M. Brusa, A. Cimatti (UniBO), & VUDS



Are AGN special? – Durham, 3 August 2018

CO & [CII] emission lines (molecular phase)

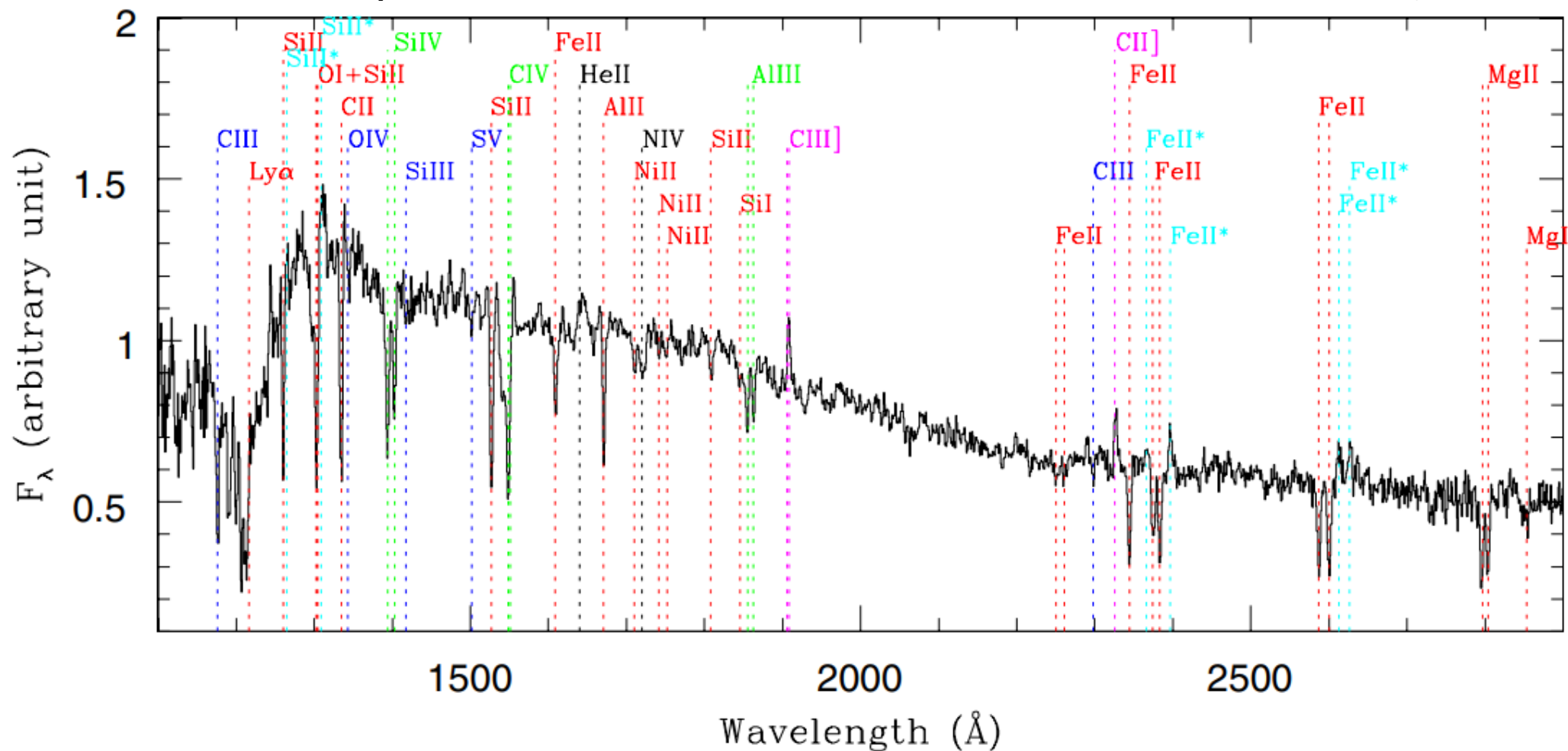
Optical emission lines (ionized phase)

UV absorption lines (neutral/low-ionized phase)

[e.g. Shapley+'03, Steidel+'10, Du+'18]

stacked spectrum of 74 SFGs at $z=2$

Talia et al. 2012



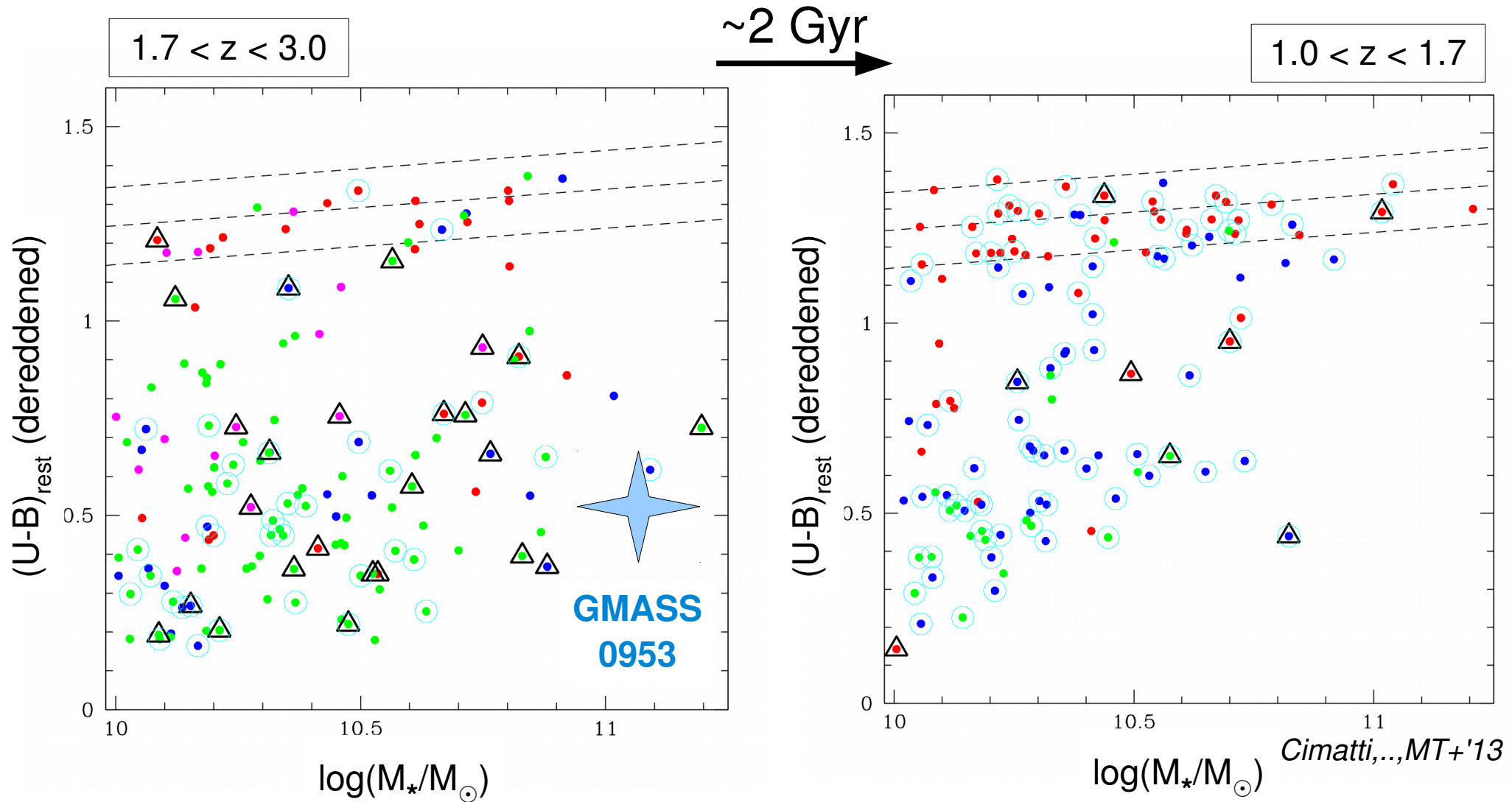
Stellar photospheric absorption lines

Nebular emission lines

Low-ionization IS absorption lines

High-ionization IS absorption lines

Link between galaxy evolution and AGN activity → feedback



At $z \sim 2$ AGN activity might help galaxies suppress their star formation and migrate from the blue cloud to the red sequence

Which is the driving mechanism of the outflow?

