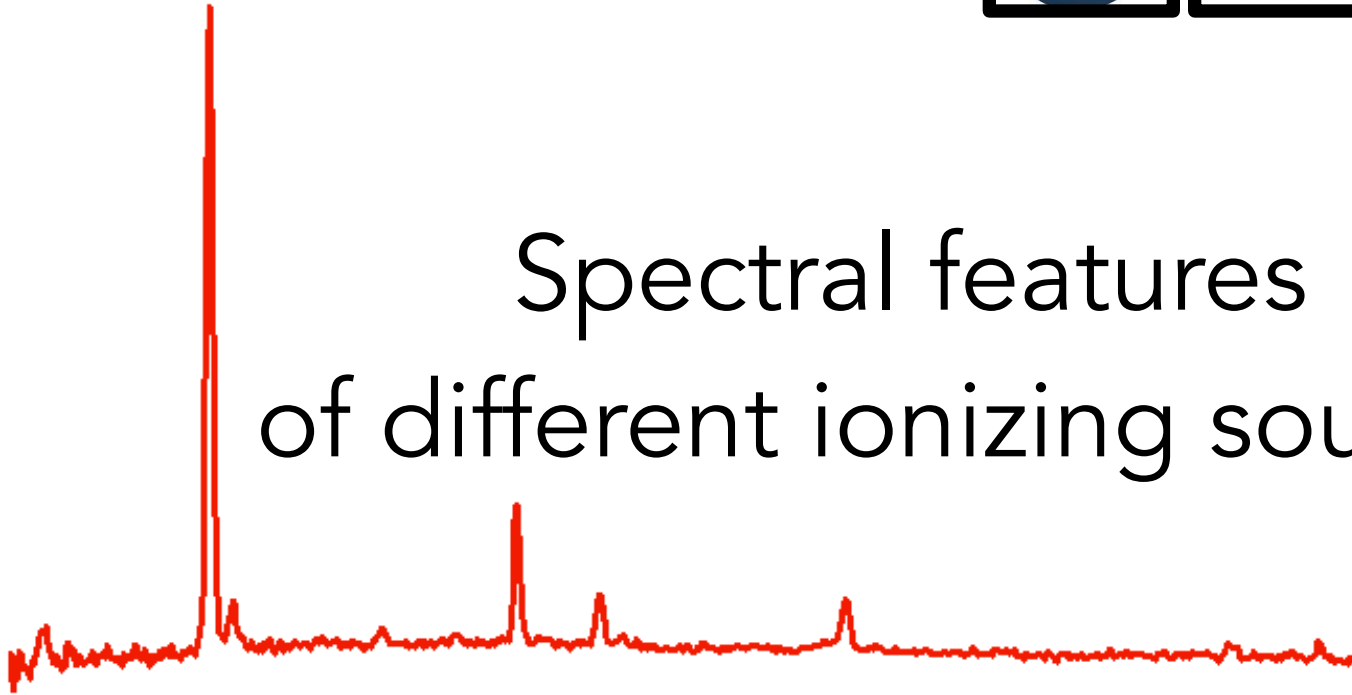




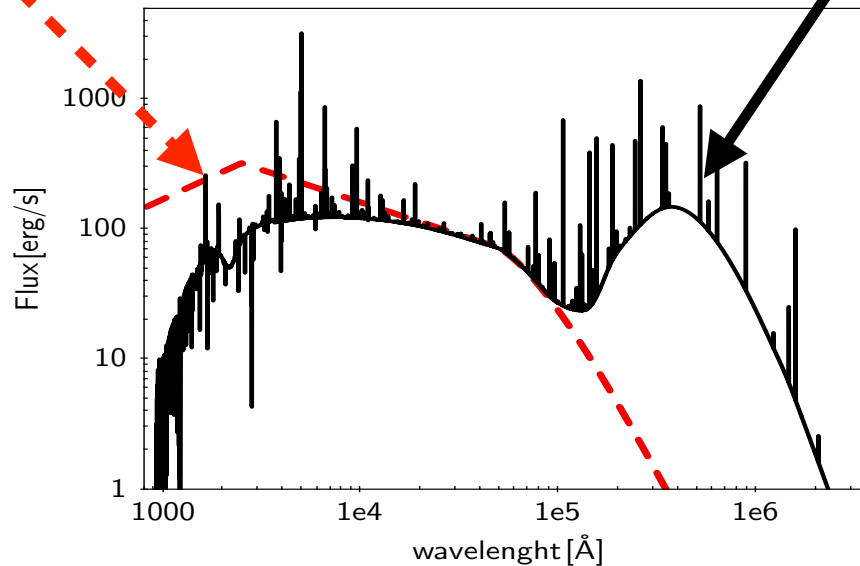
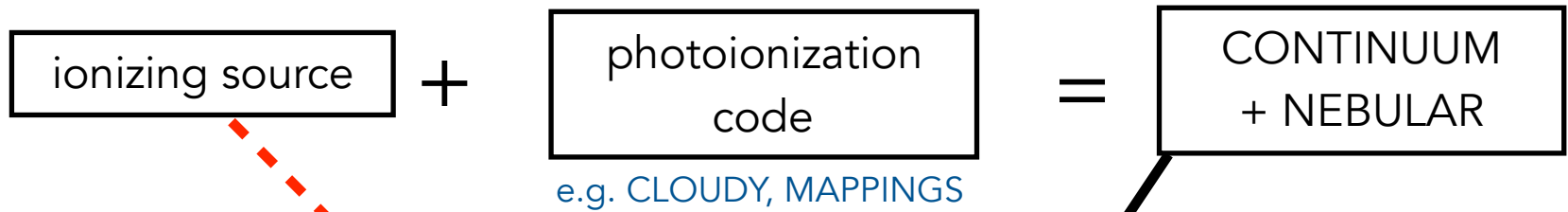
# Spectral features of different ionizing sources



A. Feltre

R. Bacon, L. Tresse + MUSE consortium,  
S. Charlot, M. Hirschmann, J. Chevallard + NEOGAL team,  
M. Mignoli, F. Calura, R. Gilli

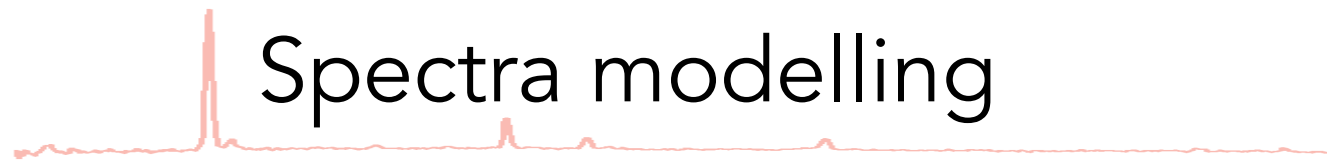
# Spectral modelling



- ➔ ionization parameter  $(n\gamma/n_H) \log(U)$
- ➔ hydrogen gas density  $\log(n_H/\text{cm}^{-3})$
- ➔ metallicity  $Z$  (gas+dust phase)
- ➔ dust-to-metal mass ratio (**depletion**)  $\xi_d$

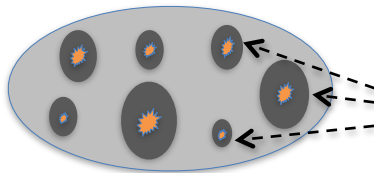
PHYSICAL  
PRESCRIPTIONS

# Spectra modelling



## \* star-forming galaxies

e.g. Charlot & Longhetti 01, Kewley+13,  
**Gutkin+16**, Jaskot & Ravindranath 16,  
Nakajima+17



