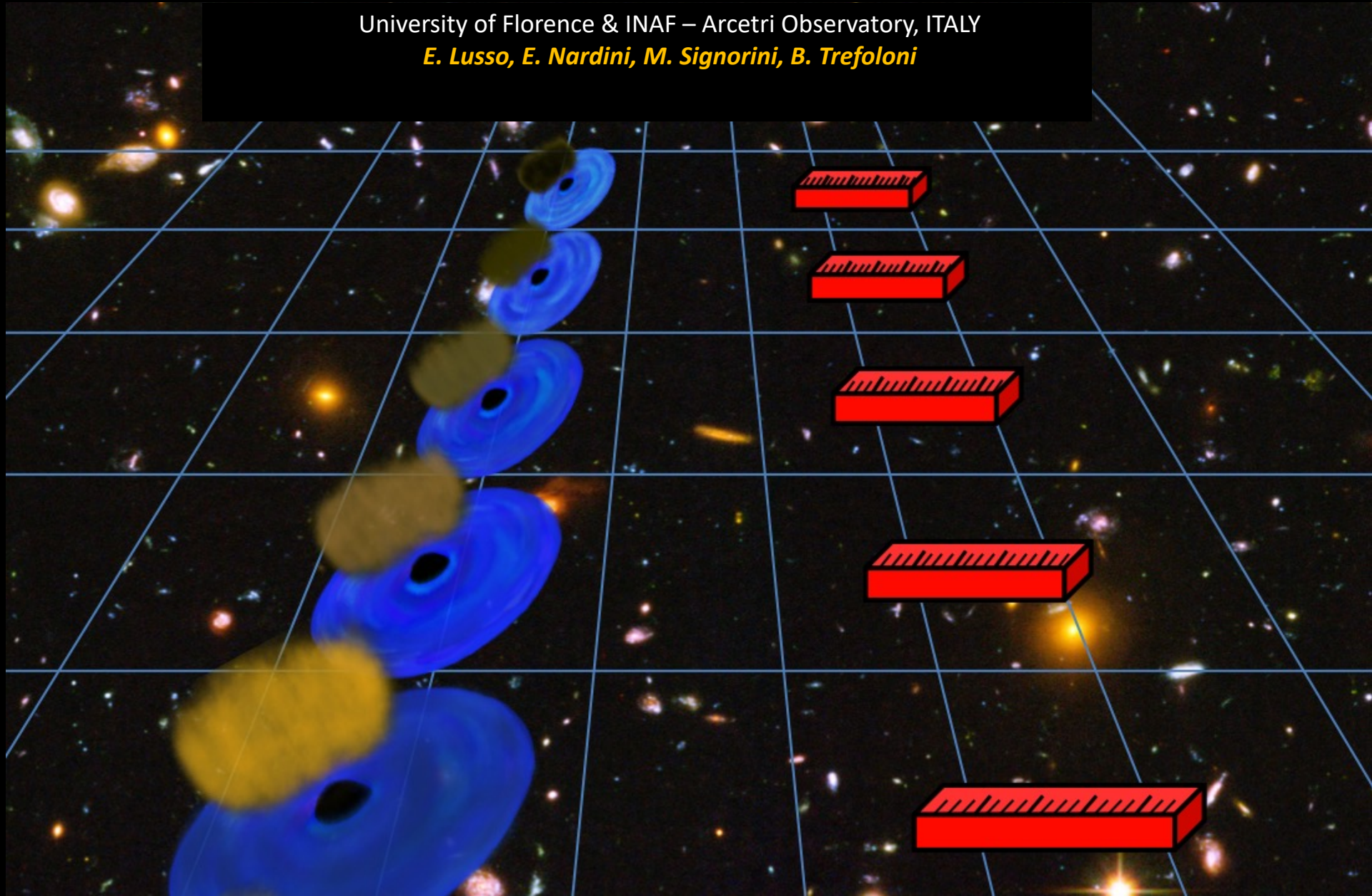


# X-ray variability of SDSS quasars

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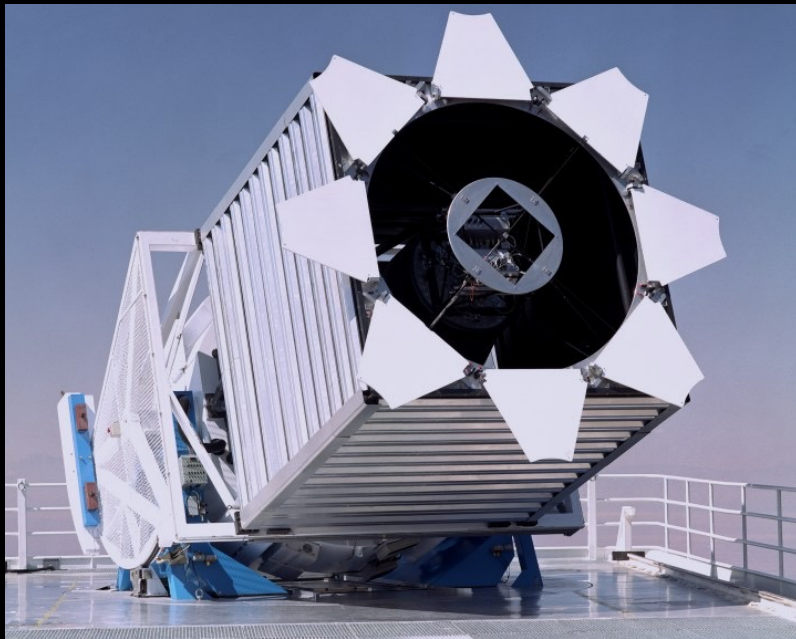
GOAL: building an optimal sample to investigate the average long-term X-ray variability properties of quasars

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Quasars with optical (SDSS) AND X-ray (XMM-Newton) spectral data:

