

**Active Galactic Nuclei 10**

**Roma, Italy, September 10-13, 2012**

# **on the cool gas halos of quasars**

**Emanuele Paolo Farina**  
**Università Insubria - Como**

**R. Falomo – INAF OA Padova**

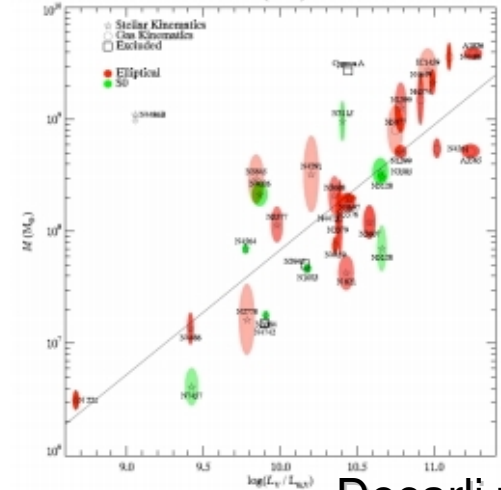
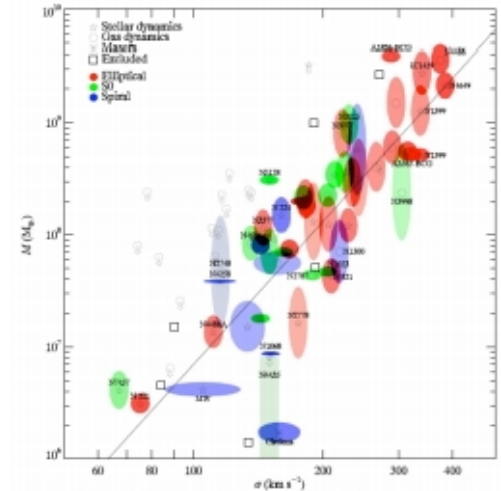
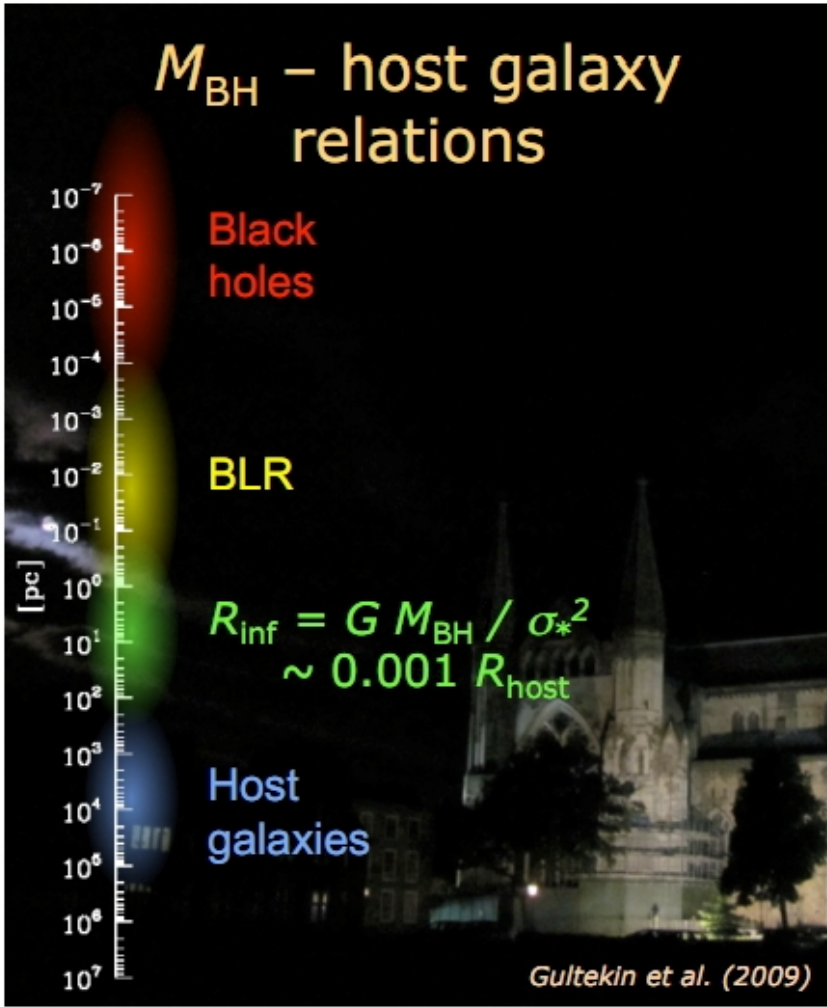
**R. Decarli – MPIA**