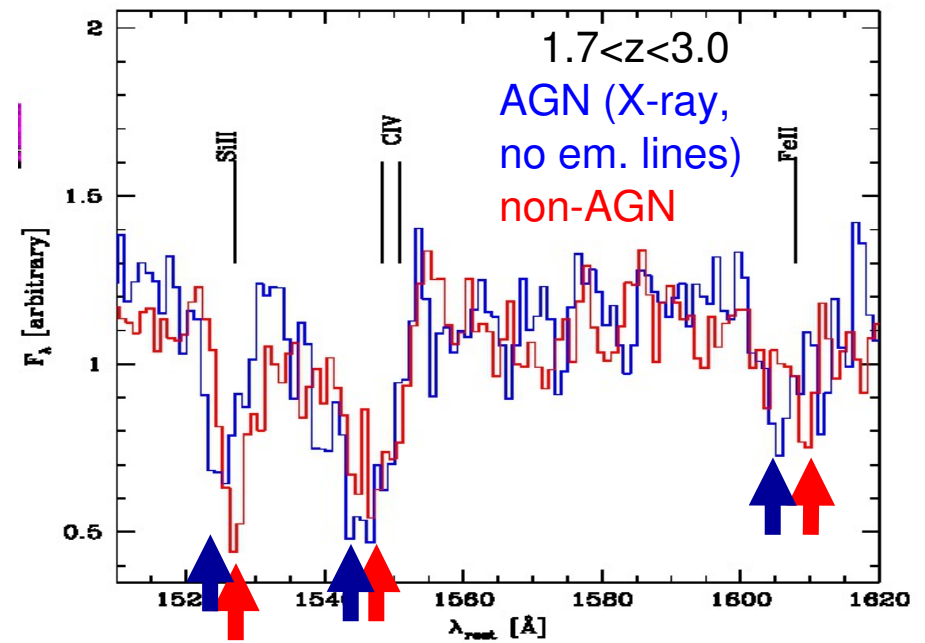
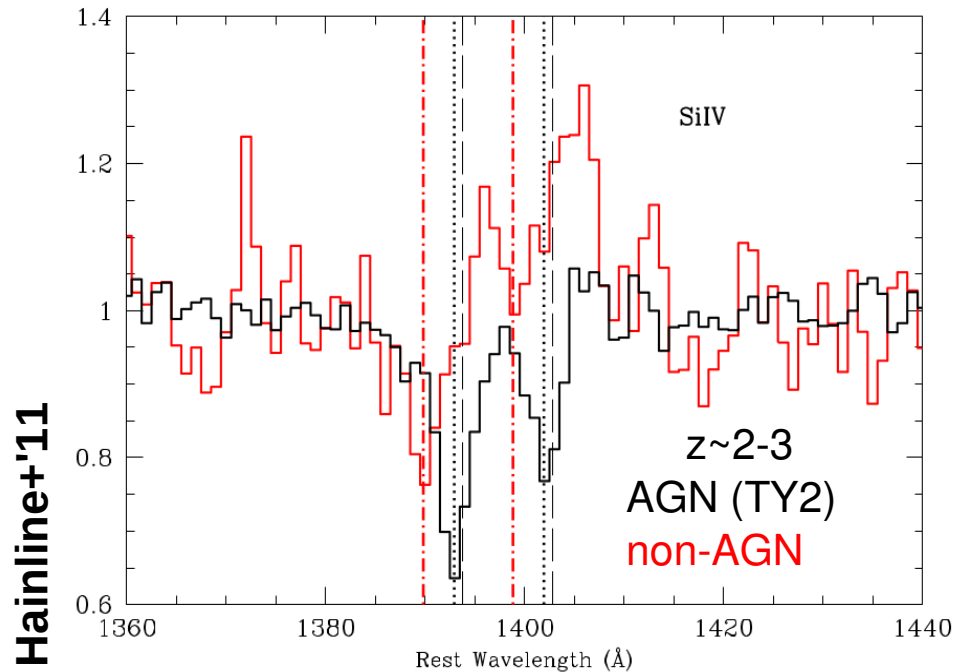
UV absorption lines

Velocities of ~ - 70-100 km/s in SFGs

(e.g. Shapley+'03, Weiner+'09, Talia+'12, Ciccone+'16)

~ - 600-800 km/s in AGN

(e.g. Hainline+'11, Cimatti+'13)



Which is the driving mechanism of the outflow?

UV absorption lines

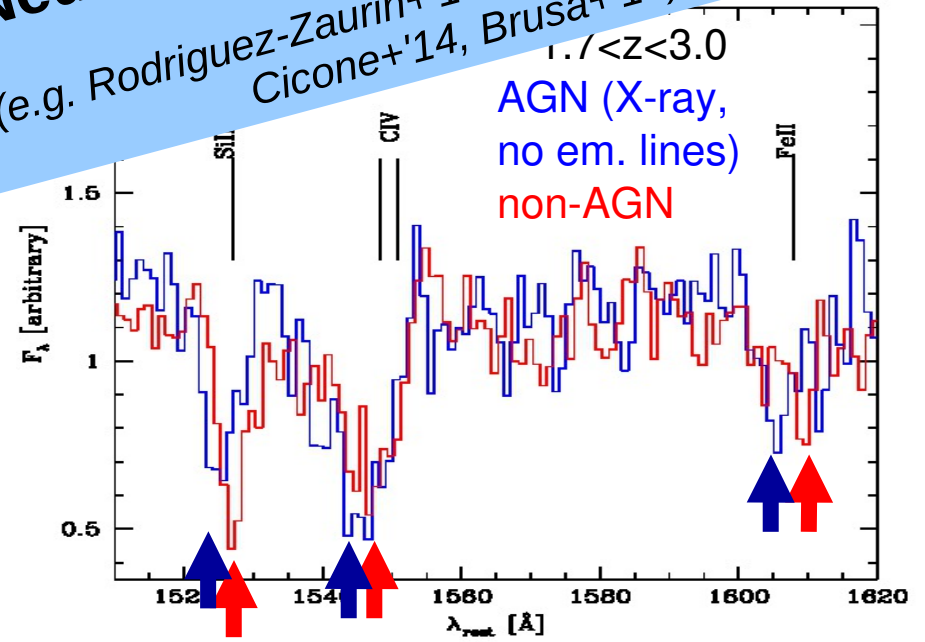
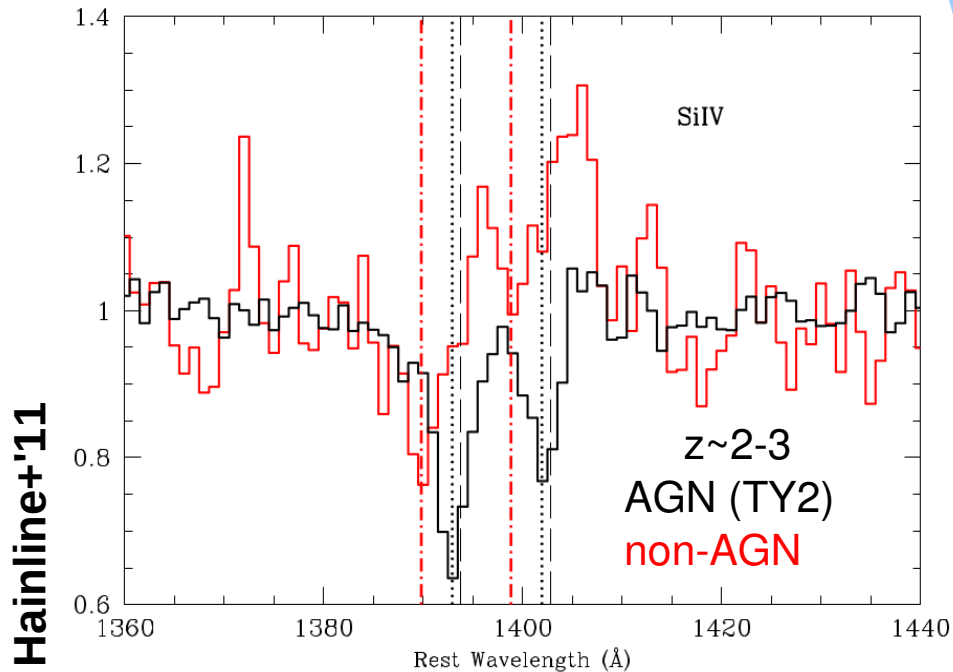
Velocities of ~ - 70-100 km/s in SFGs

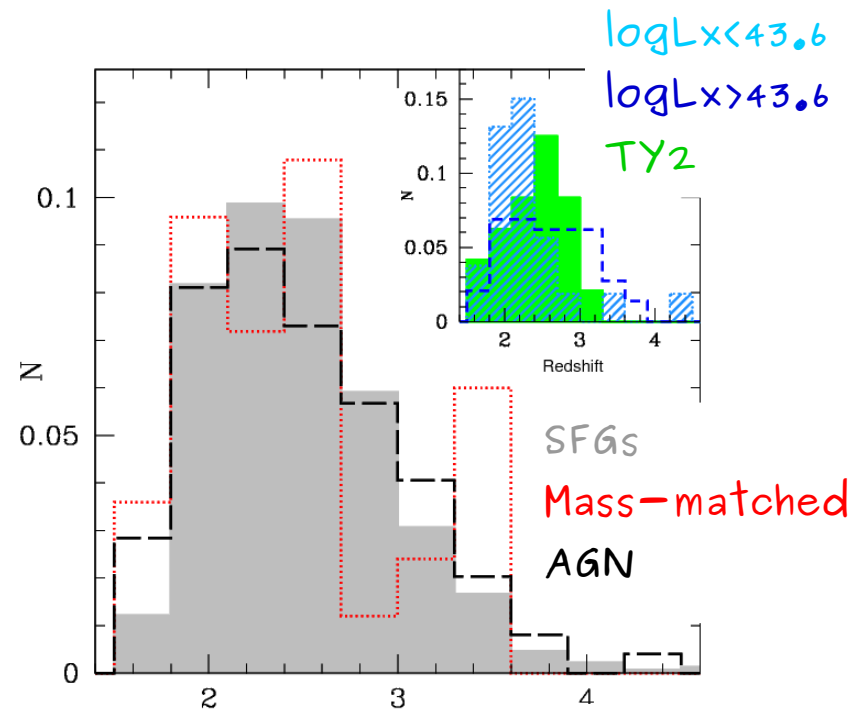
(e.g. Shapley+'03, Weiner+'09, Talia+'12, Ci)