Several  
HII regions

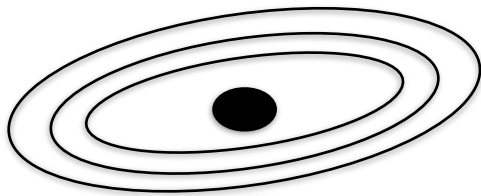
## \* post AGB stars

e.g. Binette+92, Flores-Fajardo+11,  
**Hirschmann, Charlot, AF +17**



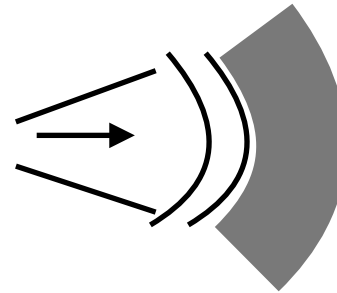
## \* AGN

e.g. Binette+96, Dopita+02,  
Groves+04, Nagao+06, **Feltre+16**,  
Nakajima+17, **Feltre+in prep.**



## \* shocks

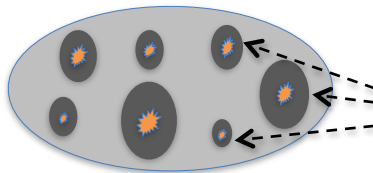
e.g. Allen+98, Allen+08



# Spectra modelling

## \* star-forming galaxies

e.g. Charlot & Longhetti 01, Kewley+13,  
**Gutkin+16**, Jaskot & Ravindranath 16,  
Nakajima+17



Several  
HII regions

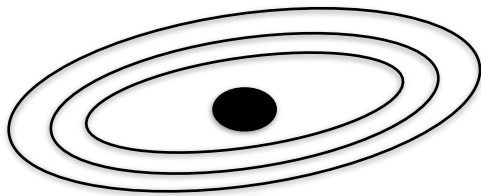
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e.g. Binette+92, Flores-Fajardo+11,  
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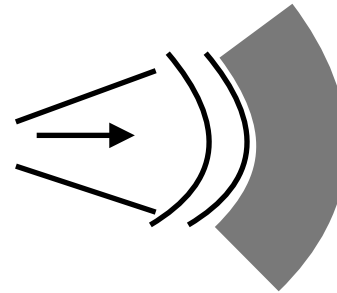
## \* AGN

e.g. Binette+96, Dopita+02,  
Groves+04, Nagao+06, **Feltre+16**,  
Nakajima+17, **Feltre+in prep.**