**A. Treves – Insubria, INAF & INFN**

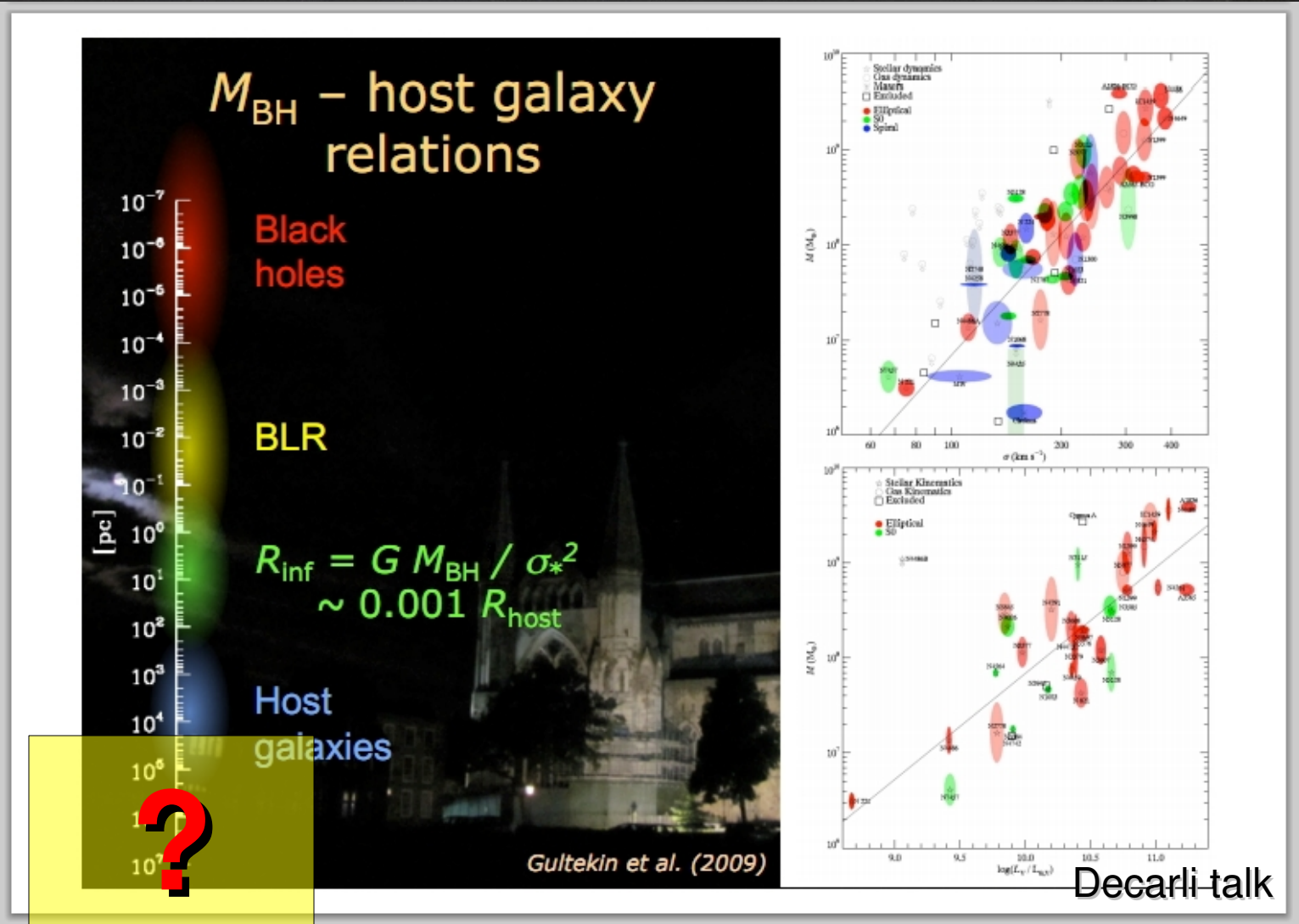
**J. Kotilainen – Tuorla Observatory**

**R. Scarpa – IAC**

# (really) close environment of QSO

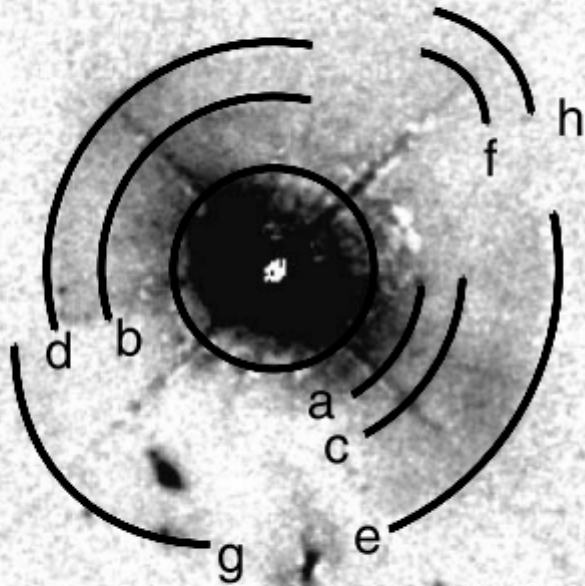


# (really) close environment of QSO

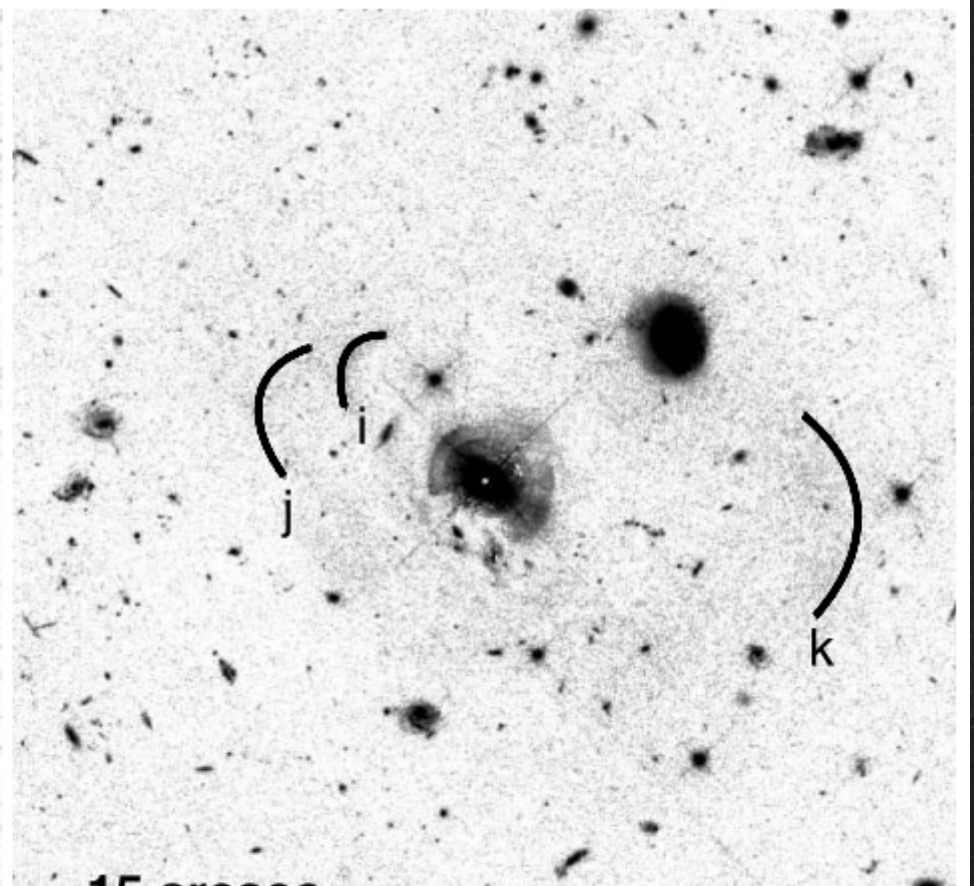


# (really) close environment of QSO

MC2-1635+119  
 $Z \sim 0.15$



5 arcsec  
13 kpc



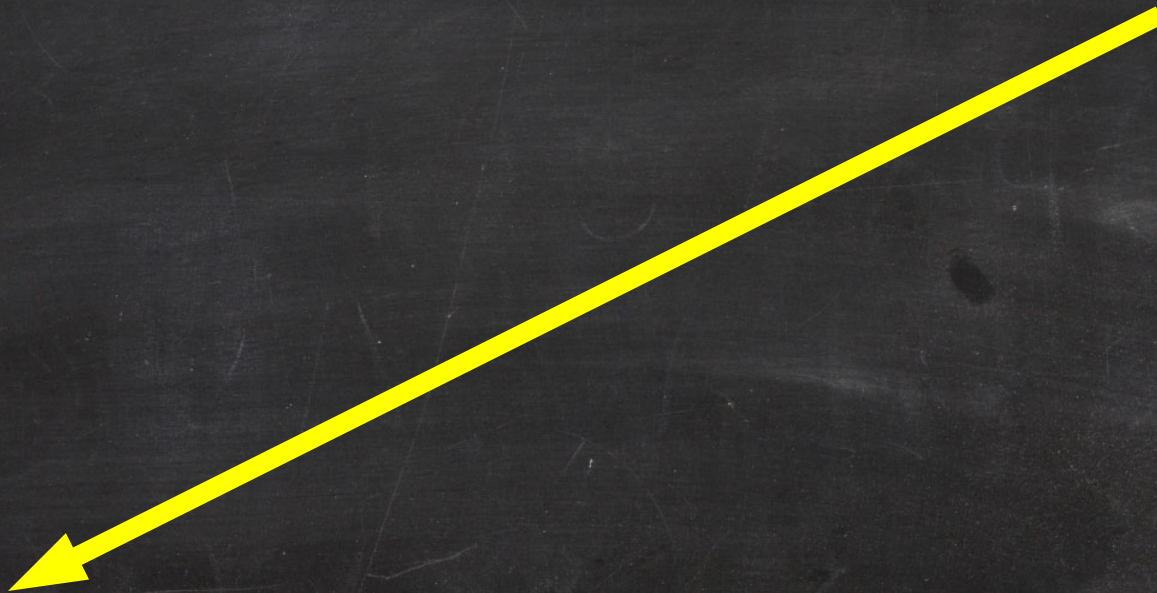
15 arcsec  
40 kpc

**11500s with HST**

# metal absorptions



QSO<sub>B</sub>



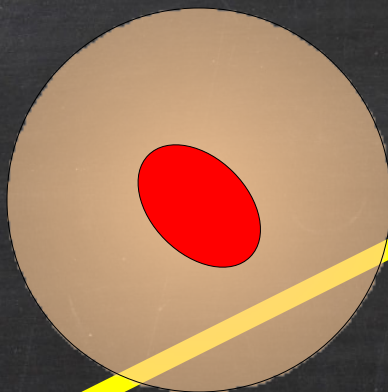
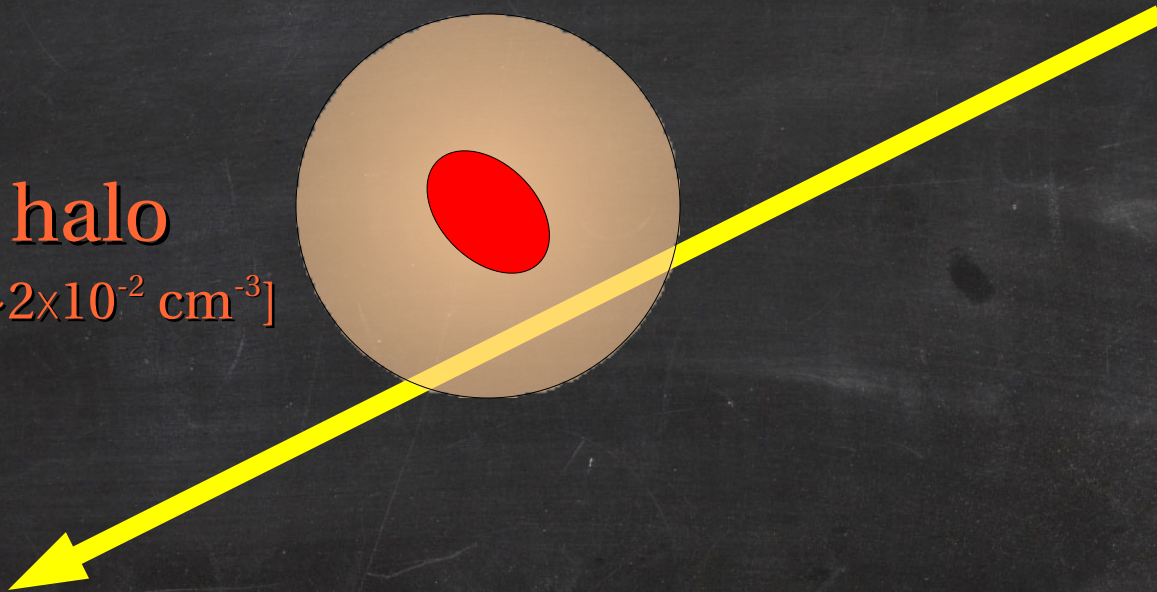
# metal absorptions

galaxy<sub>F</sub>