~ - 600-800 km/s in AGN

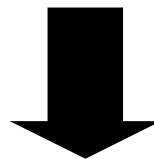
(e.g. Hainline+'11,

Consistent results for all the phases of the outflow: Neutral, Ionized, and Molecular
(e.g. Rodriguez-Zaurin+'13, Förster Schreiber+'13, Cicone+'14, Brusa+'15)

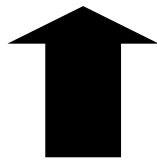




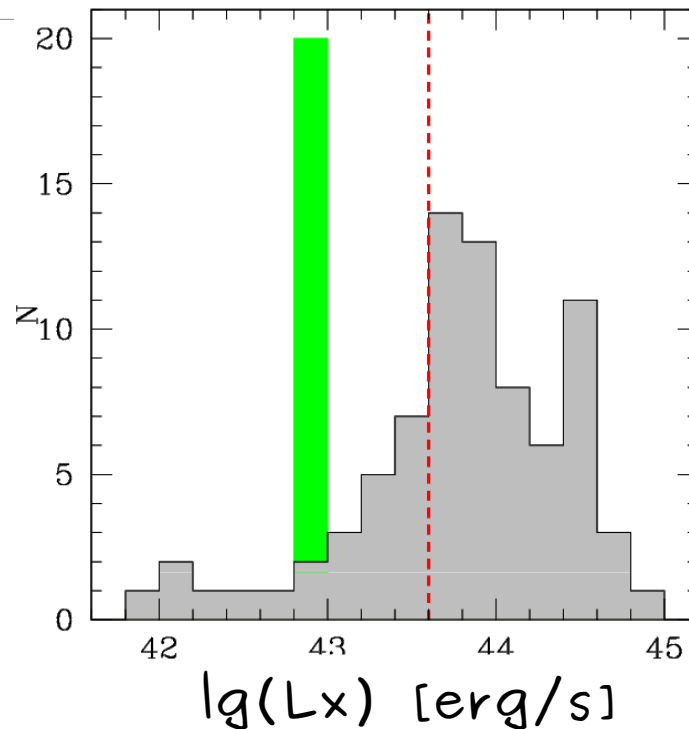
Lx
distribution
of the AGN
sample
(#79+#20)
NO TY1



Redshift



**Redshift
distribution
of the total
sample**



The Data

**GOODS-South +
COSMOS fields**

K < 24

[Grazian+'06, Ilbert+'13]

1.7 < z < 4.6

**AGN identification based
on X-ray from CHANDRA:**

CDFS 7Ms

COSMOS-Legacy

[Luo+'17, Civano+'16, Marchesi+'16]

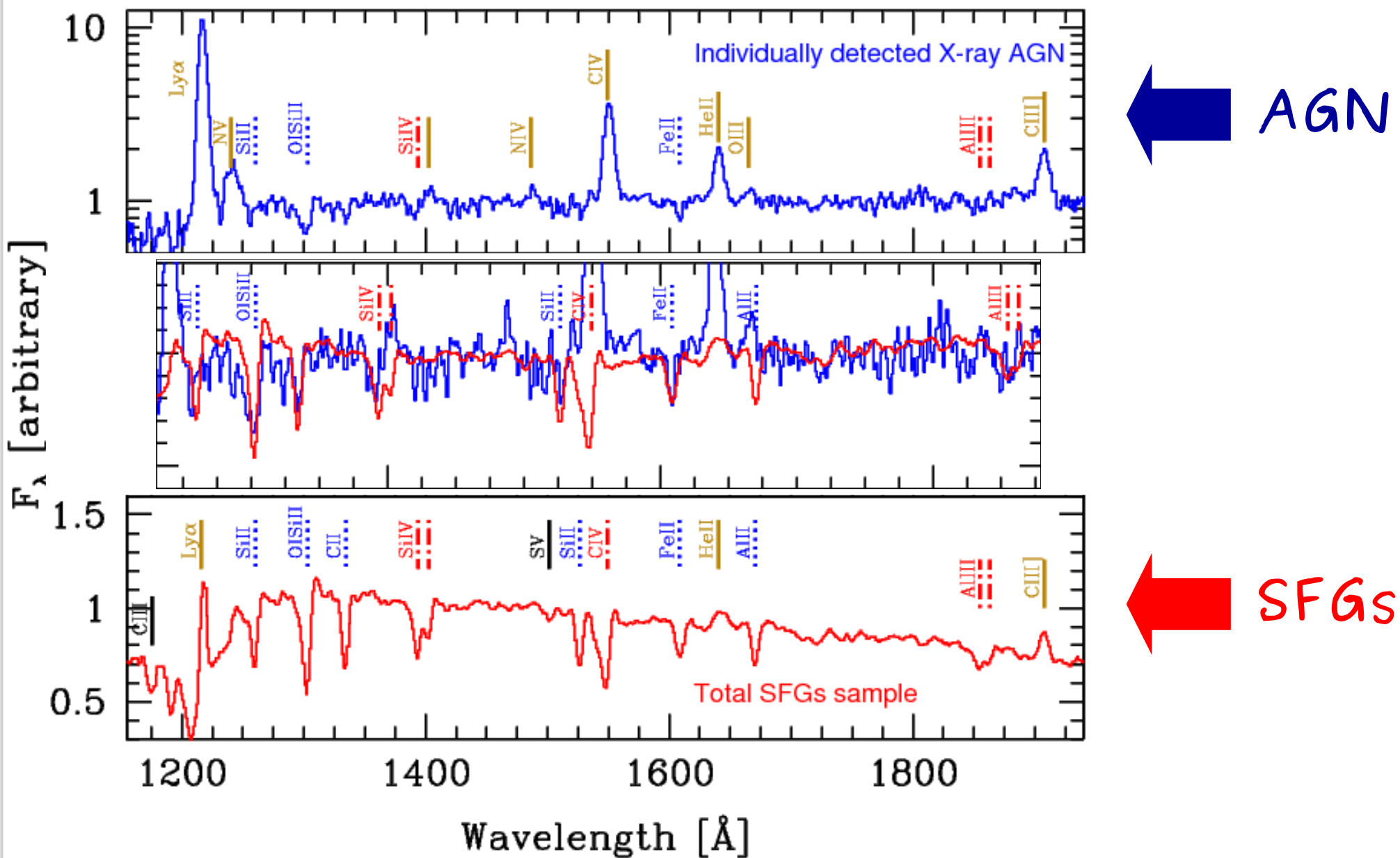
**~ 1400 spectra from:
VUDS**

Public ESO Surveys

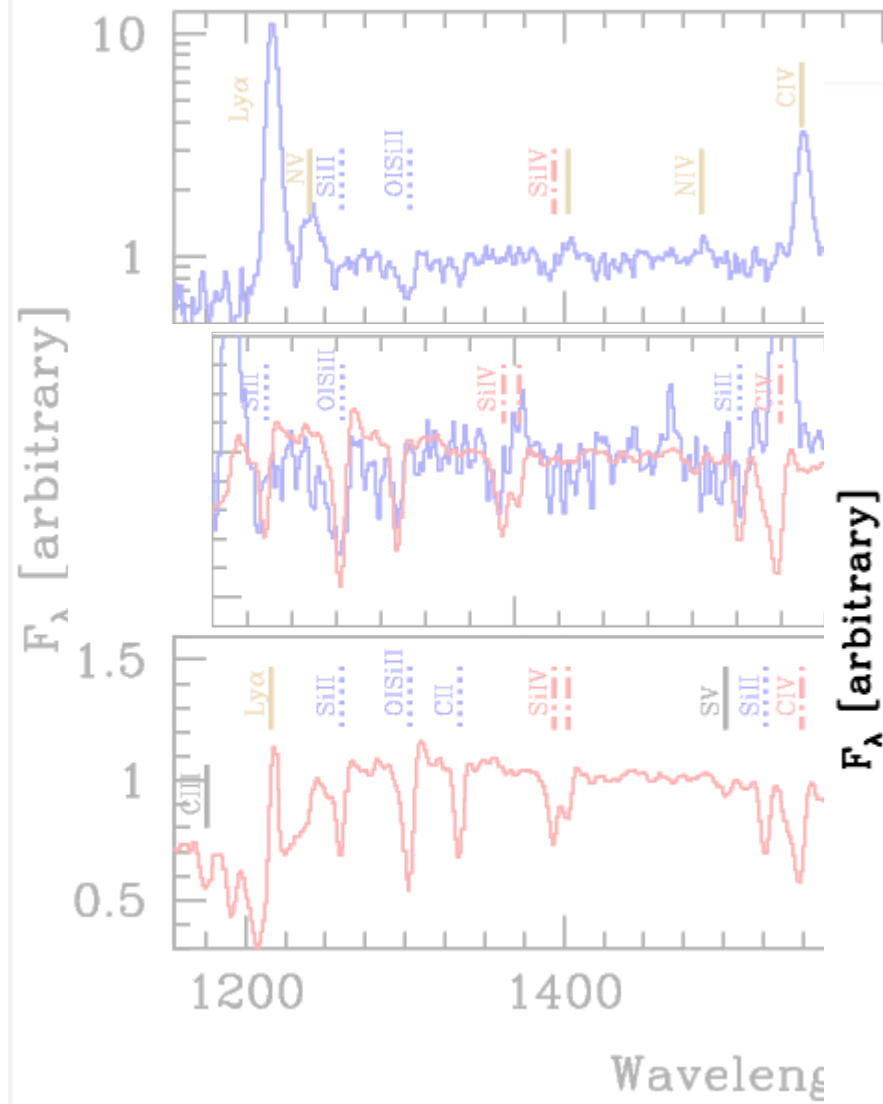
zCOSMOS

[Szokoly+'04, Mignoli+'05, Lilly+'07,
Vanzella+'08, Popesso+'09,
Silverman+'10, Trump+'09,
Kurk+'13, Le Fevre+'15]