## \* shocks

e.g. Allen+98, Allen+08



# Ionizing spectra

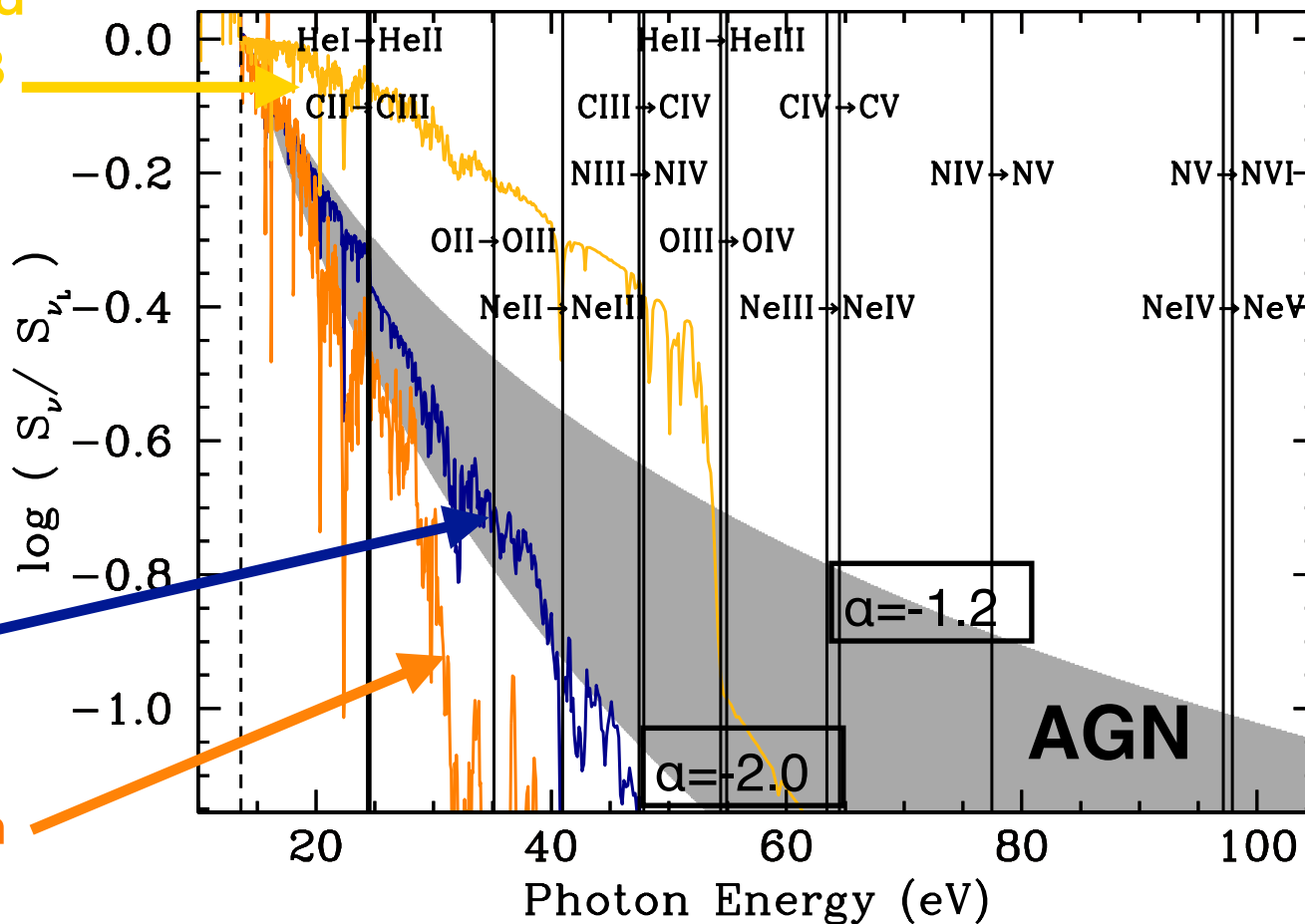


SSP 9Gyr old  
(input PAGB  
models)

adapted from Feltre+16

metal poor  
 $Z=0.001$   
(SF galaxy)