QSO<sub>B</sub>

cool gas halo

[<100kpc  $\sim 10^4\text{K}$   $\sim 2 \times 10^{-2} \text{ cm}^{-3}$ ]



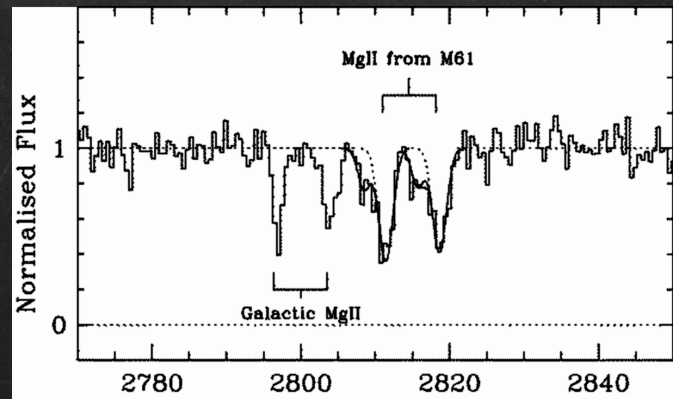
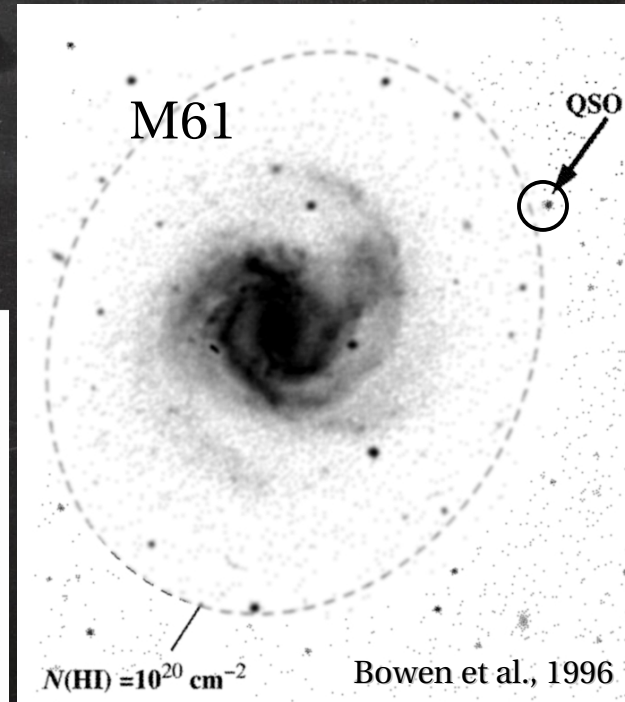
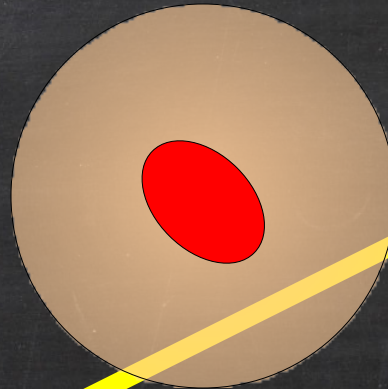
# metal absorptions

galaxy<sub>F</sub>

QSO<sub>B</sub>

cool gas halo

[<100kpc  $\sim 10^4$ K  $\sim 2 \times 10^{-2}$  cm<sup>-3</sup>]



# metal absorptions

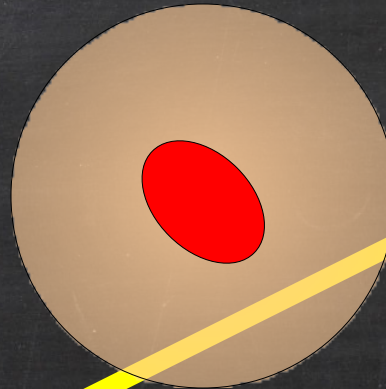
galaxy<sub>F</sub>



QSO<sub>B</sub>

cool gas halo

[<100kpc  $\sim 10^4\text{K}$   $\sim 2 \times 10^{-2} \text{ cm}^{-3}$ ]



**OLD IDEA:**

Bahcall & Spitzer (1969)