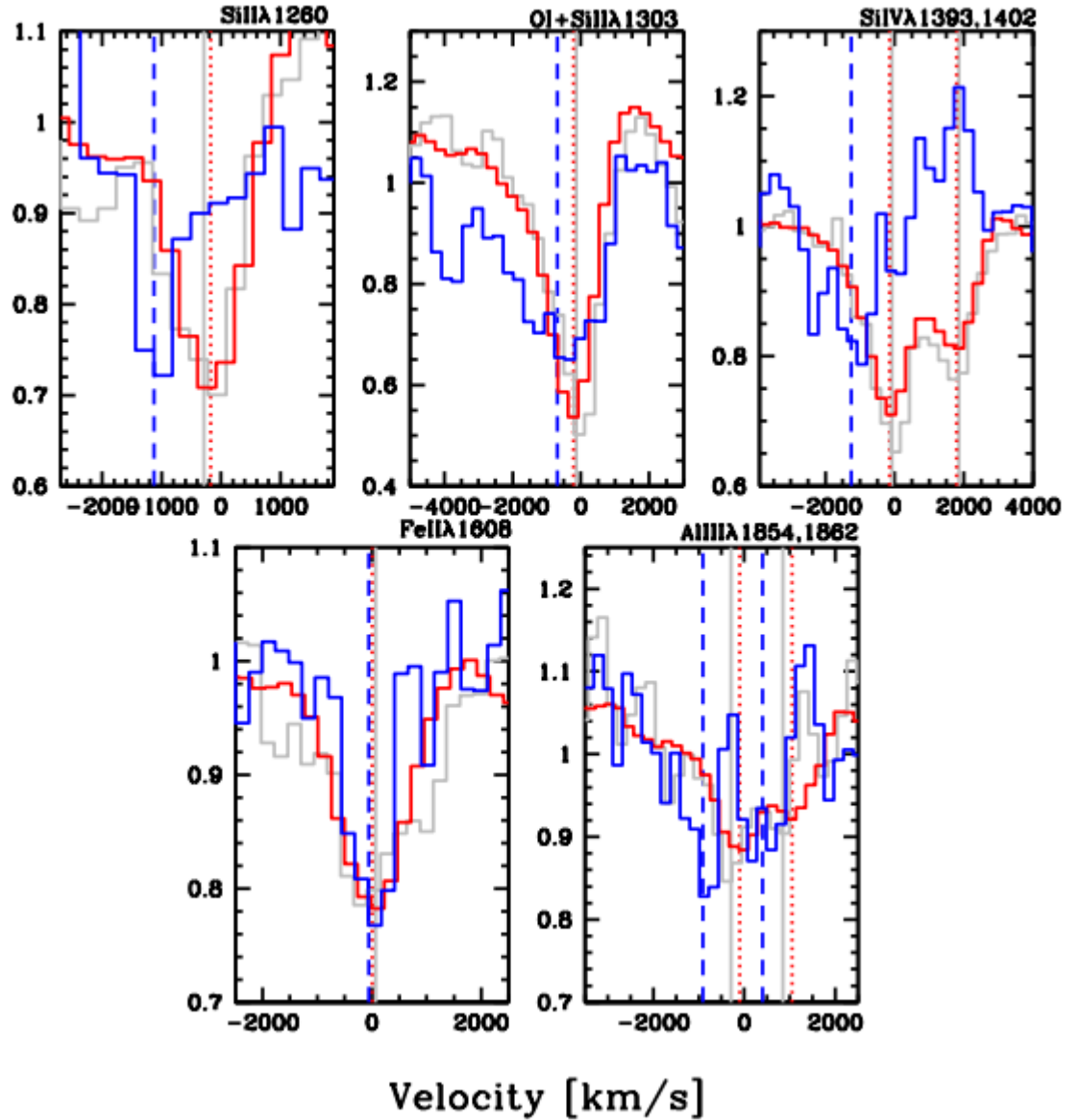
SFGs vs. AGN



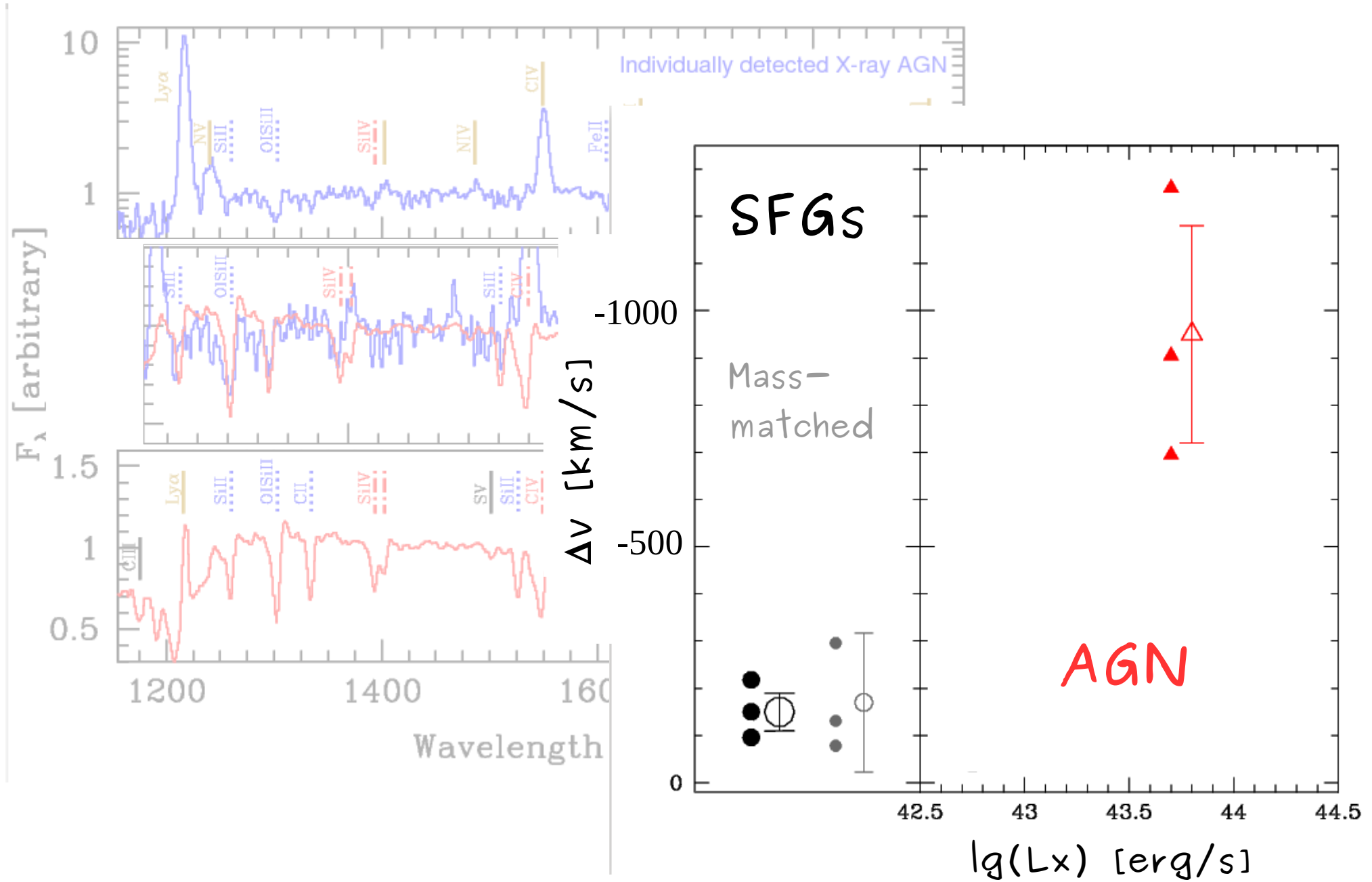
SFGs vs. AGN



Individually detected X-ray AGN



SFGs vs. AGN



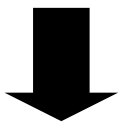
SFGs vs. AGN

SFGs in the same
mass range of the
AGN sample
 $\lg(\text{Mass}) > 10.2$