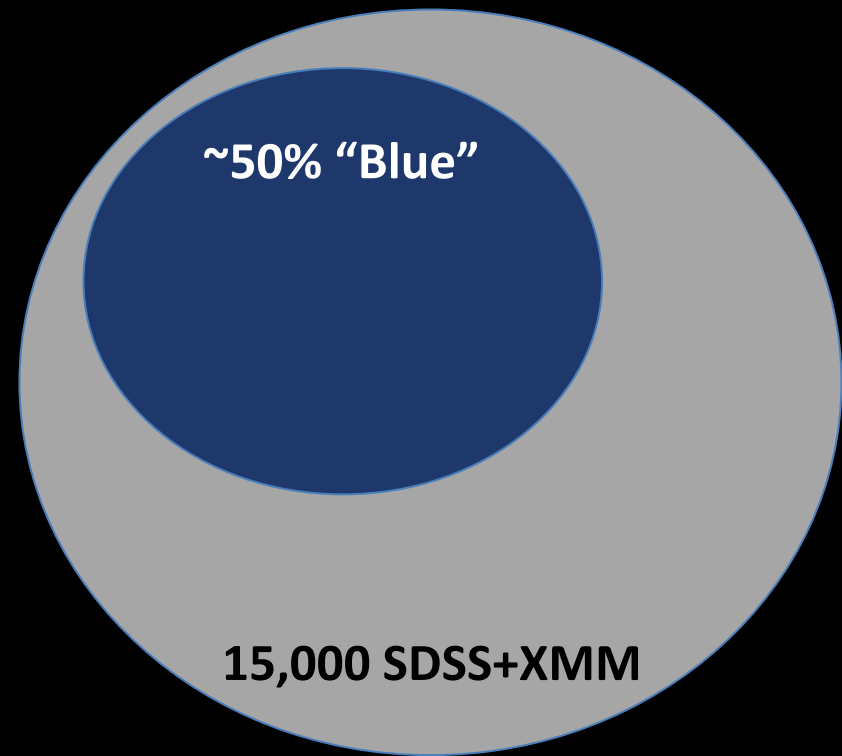
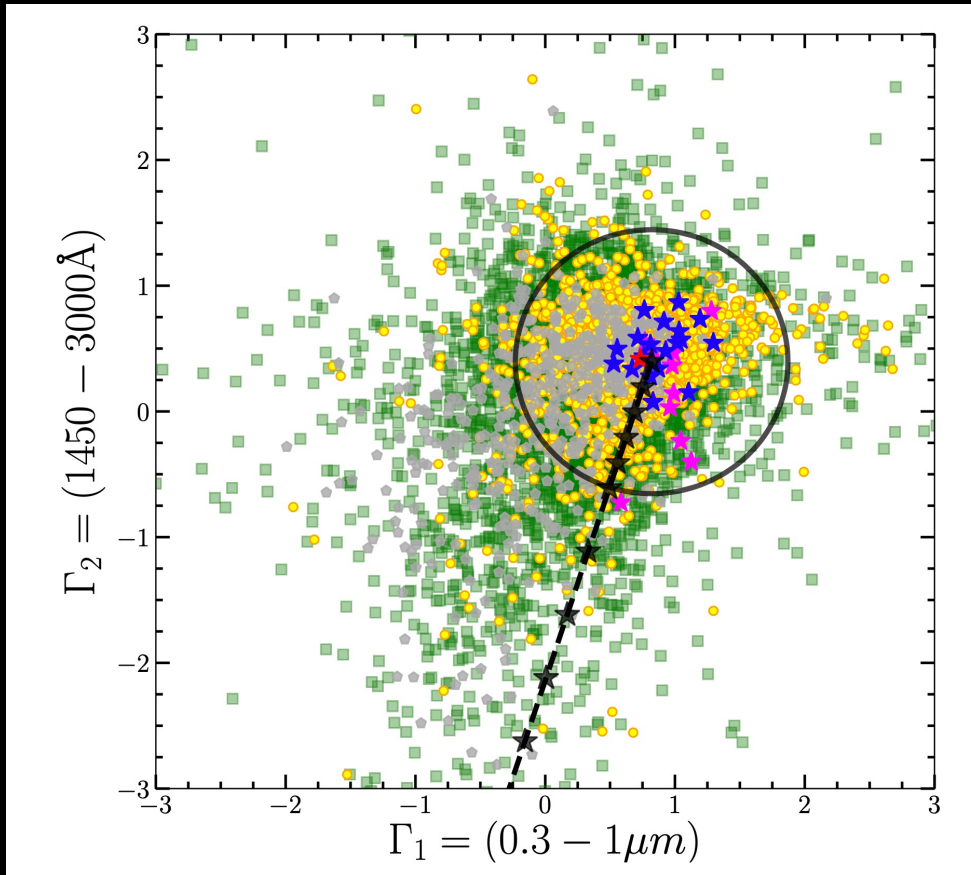
SDSS-DR16 + 4XMM-DR12

~18,000 SDSS quasars with serendipitous XMM obs.



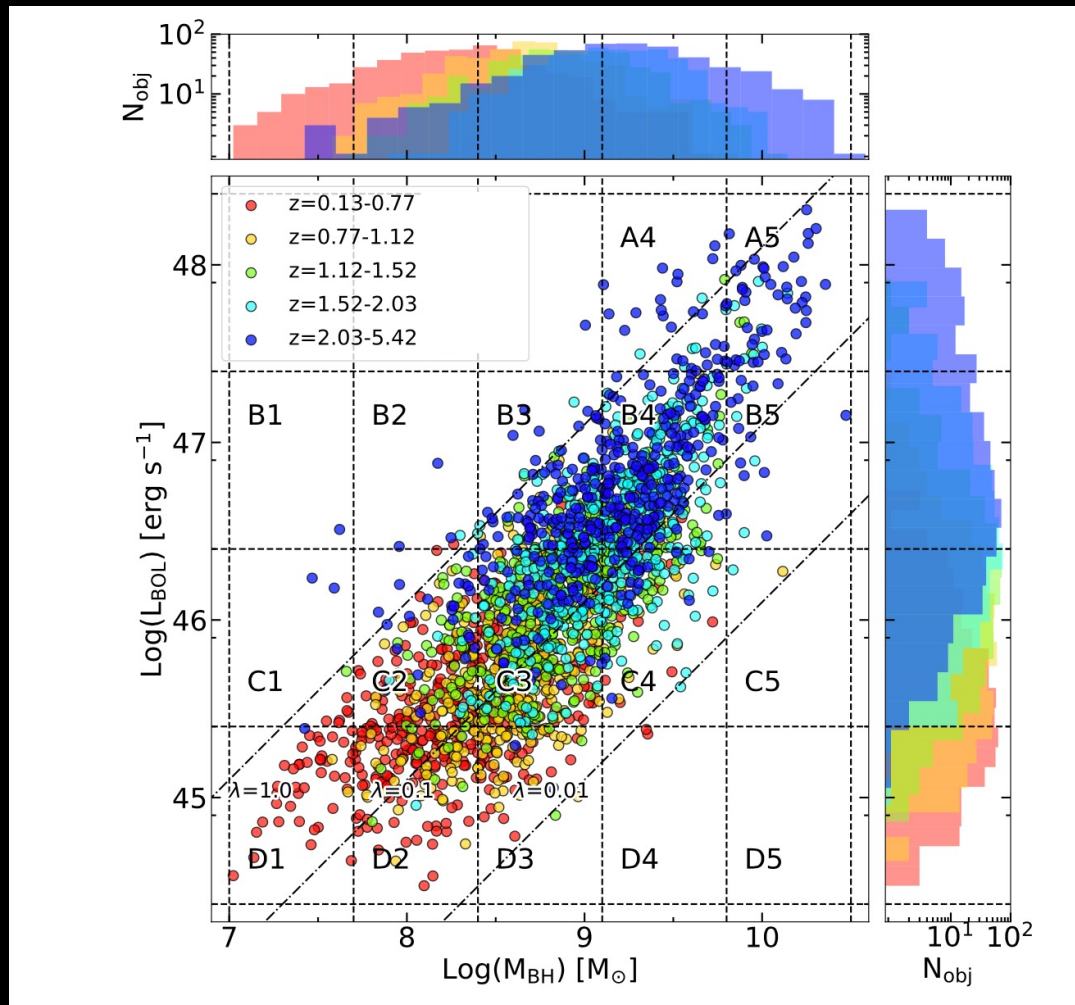
# Selection of a homogeneous quasar sample