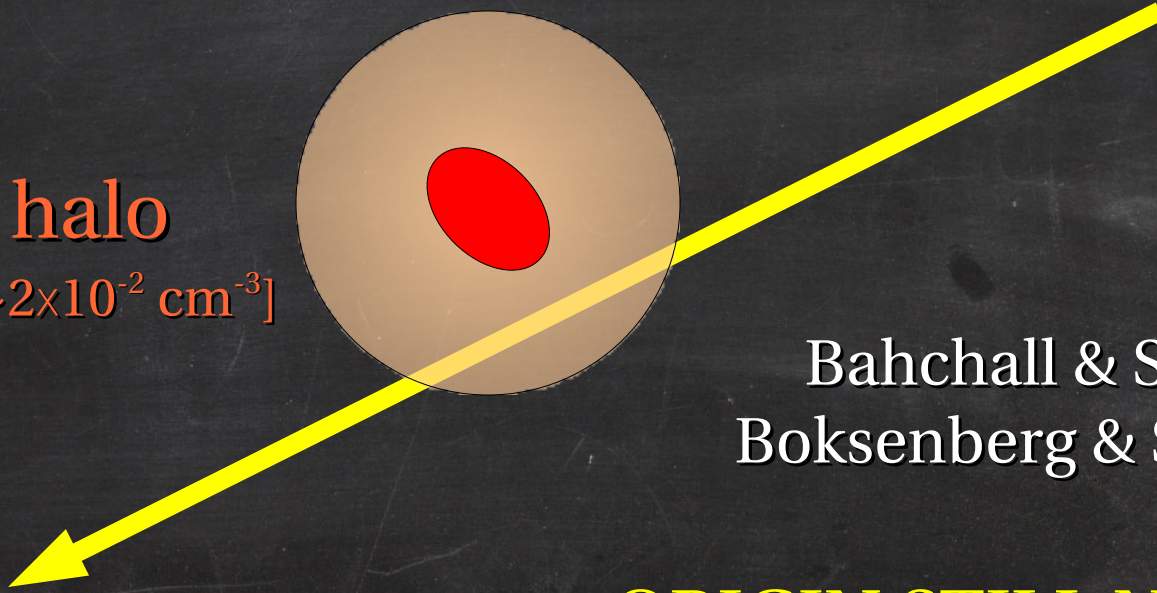
Boksenberg & Sargen (1978)

**ORIGIN STILL NOT CLEAR:**

outflow SFR : e.g., Zibetti et al. (2007)

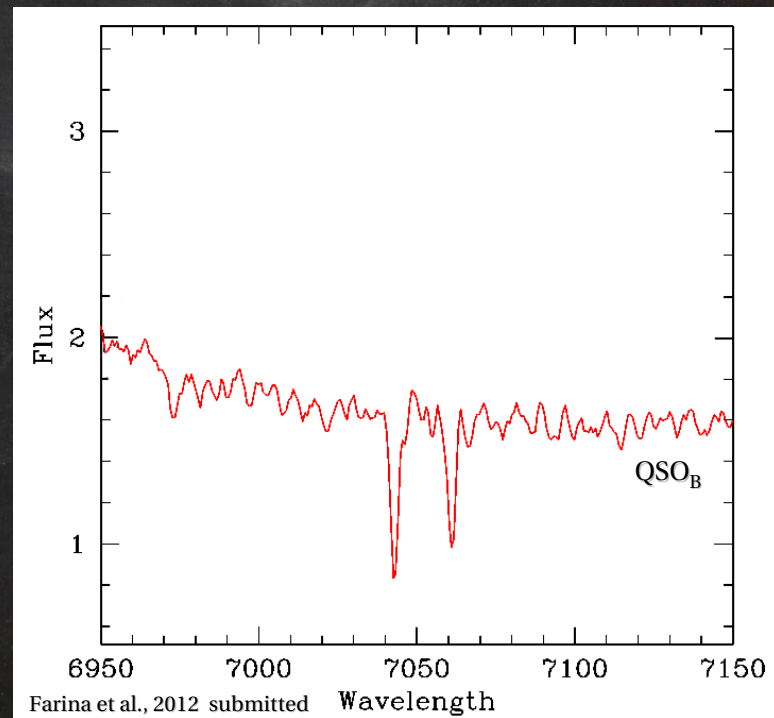
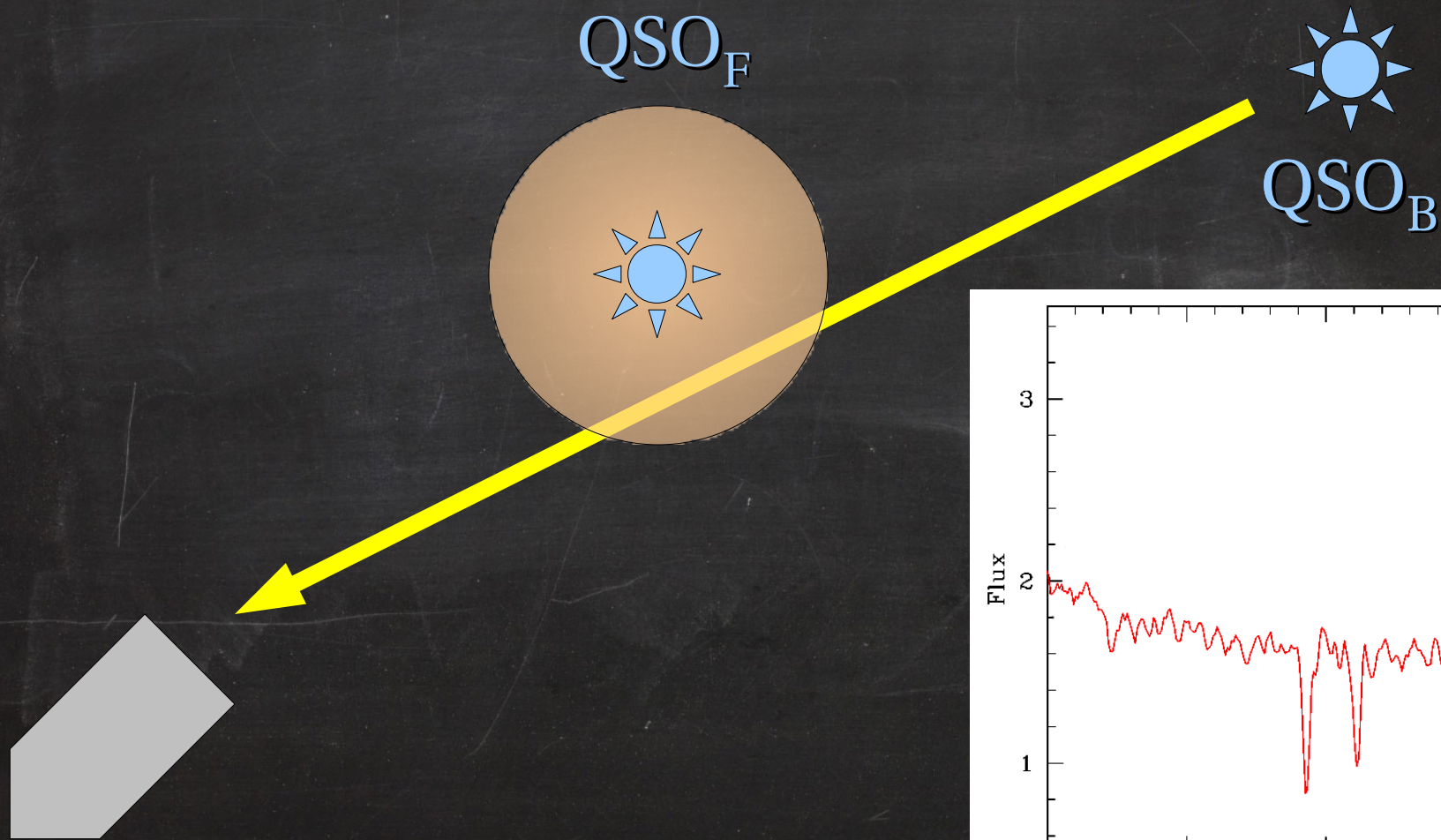
inflow : e.g., Chen et al. (2010)

both : e.g., Kacprzak et al. (2012)