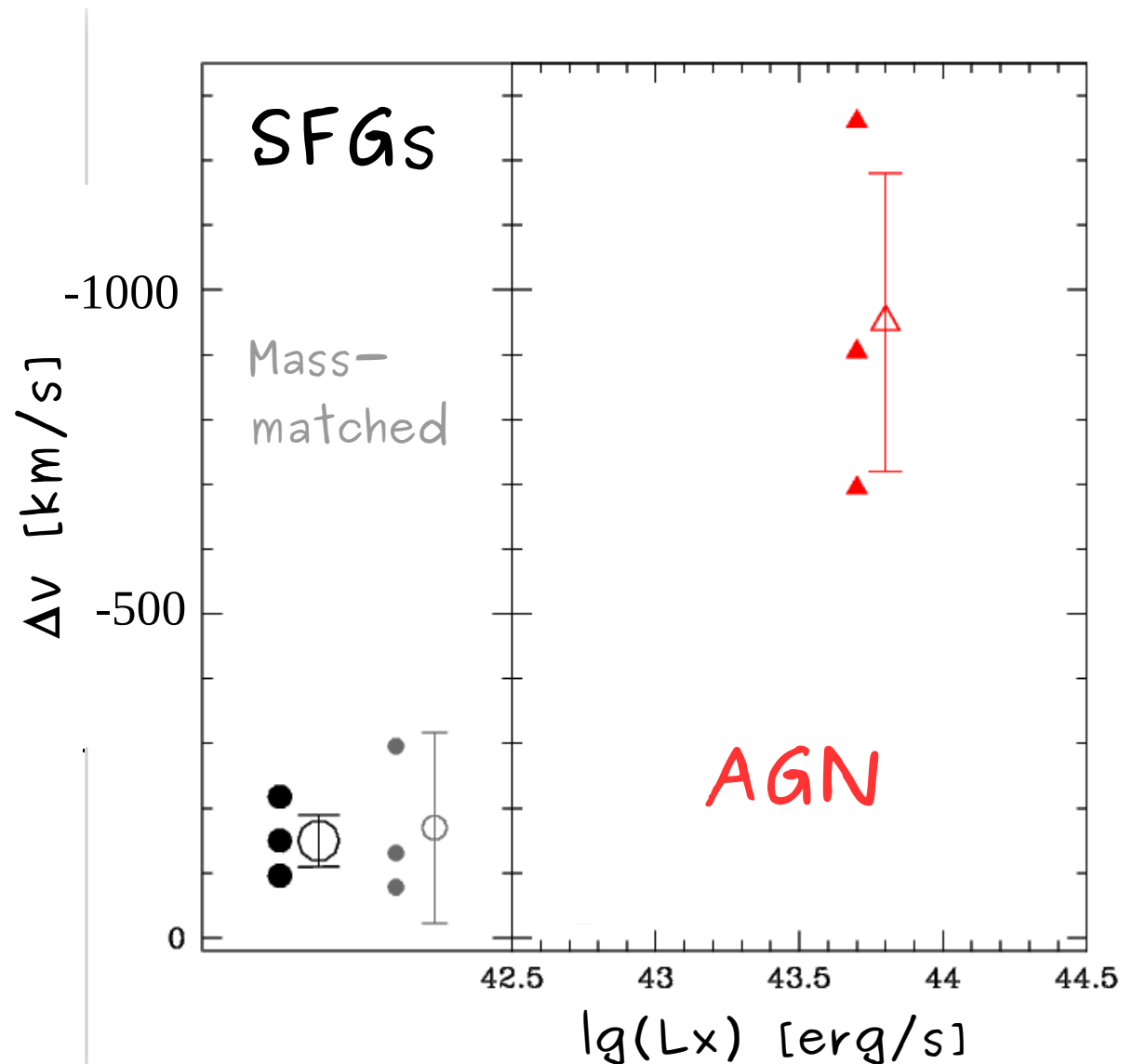


Same result

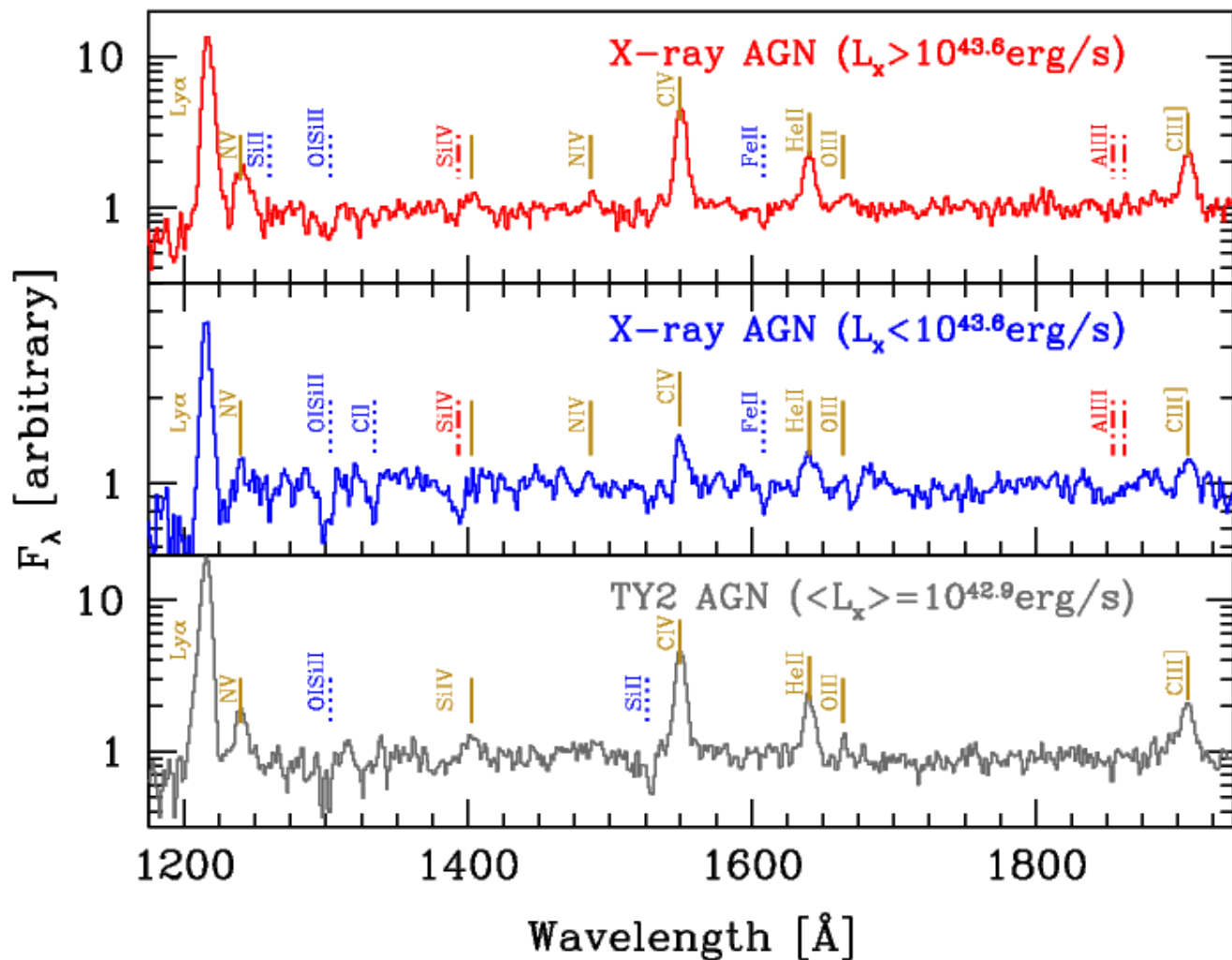
AGN have, on
average, lower
SFR than SFGs (at
fixed stellar mass)



SF cannot be the
only driver of the
outflow

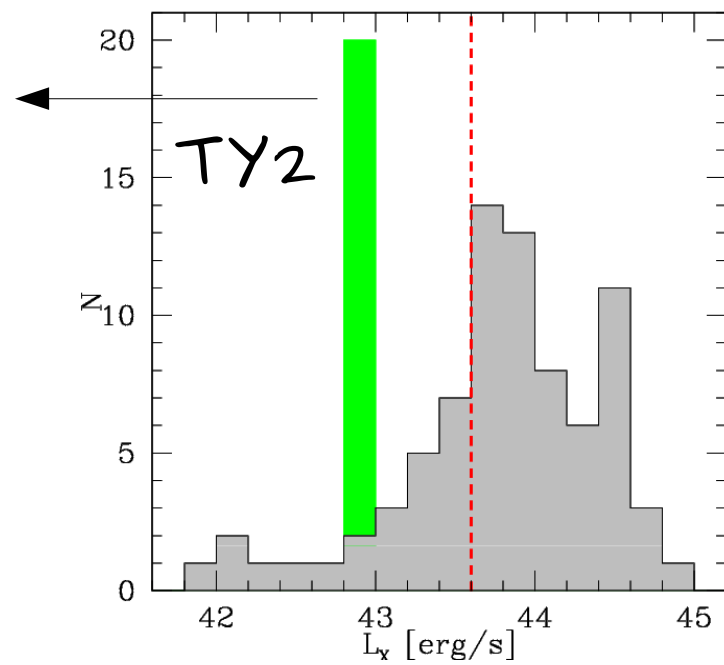


Dependence of Δv on L_x ?