## 1. Selection of **BLUE** quasars



# Selection of a homogeneous quasar sample

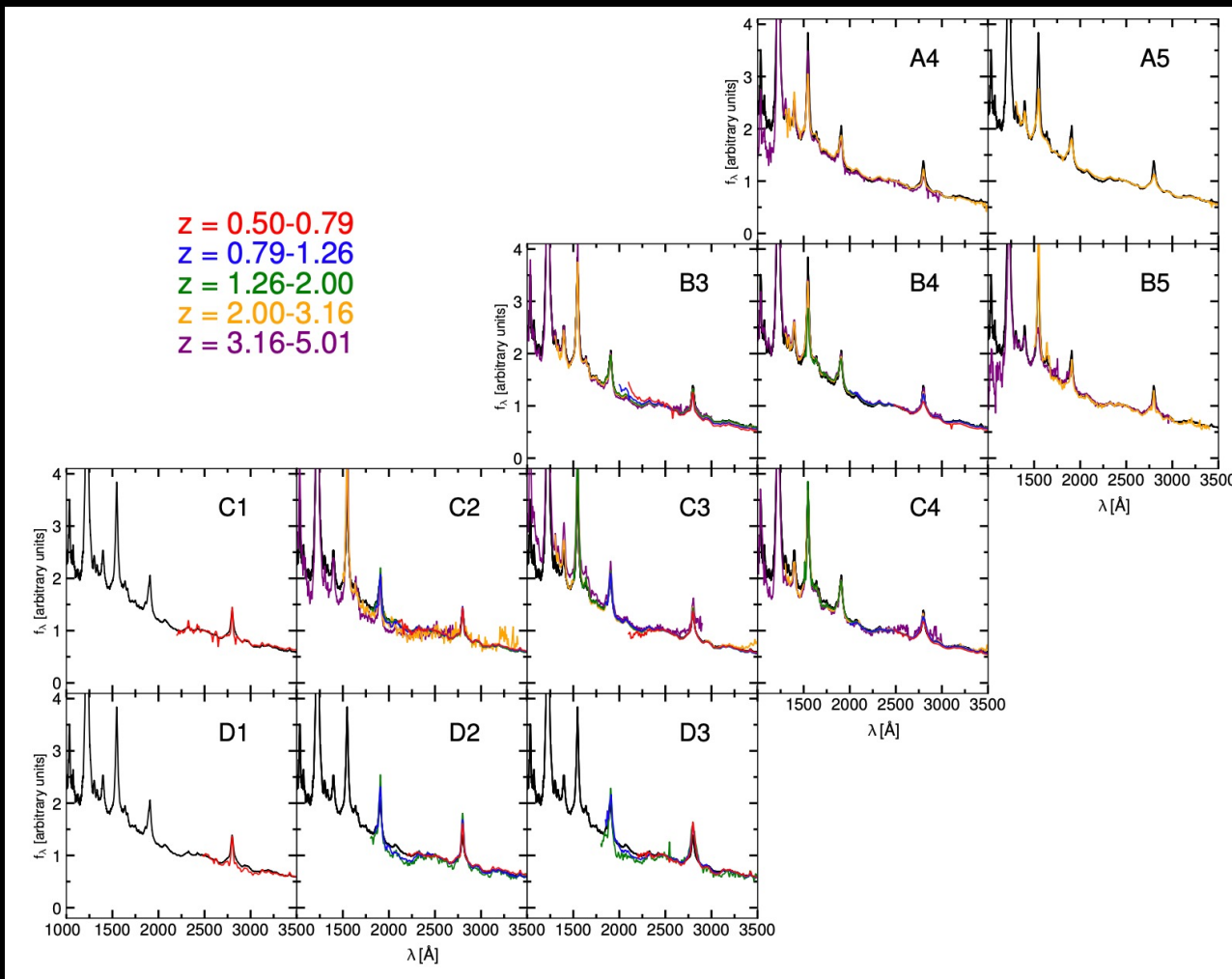
## 1. Selection of **BLUE** quasars



Wide coverage of  
the Luminosity-  
BH mass-  
redshift space

# Selection of a homogeneous quasar sample

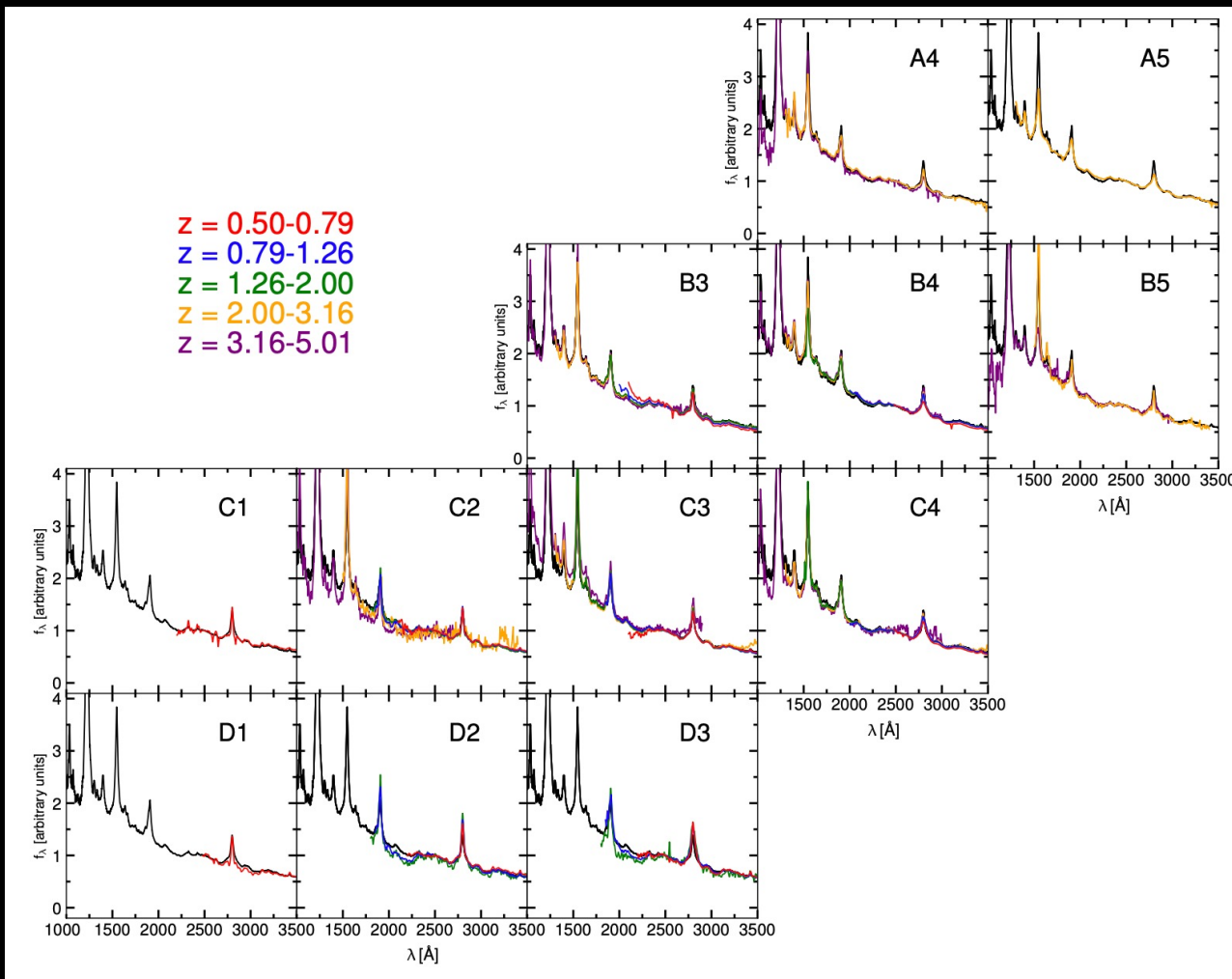
## 1. Selection of **BLUE** quasars



No dependence  
of average  
optical/UV  
emission from  
luminosity /BH  
mass / redshift