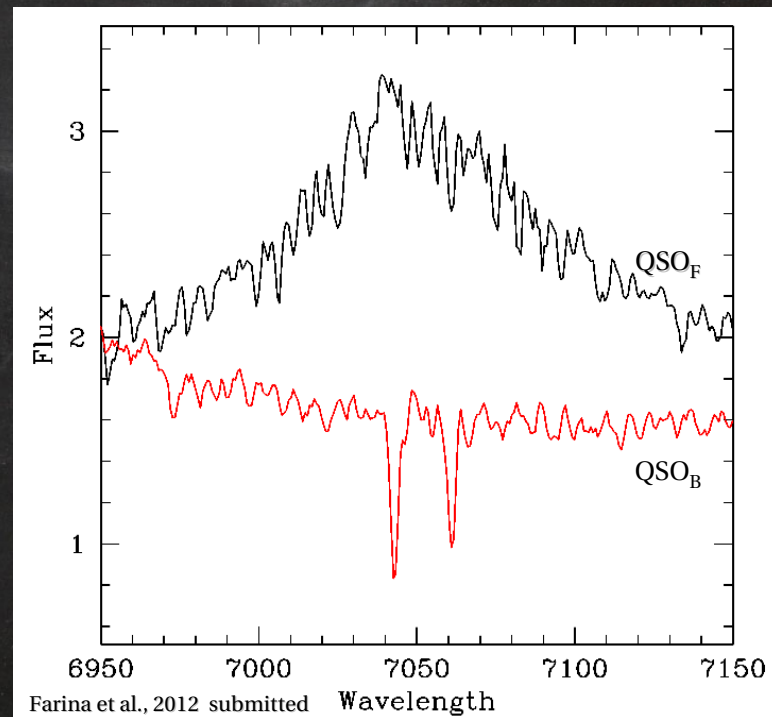
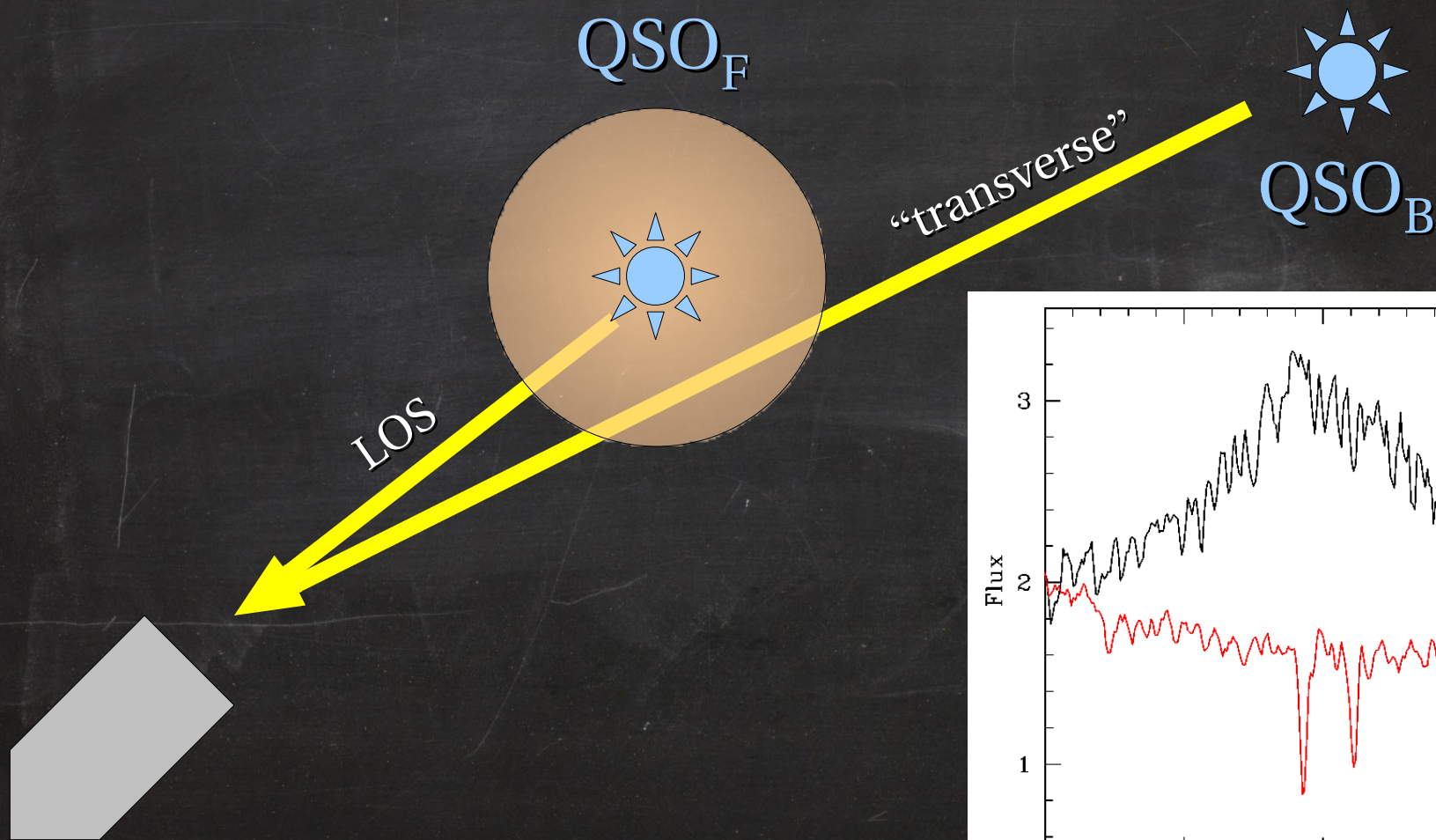




# metal absorptions



# metal absorptions



# the sample

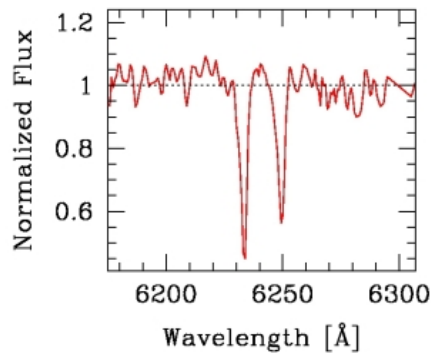
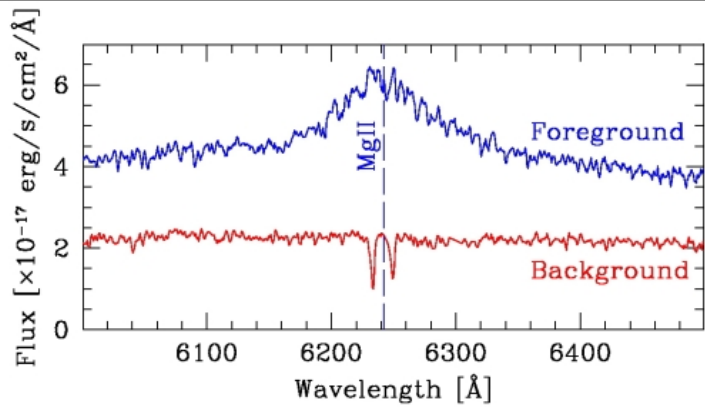
## 36 projected QSO pairs

- $PD < 200$  kpc
- $m(V) < 21$
- MgII and CIV in optical

[ 23 north + 13 south ]



e.g.