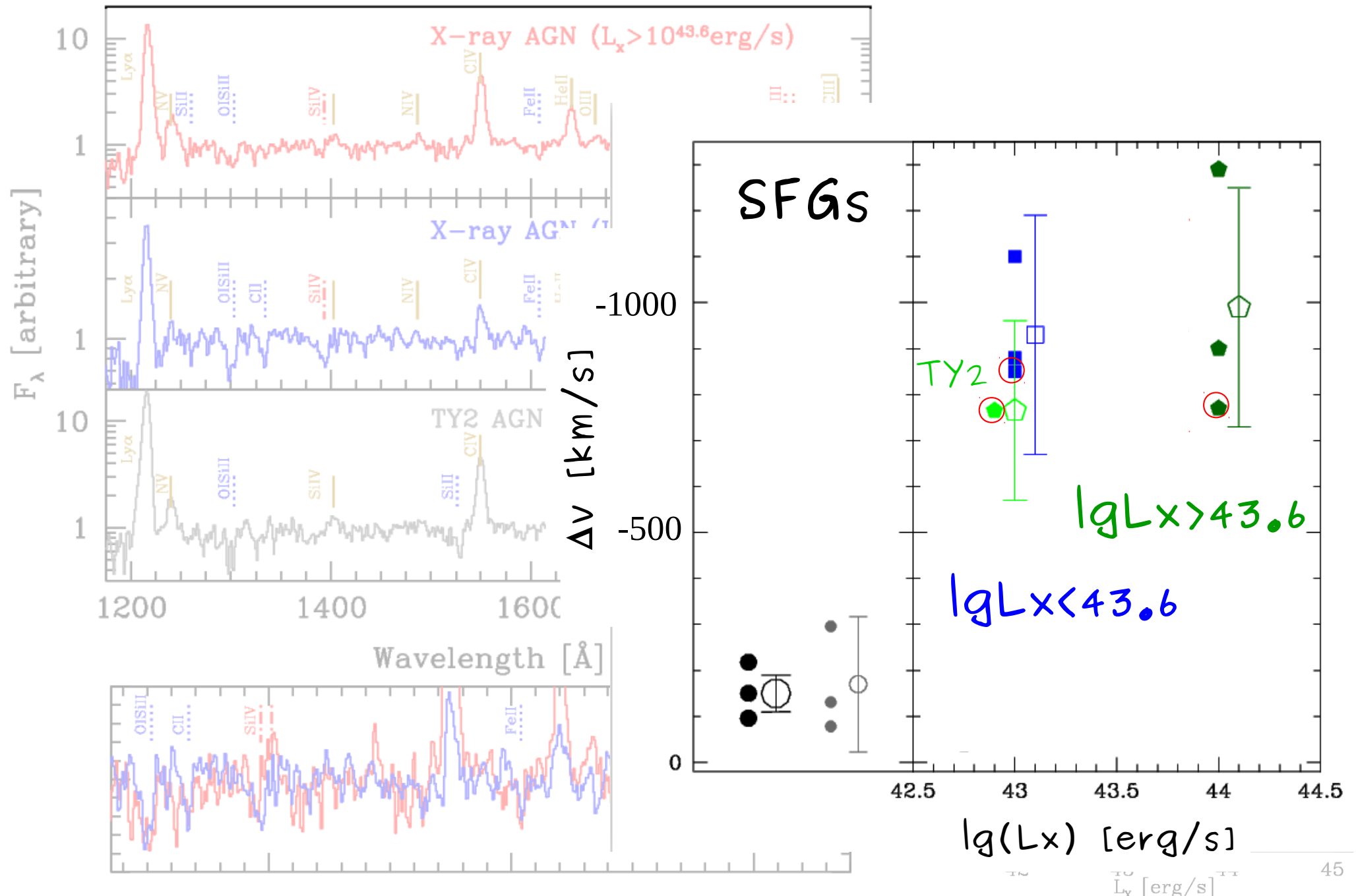


← $\lg L_x > 43.6$

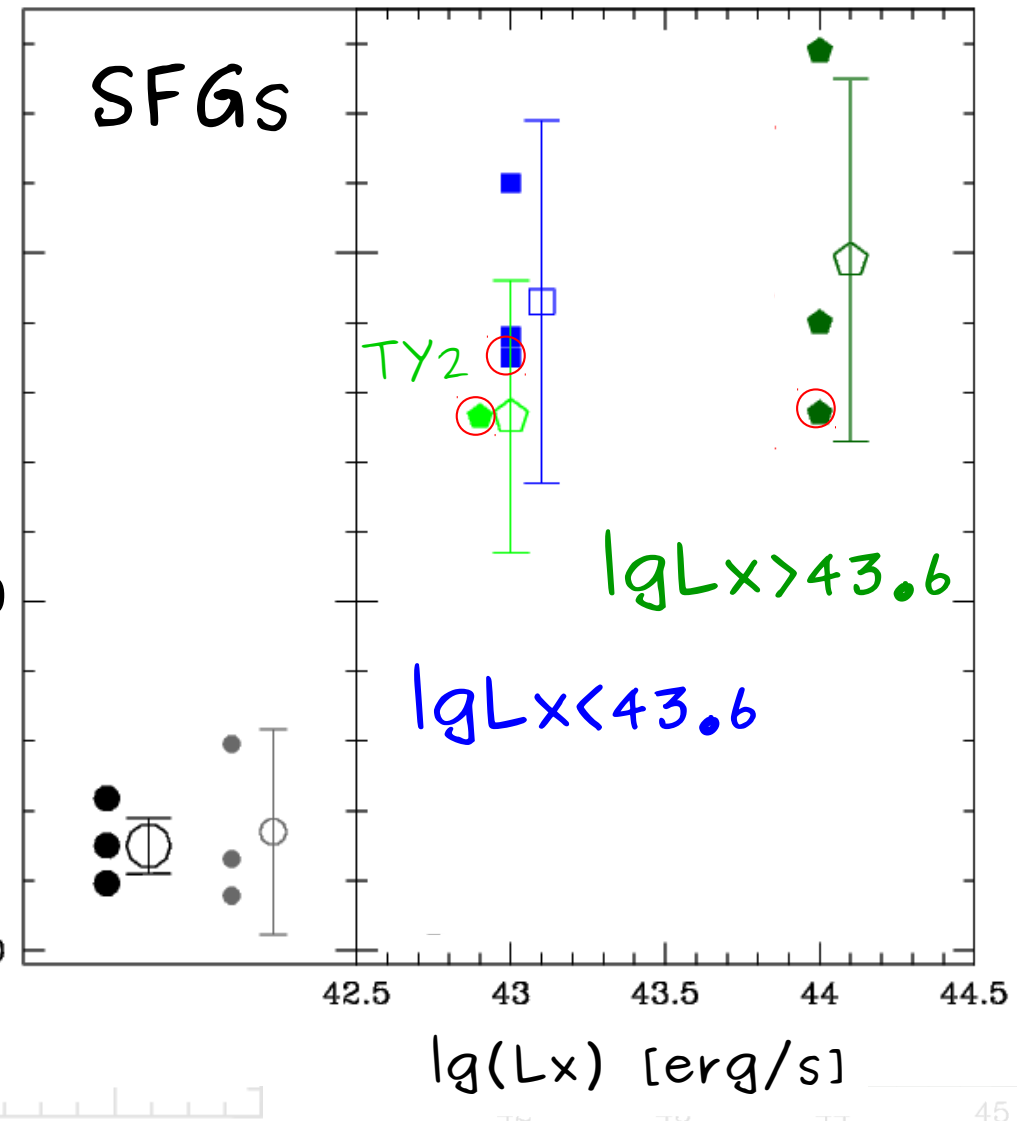
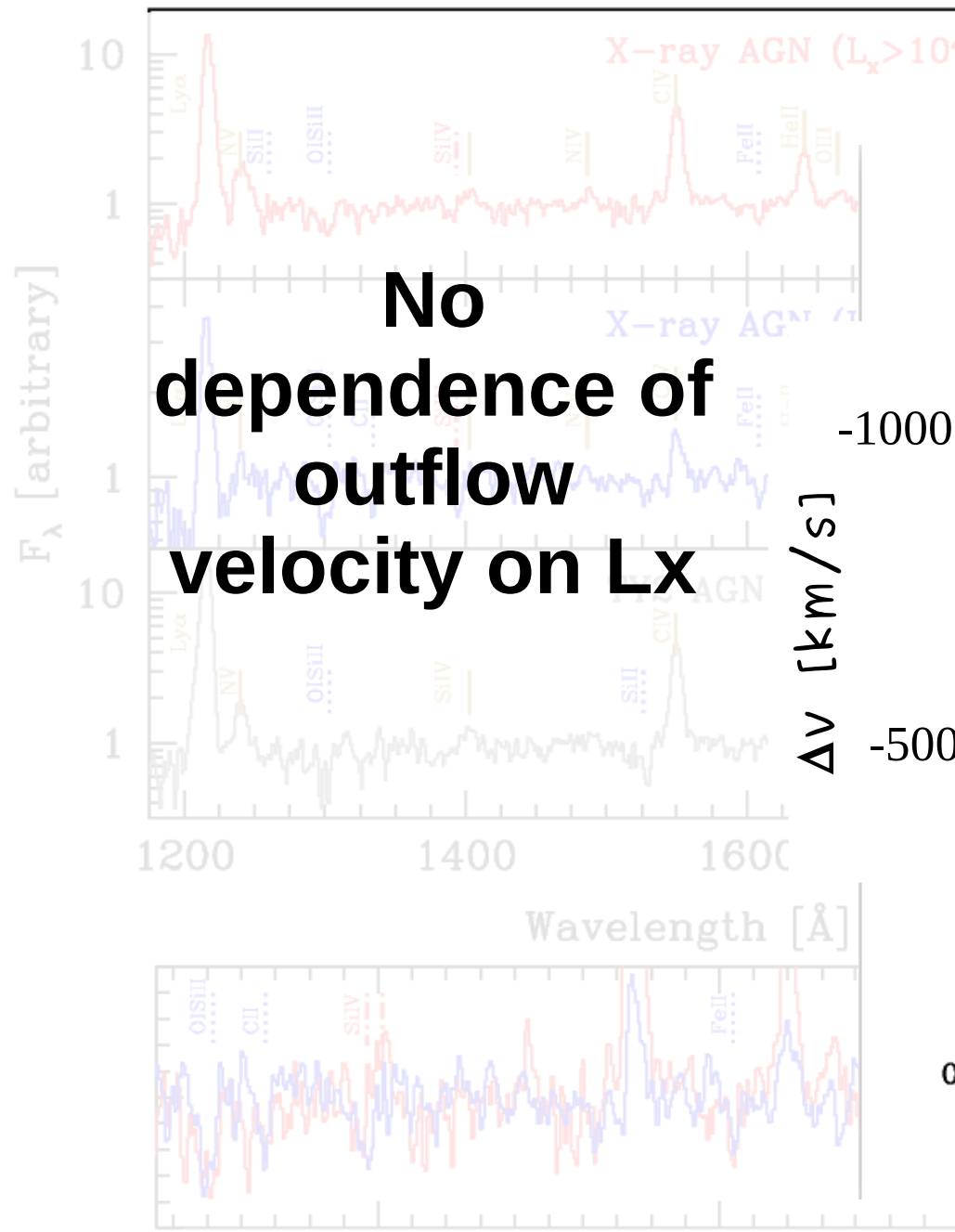
← $\lg L_x < 43.6$