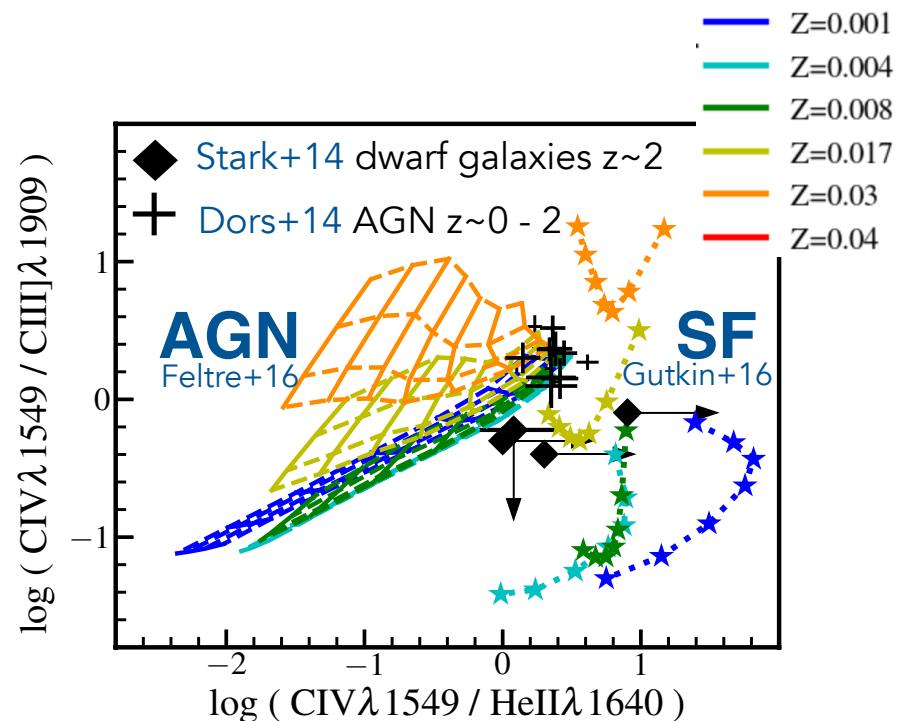
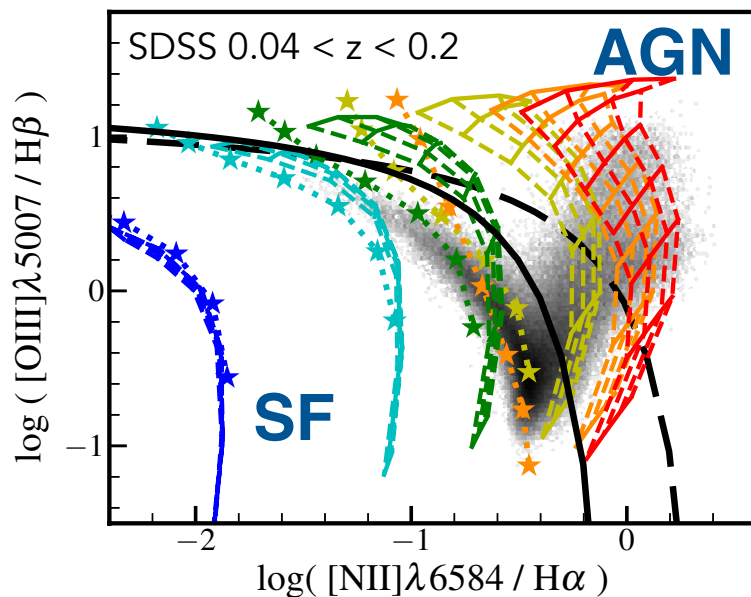
metal rich  
 $Z=0.3$   
(SF galaxy)



# Spectral models

- \* as diagnostics of the ionizing sources
- \* to study the excitation properties of the gas