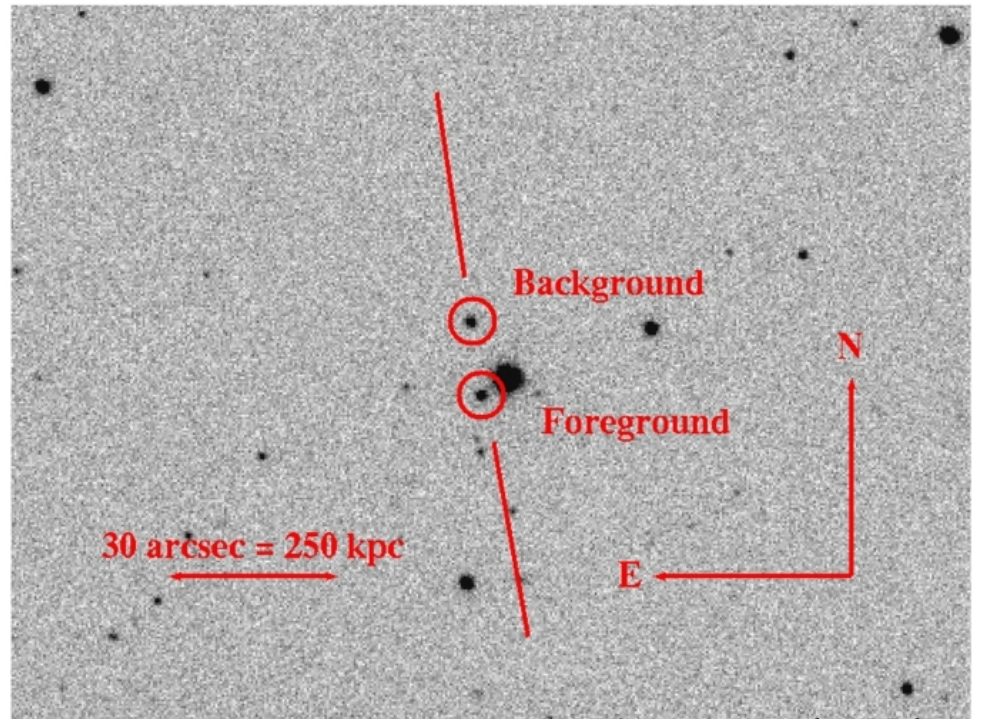
SDSS J22067-0038

$z_F = 1.231$   $V_F = 19.3$

$z_B = 1.516$   $V_B = 19.6$

$\Delta\theta = 13$  arcsec

pd = 108 kpc

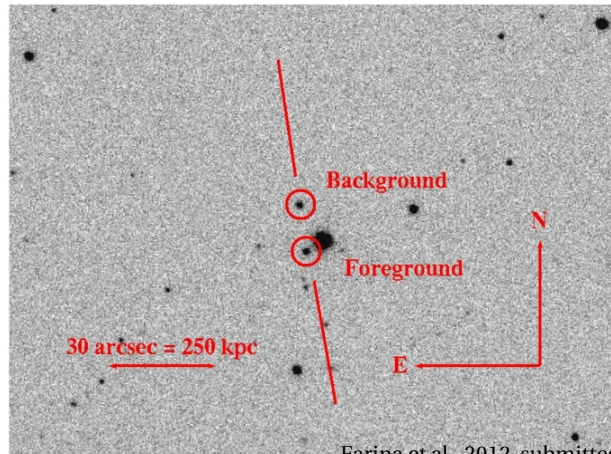
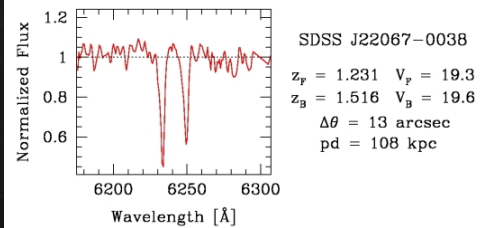
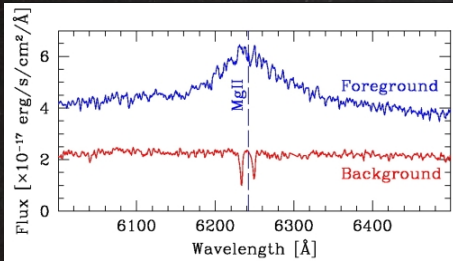
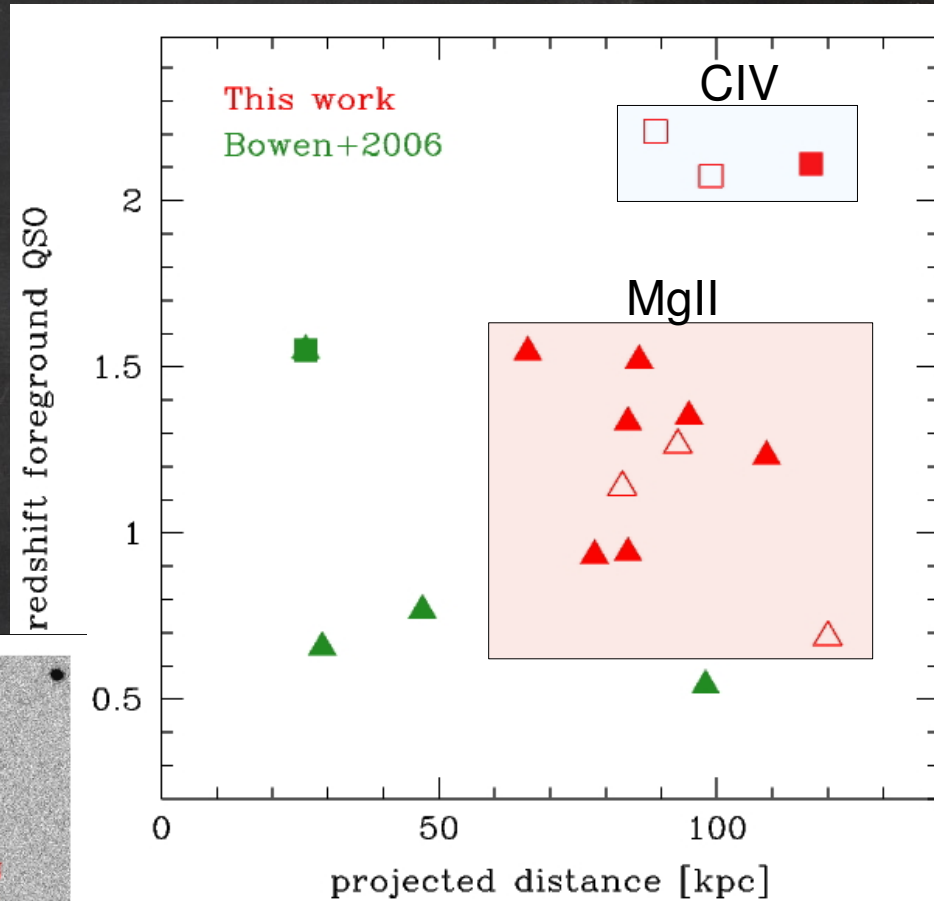