Dependence of Δv on L_x ?

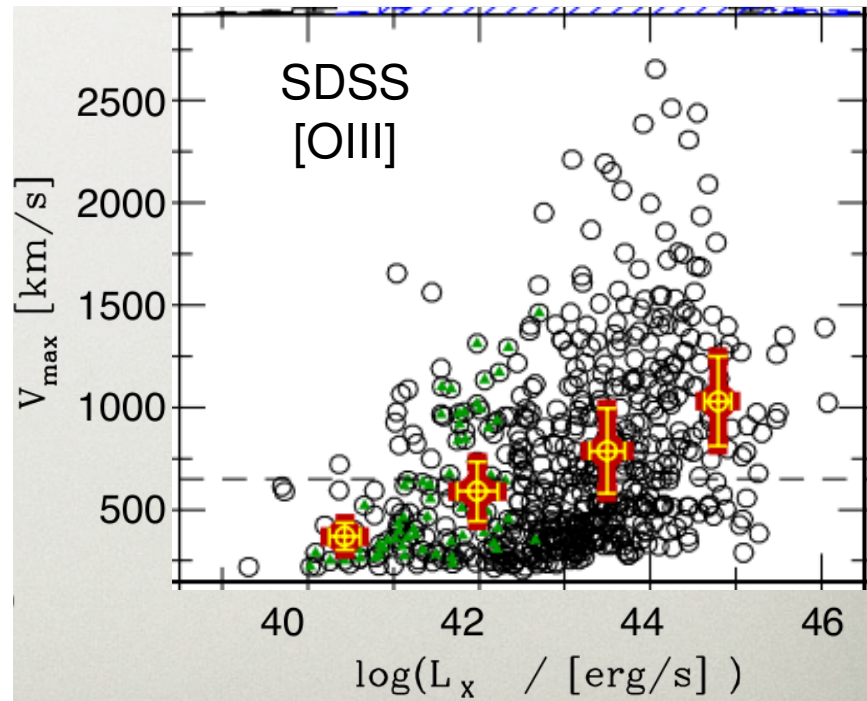


Dependence of Δv on L_x ?

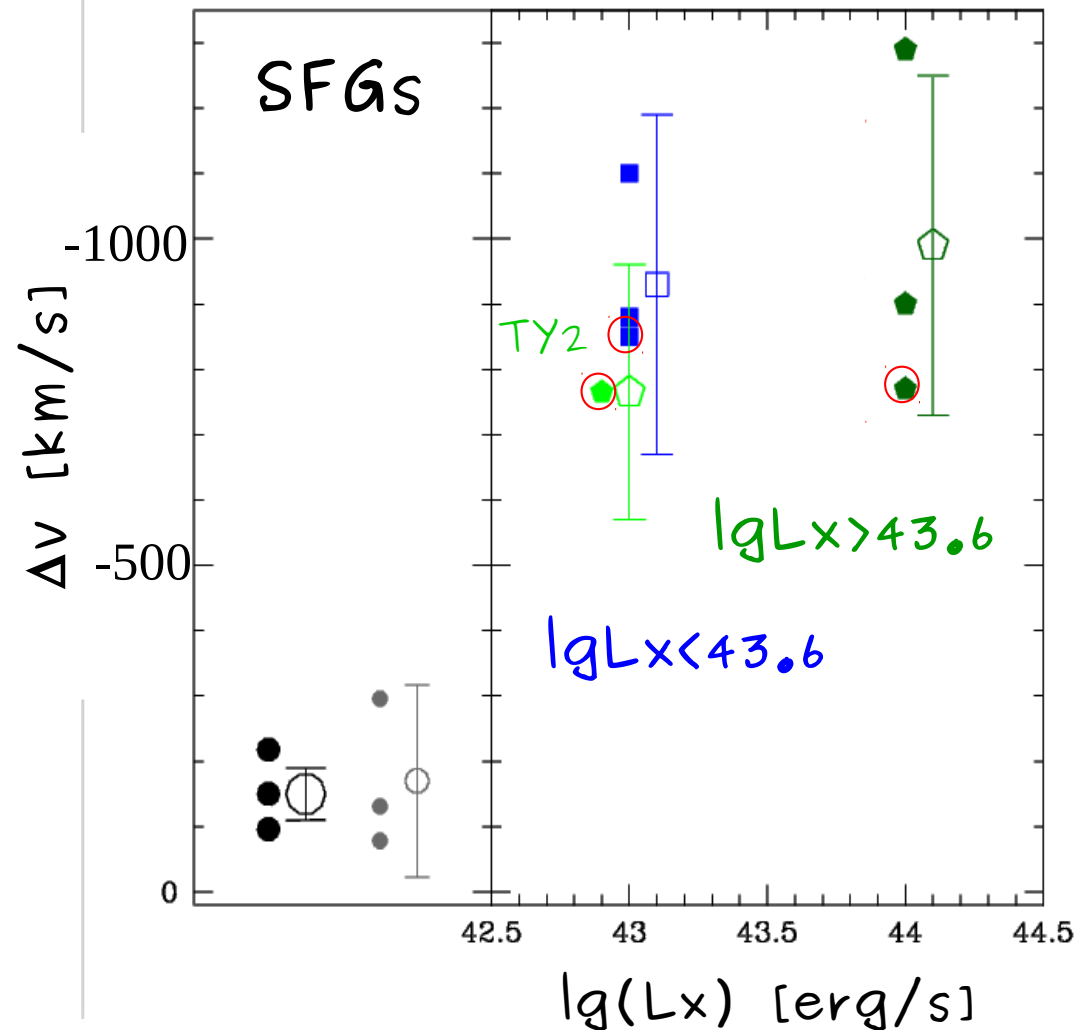


Dependence of Δv on L_x ?