# Selection of a homogeneous quasar sample

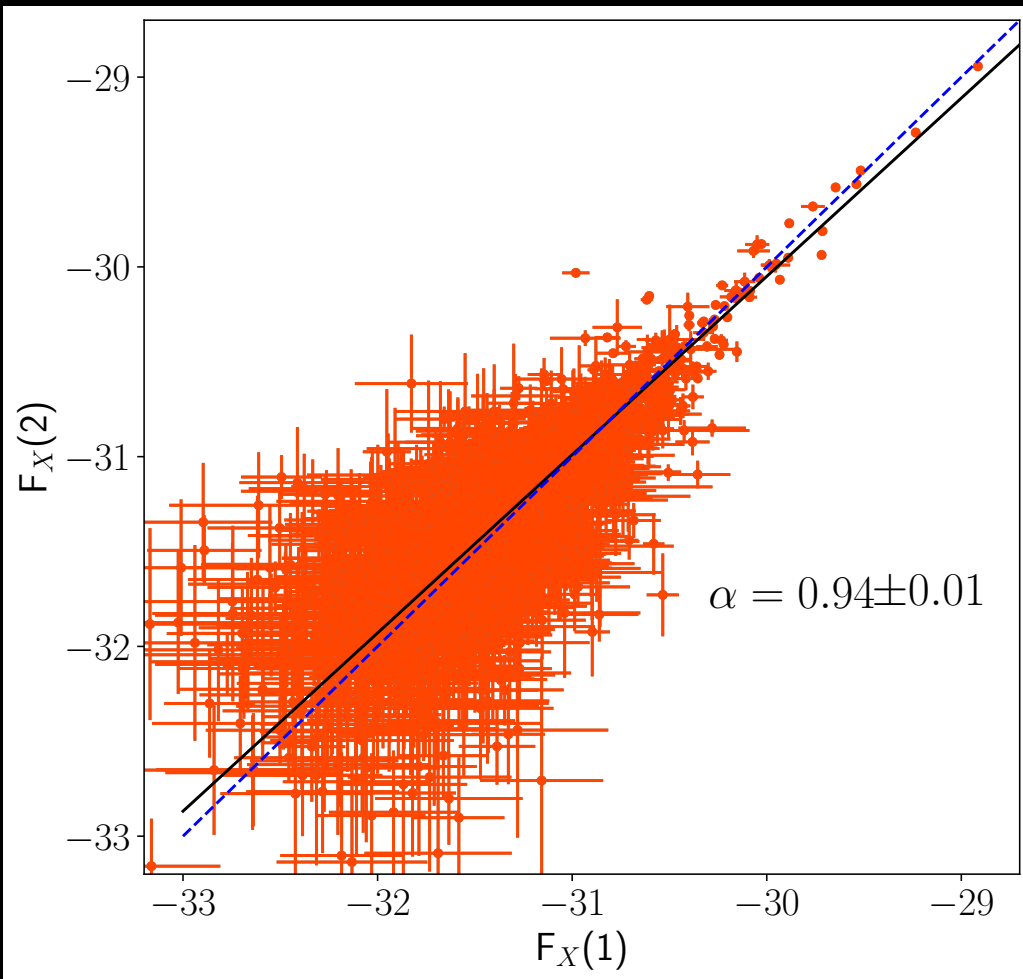
## 1. Selection of **BLUE** quasars



No dependence  
of average  
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# Selection of a homogeneous quasar sample

## 1. Selection of **BLUE** quasars



1,458 sources with at least two X-ray observations

Comparison of the X-ray fluxes (@ 2 keV, or 2-10 keV)

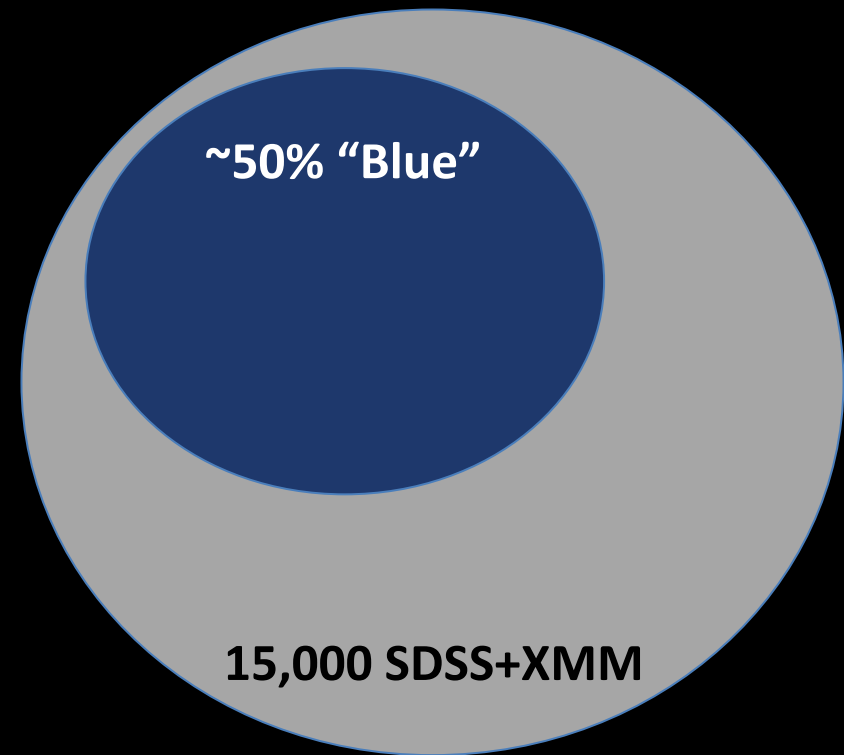
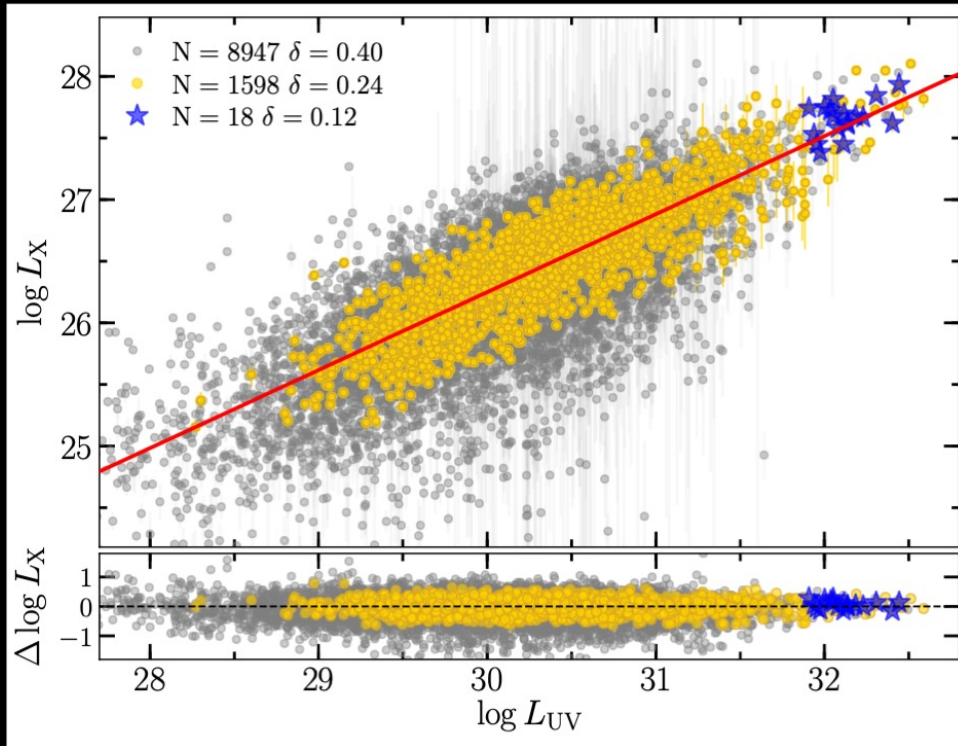
**FX(1)** : flux from the deepest observation (combinations of obs. length and off-axis angle)