Farina et al., 2012 submitted

# VLT data

## 10 Mg II + 3 C IV

- FORS2@VLT spectra
- GRISM 1200R & 1400V
- RESOLUTION : ~2800
- S/N ~ 50

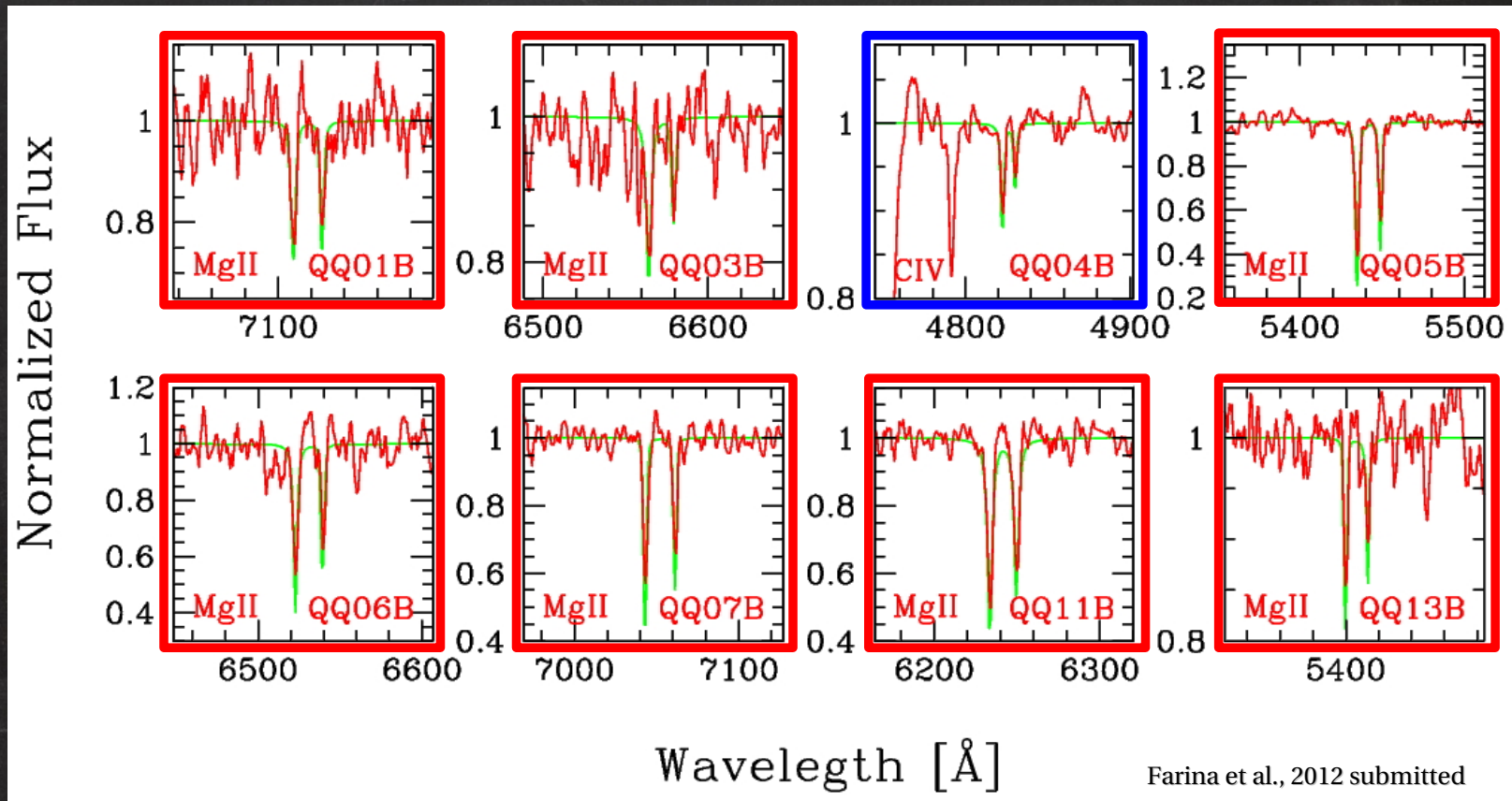


Farina et al., 2012 submitted

70 – 120 kpc  
0.7 <  $Z_F$  < 2.2