Baldwin, Phillips & Terlevich 81 BPT diagram



adapted from Feltre+16

- Kauffmann+03
- - Kewley+01

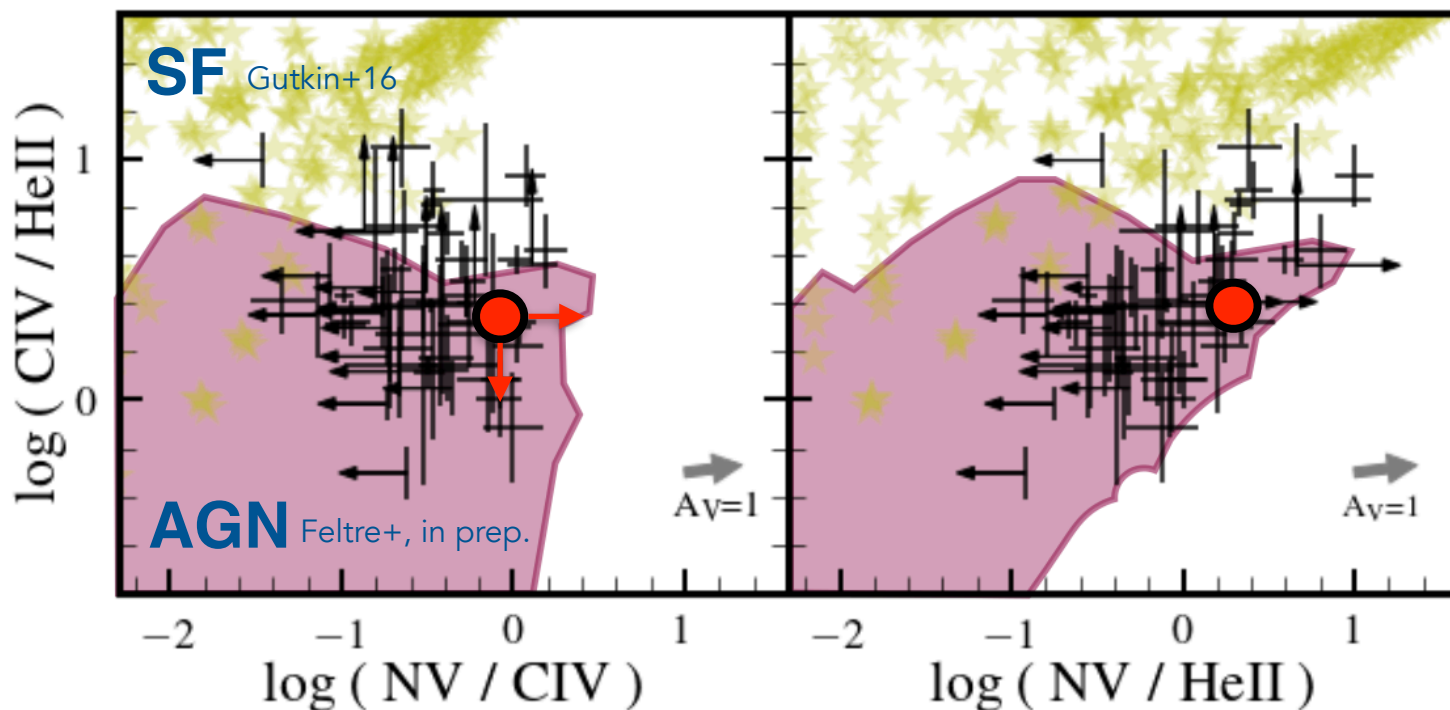
simultaneous study of optical and UV lines

# Spectral models

- \* as diagnostics of the ionizing sources
- \* to study the excitation properties of the gas