**FX(2)**: flux from the second deepest observation.



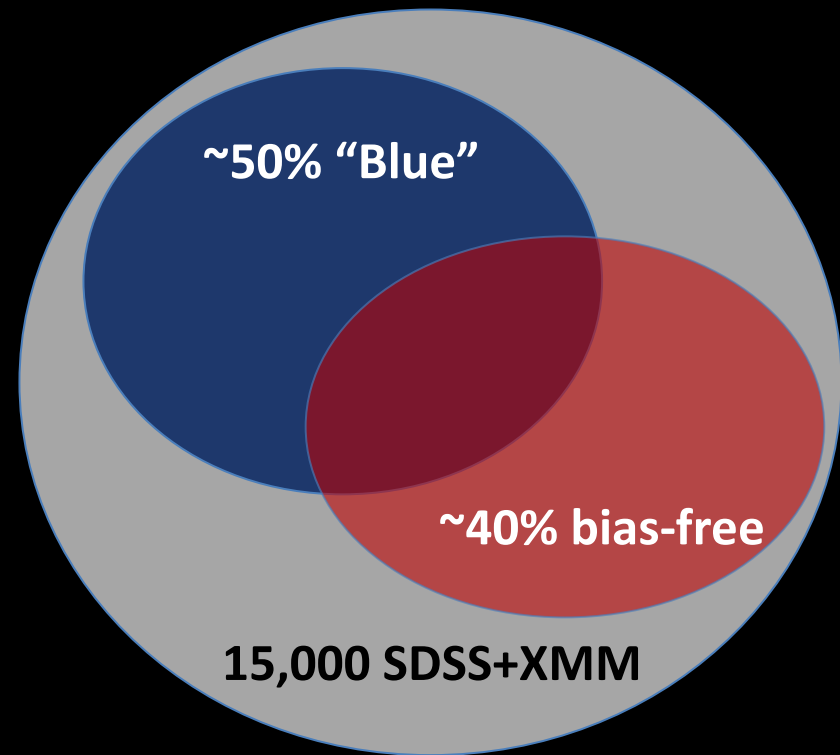
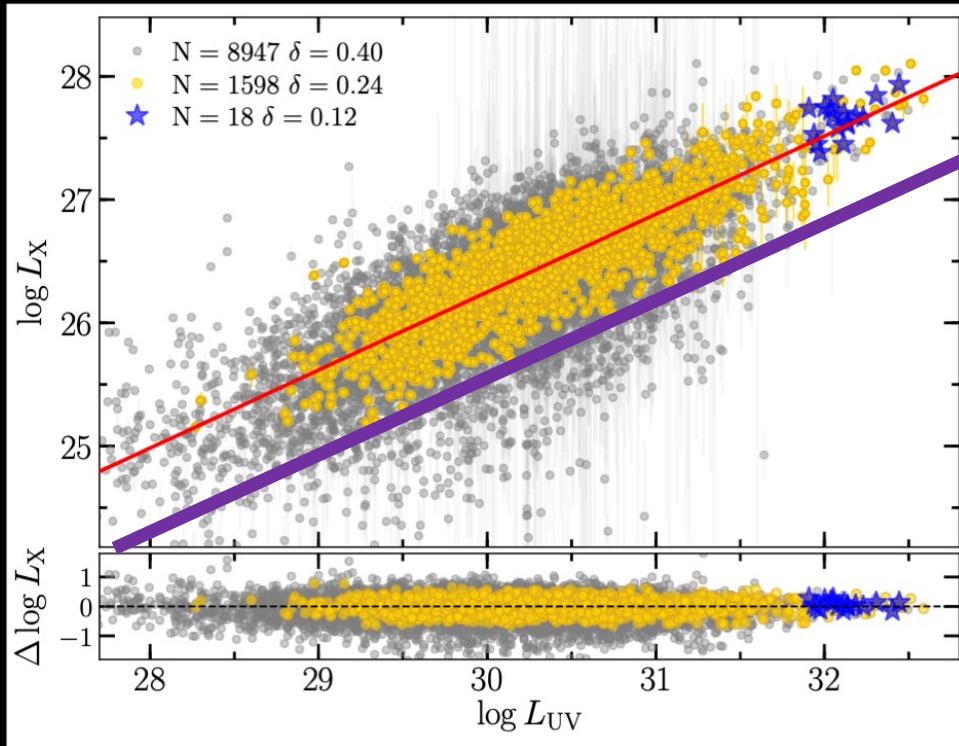
# Selection of a homogeneous quasar sample