Perna et al. 2017

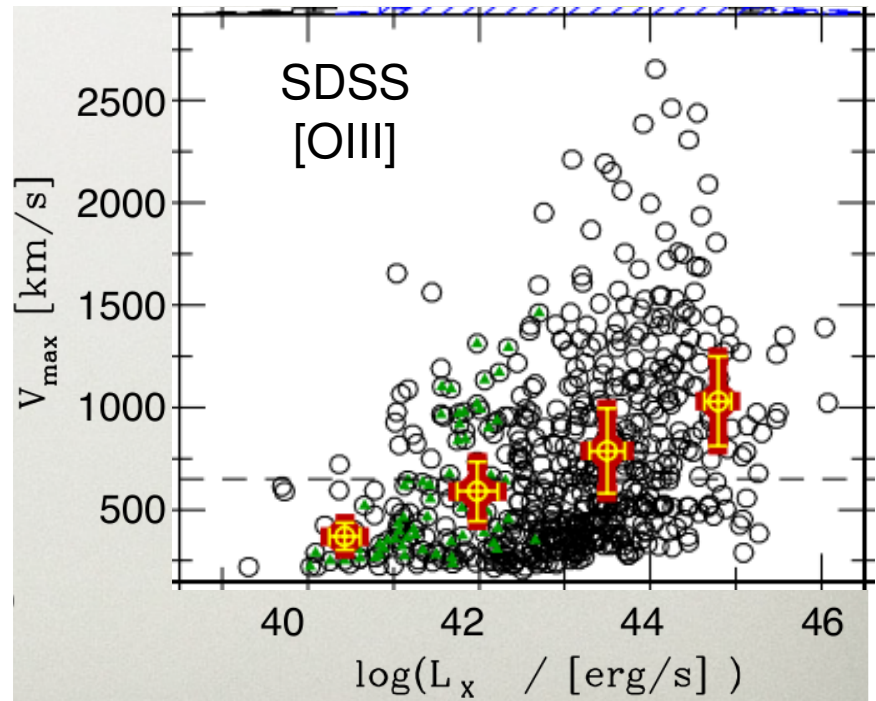


see also Zakamska & Greene (2014);
Harrison et al. 2016



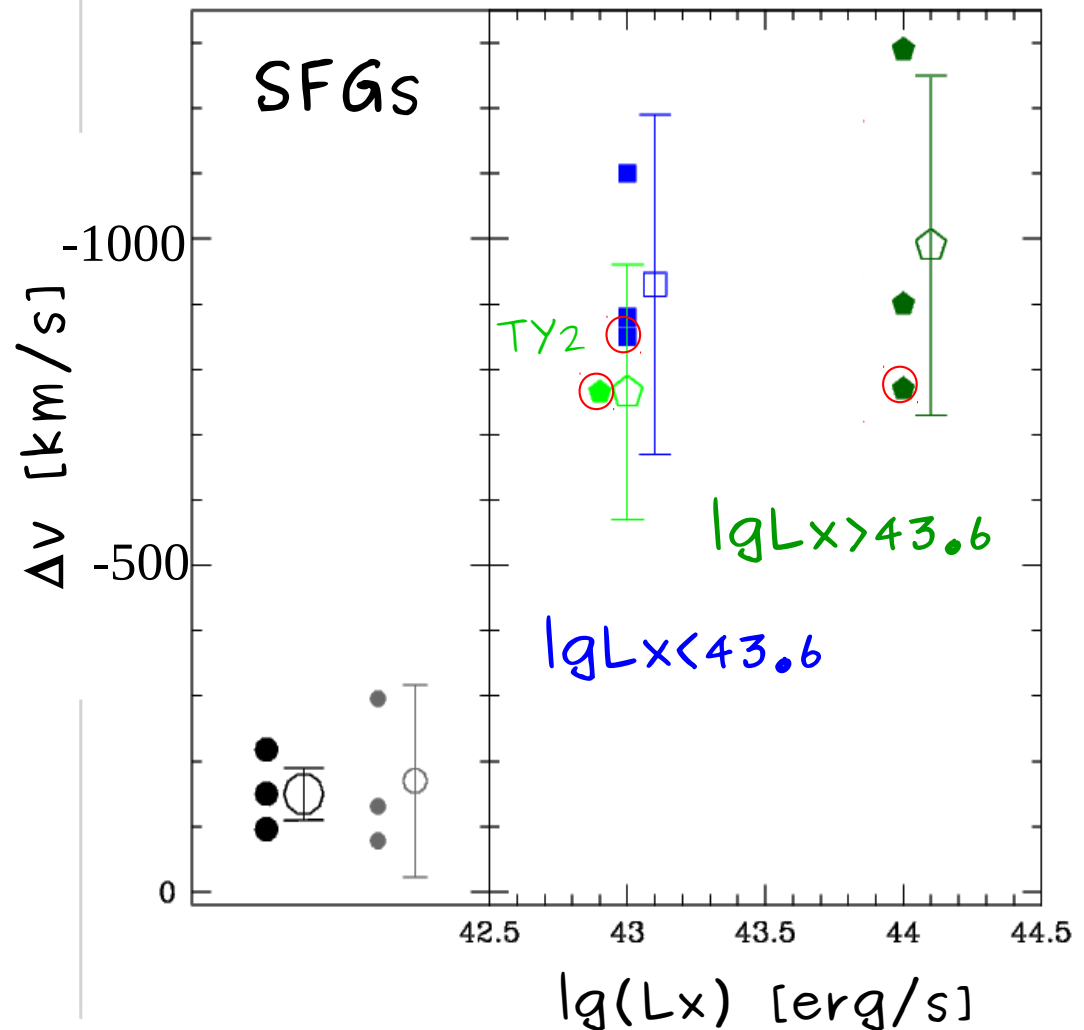
Dependence of Δv on L_x ?

Perna et al. 2017



see also Zakamska & Greene (2014);
Harrison et al. 2016

Is the gas just changing phase?

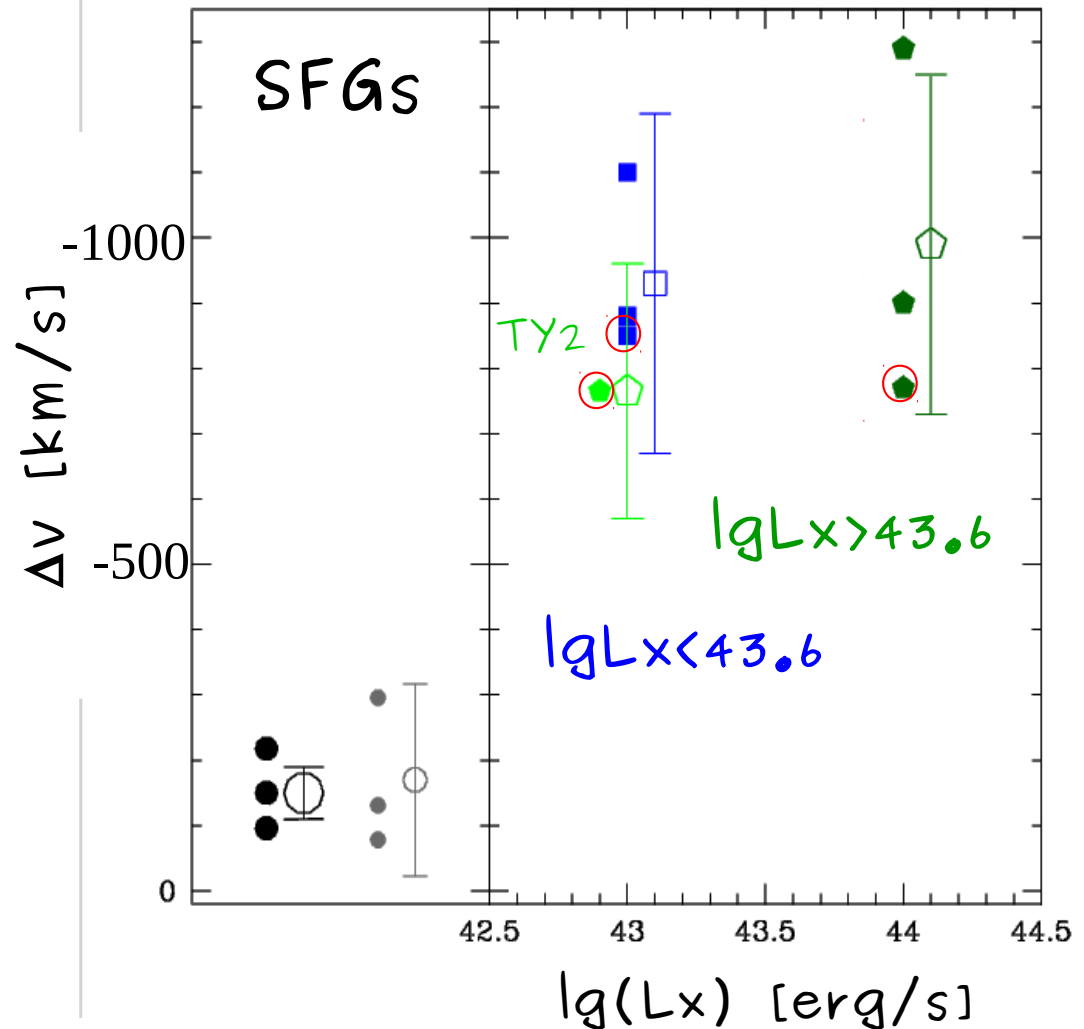


Dependence of Δv on L_x ?

WANDS

A deep VIMOS survey of the CANDELS UDS and CDFS fields

- Higher spectral resolution and S/N
- L_x / Mass / SFR / A_v / inclination / metallicity / [...] dependencies
- studies on “individual” SFGs & AGN
- synergies with near-IR surveys





Summary

1) Outflows are faster in galaxies hosting an AGN w.r.t. “inactive” SFGs

2) In the AGN sample there is no dependence of outflow velocity on L_x

THANK YOU!