90 CIV-selected obscured  
AGN  $1.5 < z < 3$  (z-COSMOS Deep)

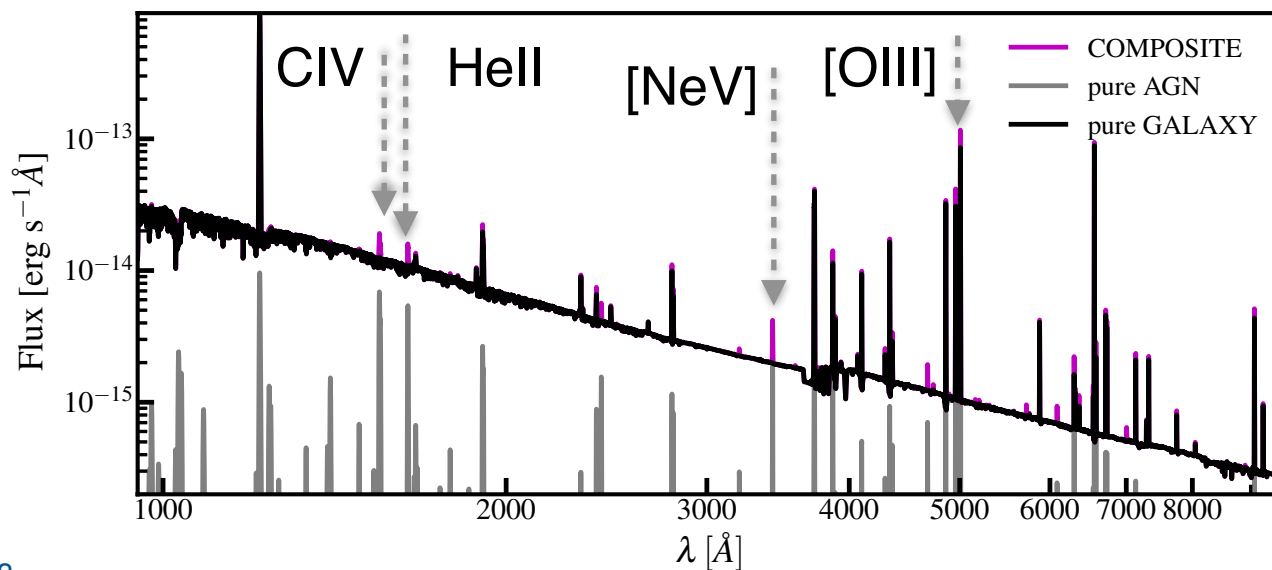
Mignoli, Feltre in prep



  $z \sim 7.15$  COSY Laporte+17

# Spectral models

- \* as diagnostics of the ionizing sources
- \* to study the excitation properties of the gas
- \* combined with fitting tools



host galaxy:  
 $10^{10} M_{\odot}$   
 $Z_{\text{gas}} = 1/2 Z_{\odot}$   
 $\log U = -3.0$

AGN:  
 $L_{\text{acc}} 10^{45} \text{ erg/s}$   
 $Z_{\text{gas}} = Z_{\odot}$   
 $\log U = -2.0$

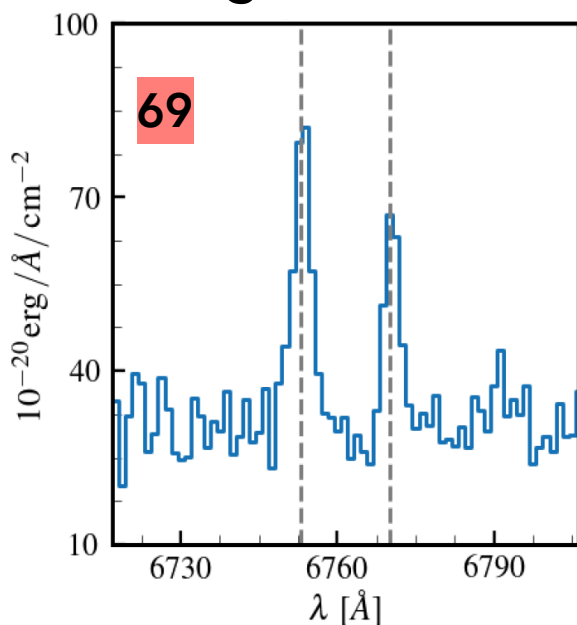




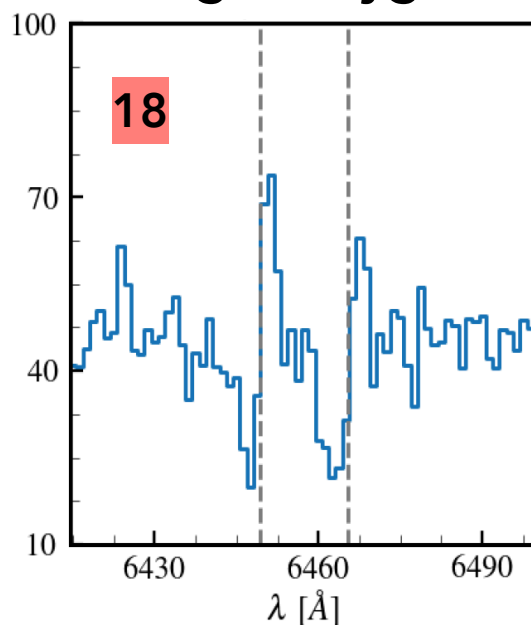
MUSE Hubble Ultra  
Deep Field Survey [Bacon+17](#)

$0.7 < z < 2.34$  (**402** sources)