## 2. Remove X-ray “Eddington bias”

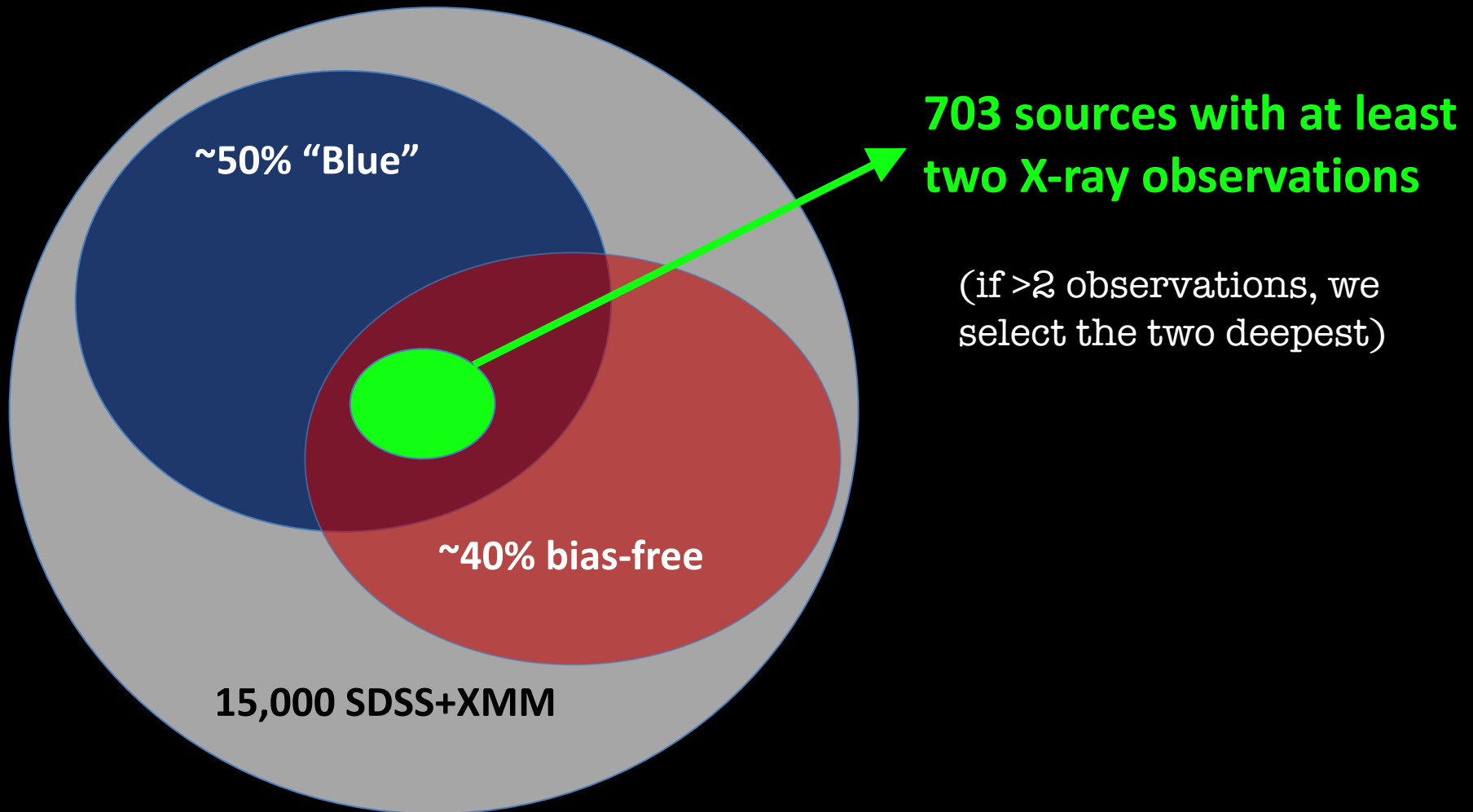


# Selection of a homogeneous quasar sample

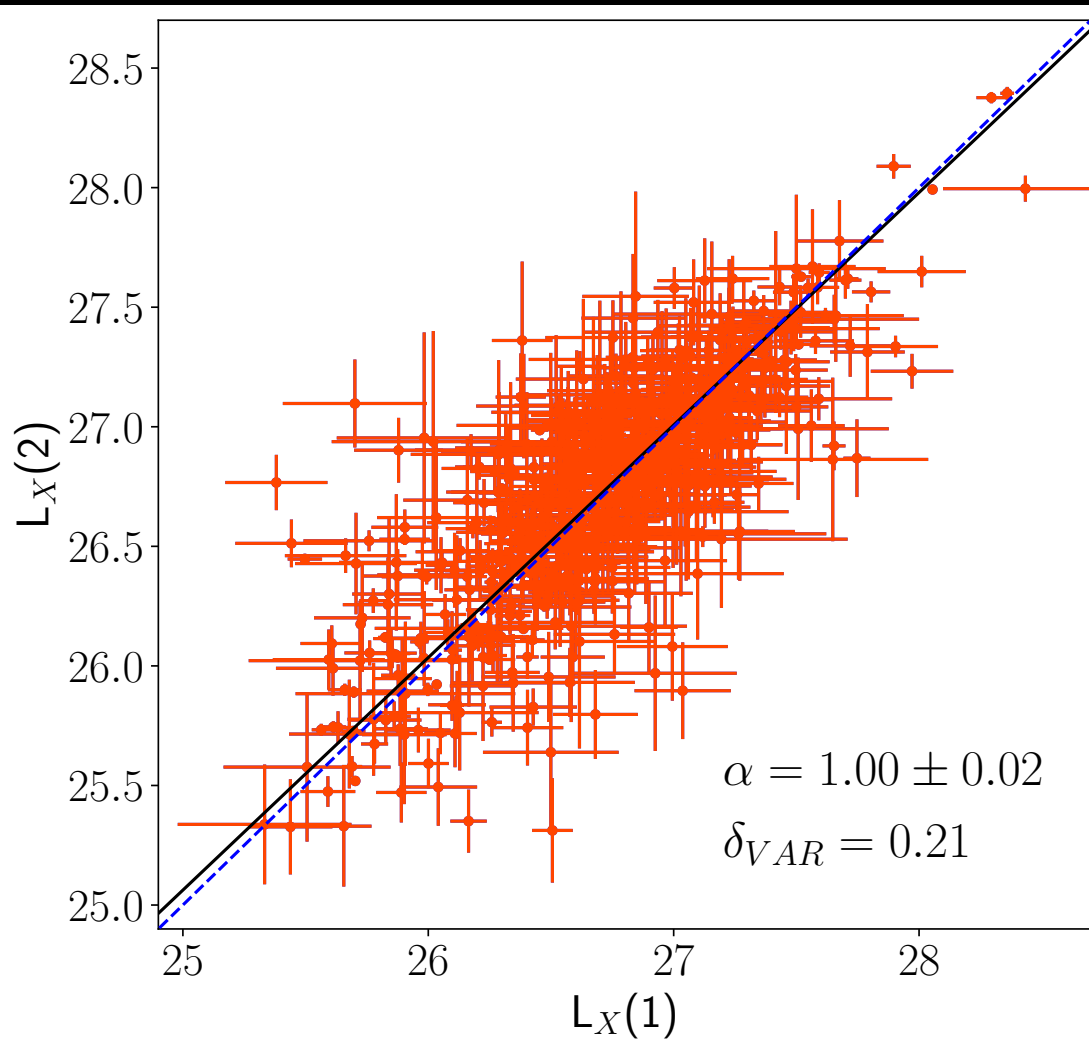
## 2. Remove X-ray “Eddington bias”



# Selection of a homogeneous quasar sample for X-ray variability studies

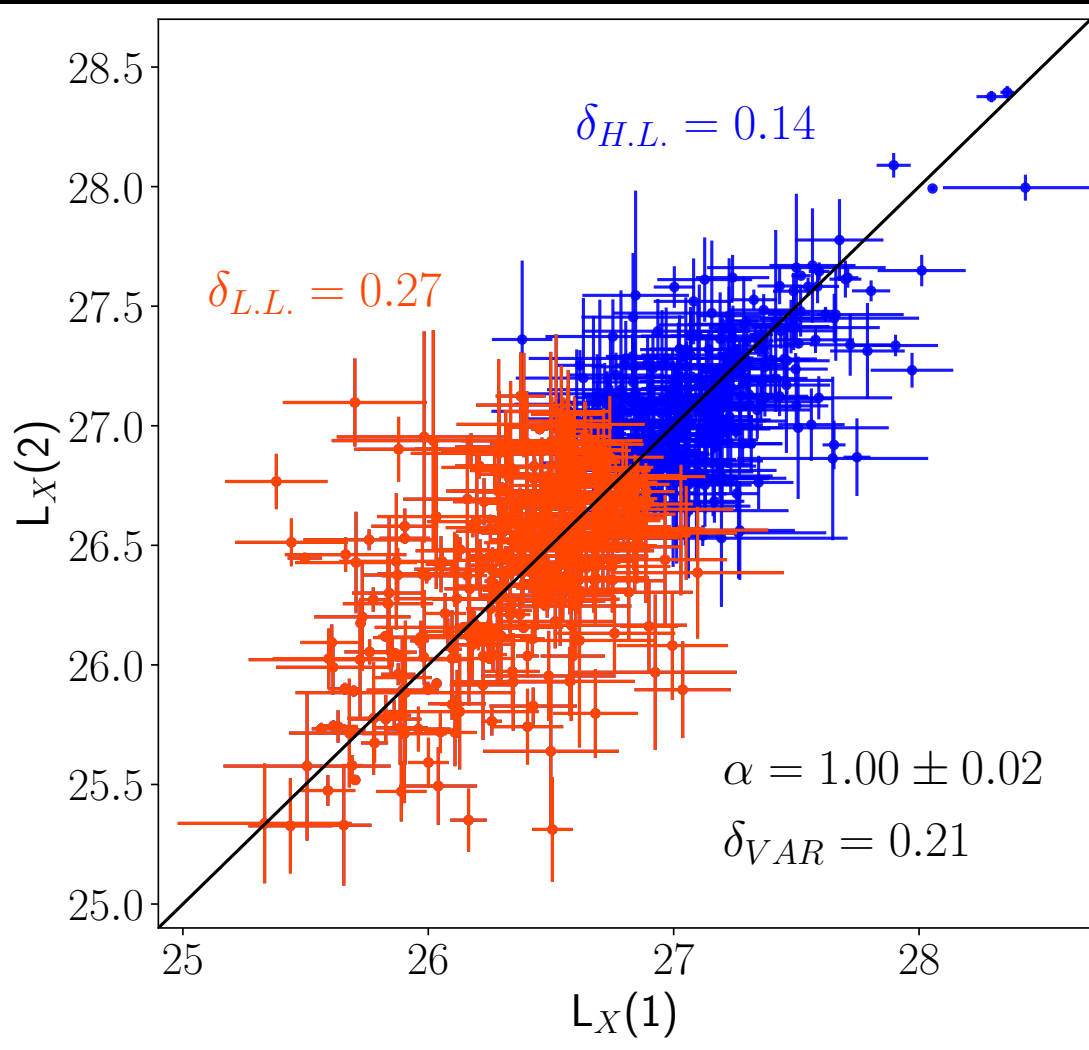


# Results: full sample



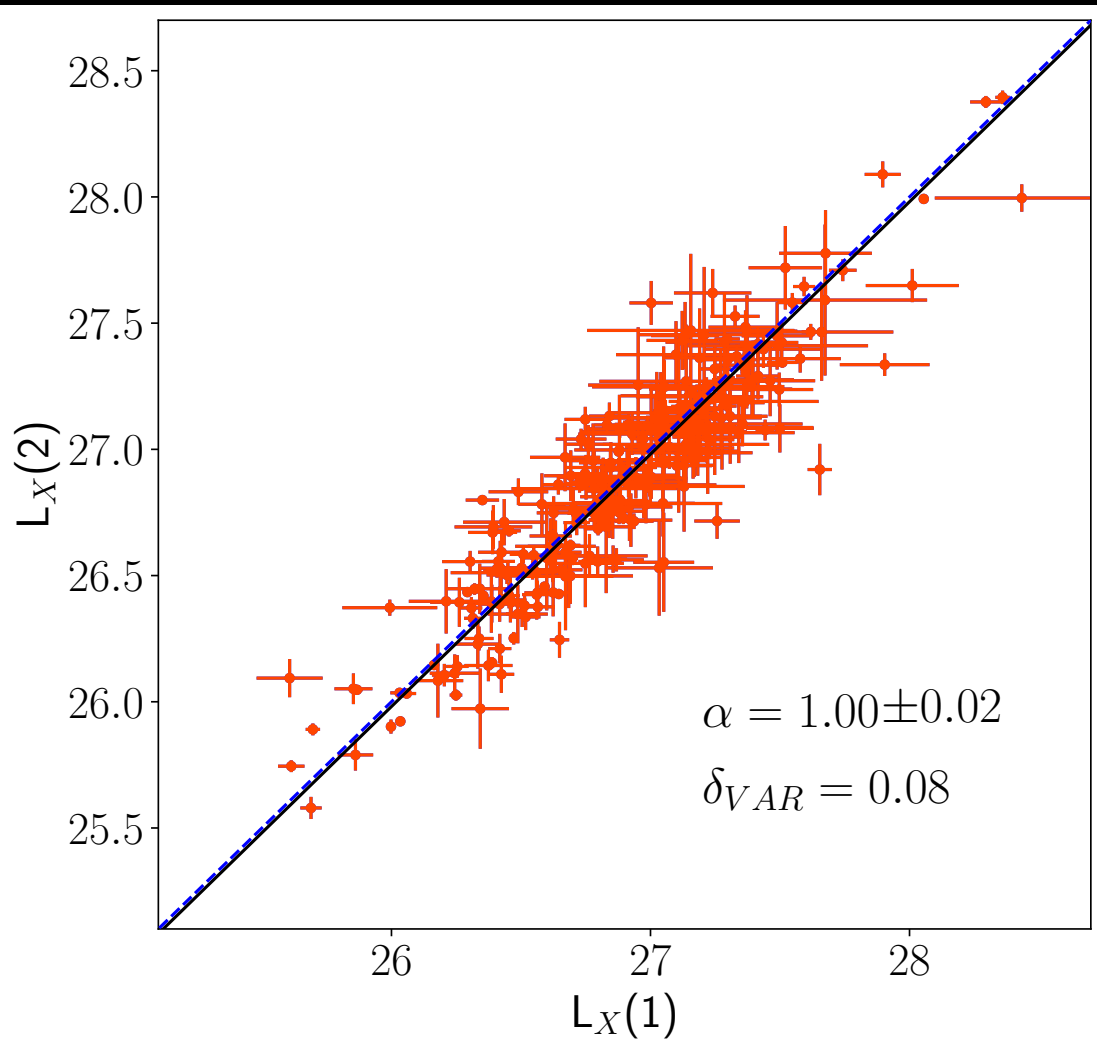
Fit with intrinsic dispersion in addition to measurement errors

# Results: full sample



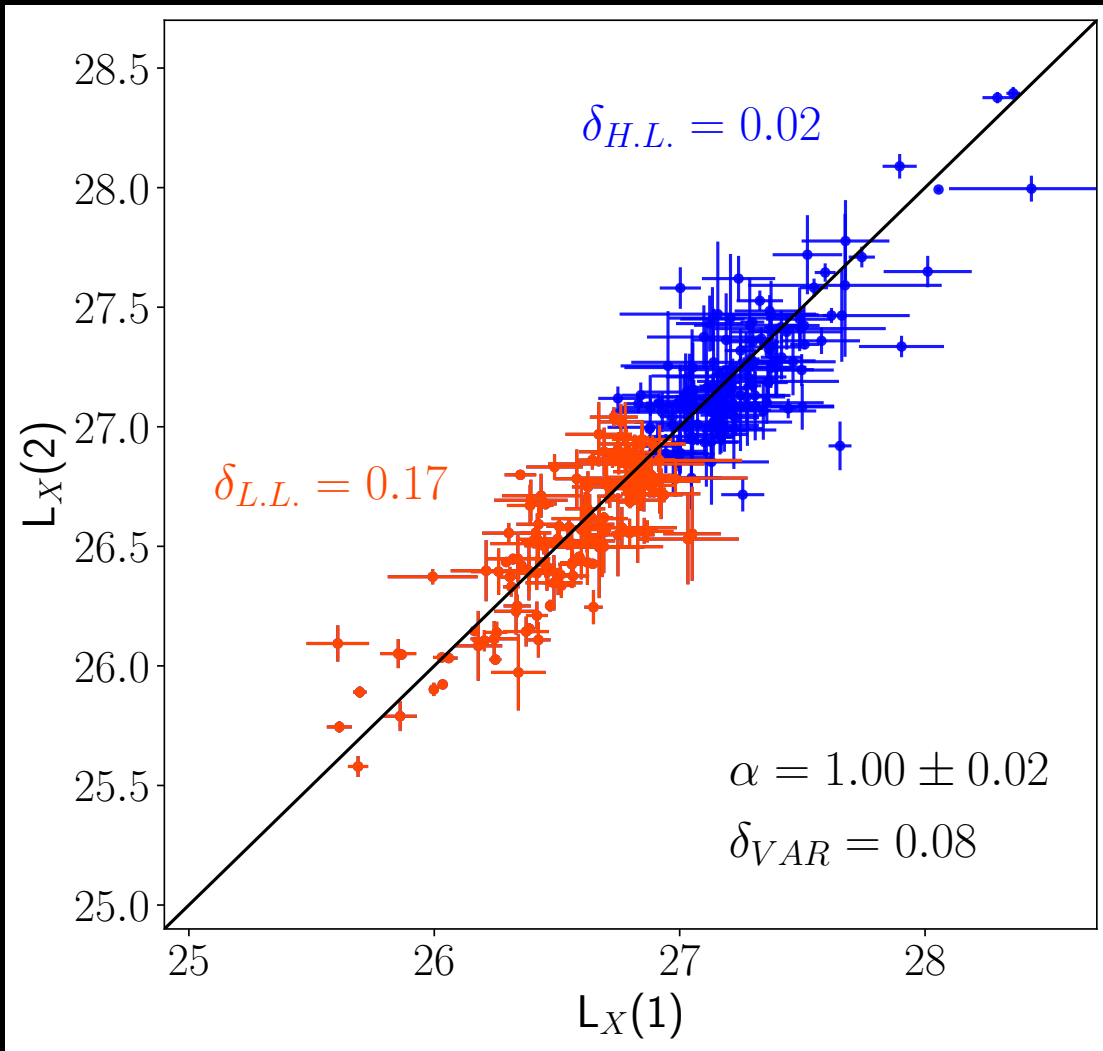
Lower variability at  
higher luminosities