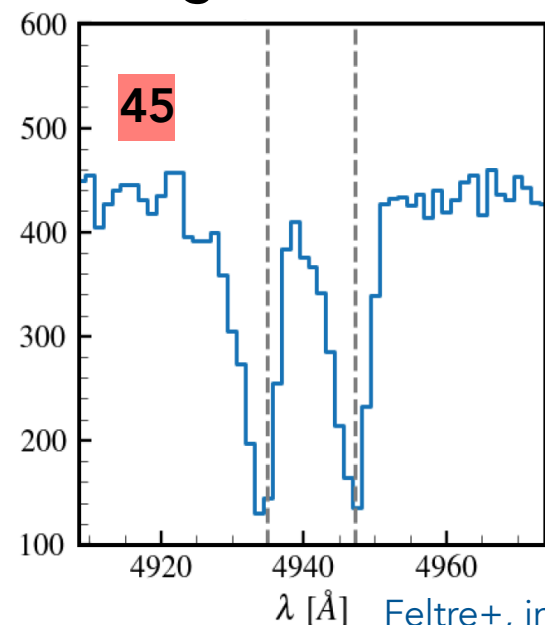
### MgII emitter



### MgII P-Cygni



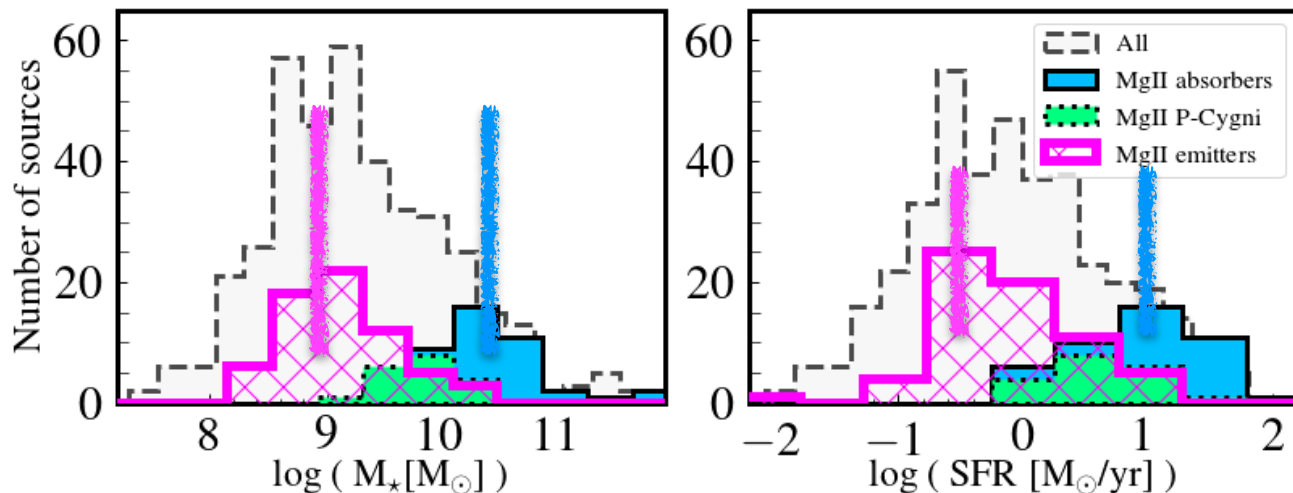
### MgII absorber



Feltre+, in prep

\* classification based on EW and S/N of emission lines and spectra + visual inspection

\* additional emission lines:  
CIII] 1907/1909, [OII] 3726/3729,  
[NeIII] 3869, H $\delta$ , H $\gamma$



Feltre+in prep

MgII emitters show

- \* similar sSFR to MgII absorbers
- \* bluer UV spectral slope
- \* lower dust optical depth
- \* similar nebular properties to MgII absorbers

(see also [Erb+12](#), [Finley+17](#))

main driver for this difference?

**(DUST) CONTENT  
of the ISM**

dedicated modelling of ISM  
required

[Finley/Garel+inprep](#)  
(see also [Vidal-Garcia+17](#))



# Take-aways

- \* different features trace different properties
- \* THE MORE (features), THE MERRIER !!  
(optical+UV lines, nebular+continuum)
- \* but comprehensive analyses required !!  
(stellar emission/absorption, nebular emission, ISM, shocks)