# Results: “X-ray steep” subsample



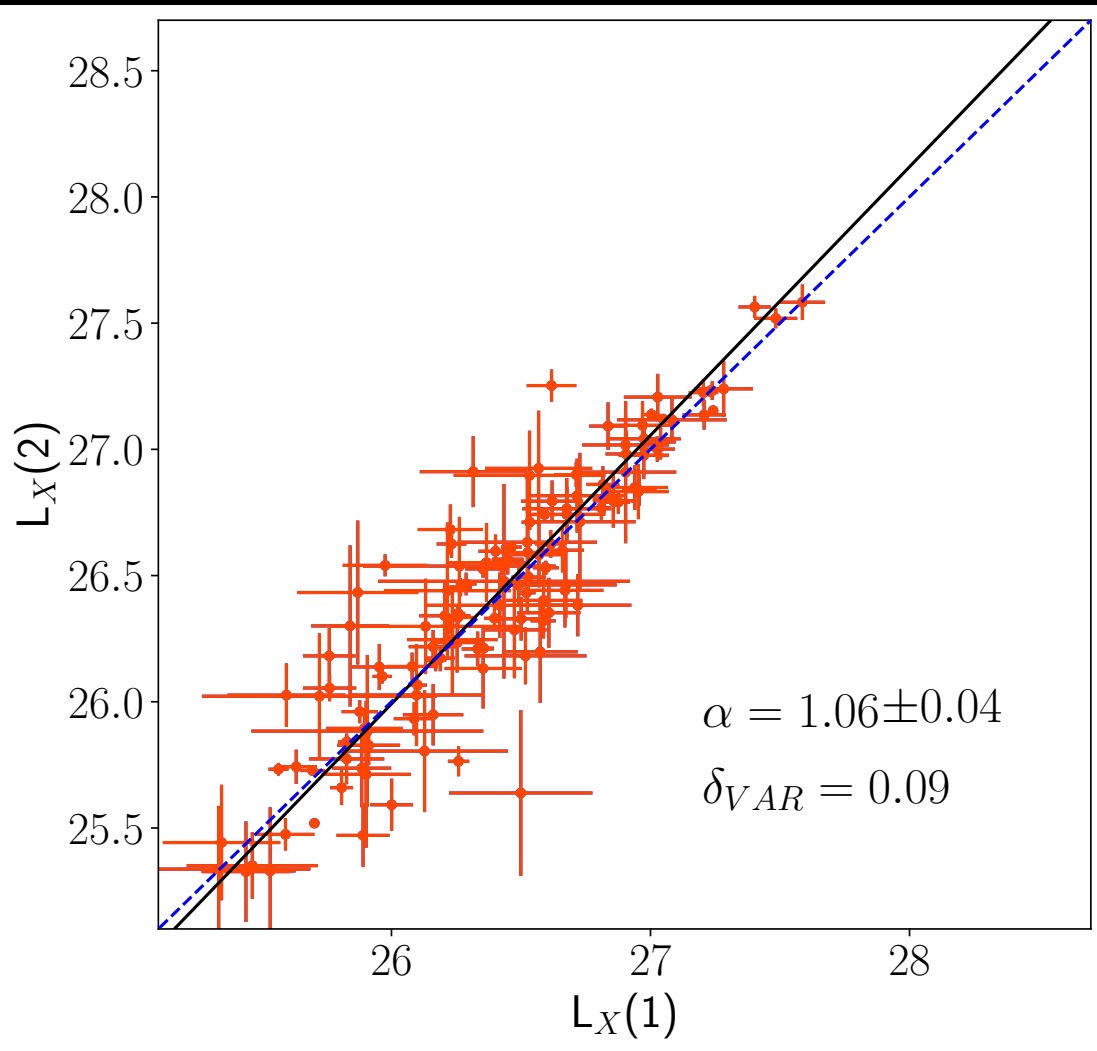
$\Gamma > 1.7$

# Results: “X-ray steep” subsample



$\Gamma > 1.7$

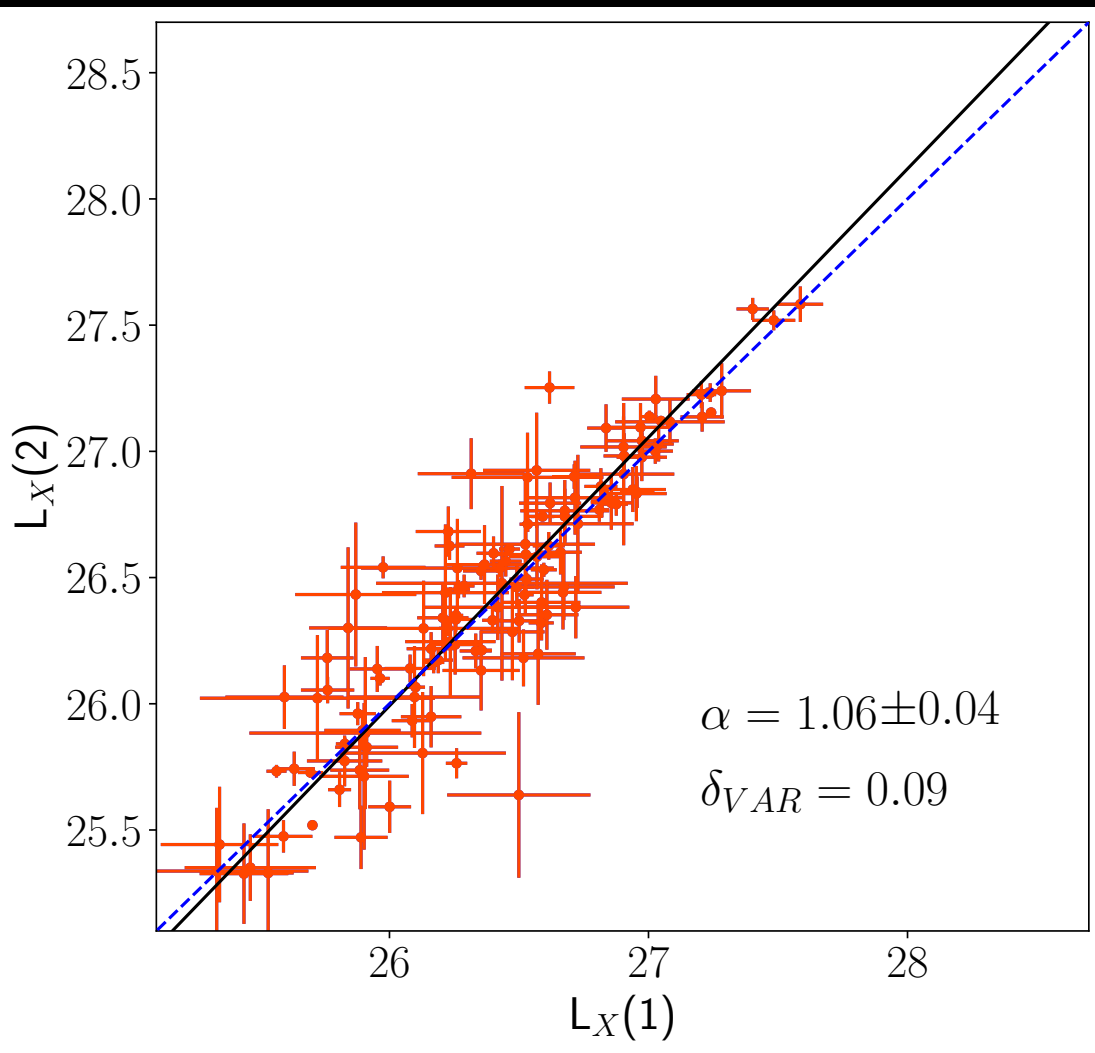
# Results: “X-ray flat” subsample



$\Gamma < 1.7$



# Results: “X-ray flat” subsample



$$\Gamma < 1.7$$

The selection on  $\Gamma$  applies on each individual observation, so in both subsamples  $\Delta\Gamma$  is small !!

High X-ray *flux* variability in blue, optically selected quasars is associated to strong *spectral* variability