# TRANSVERSE ABSORBERS

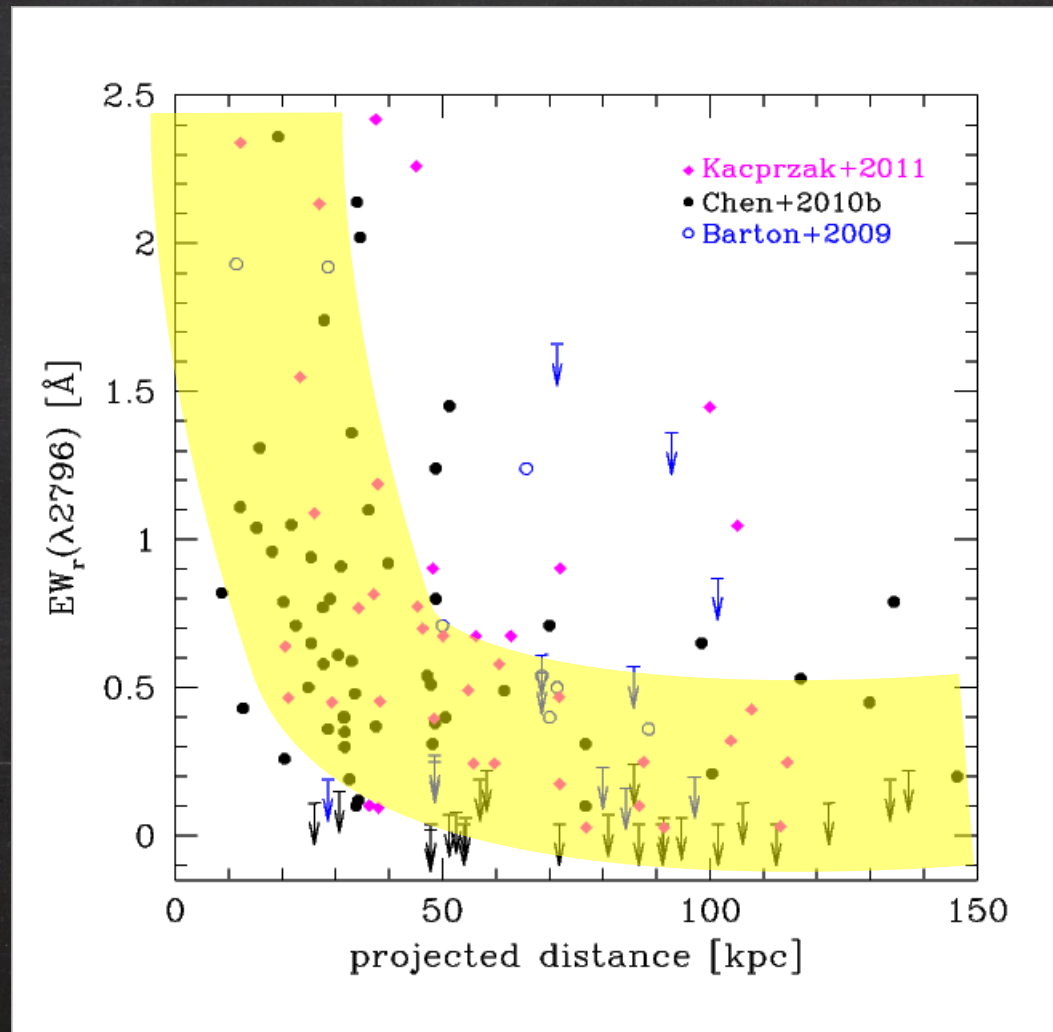
# transverse absorbers



**7/10 for Mg II**

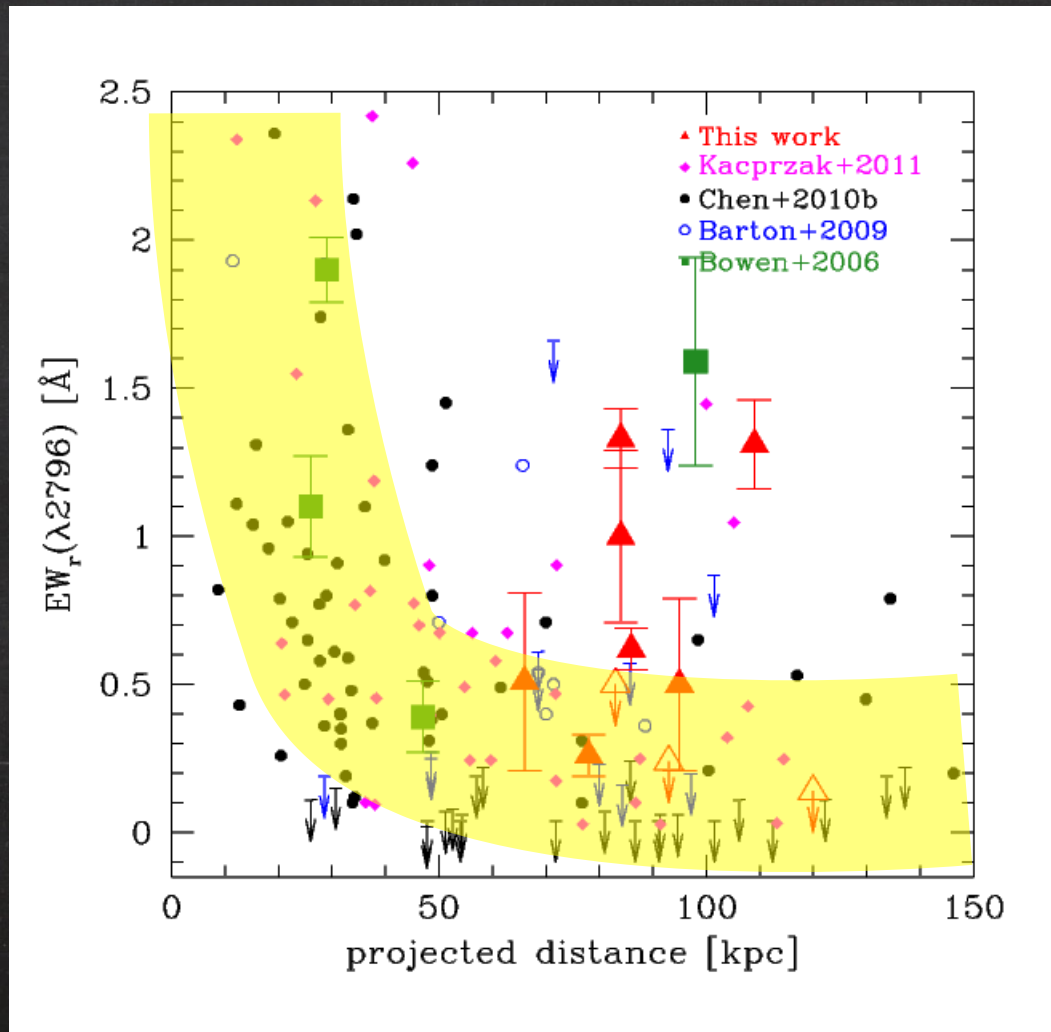
**1/3 for CIV**

# MgII transverse absorbers

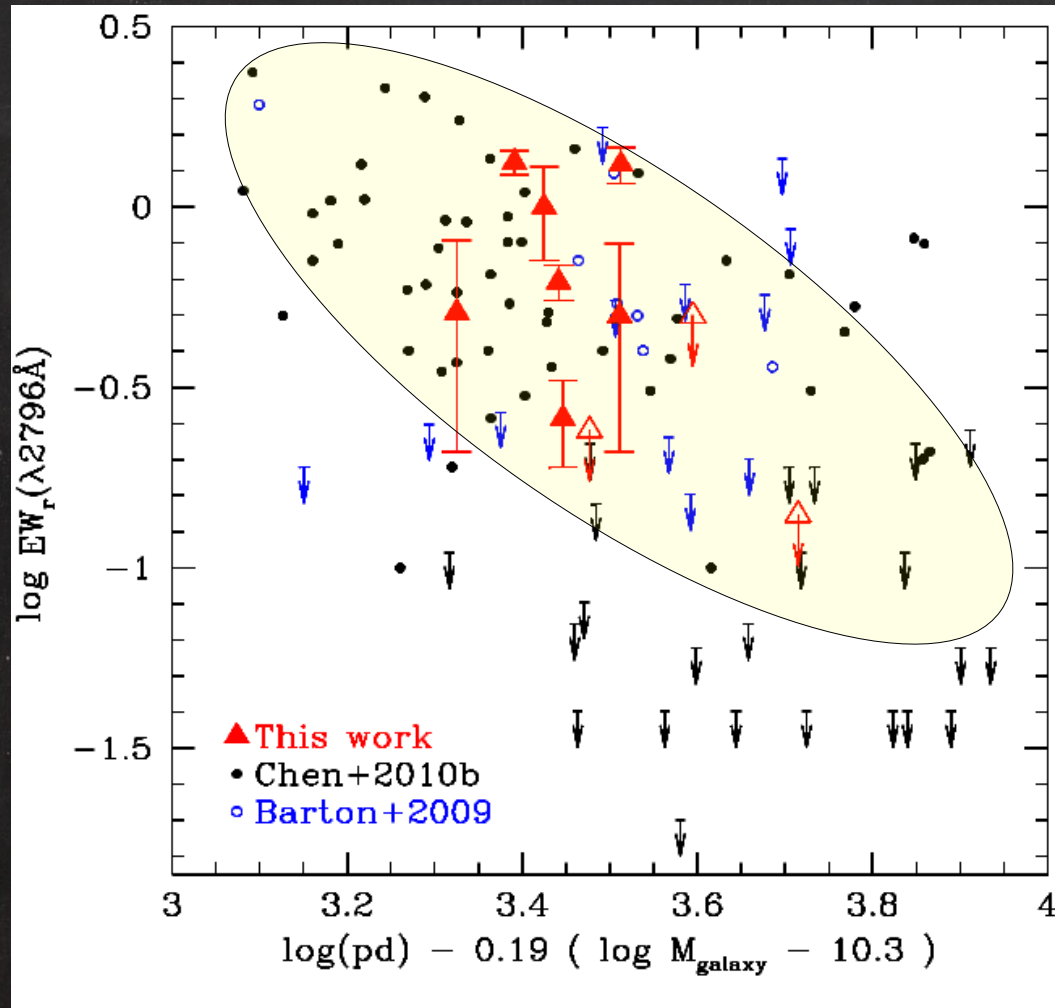




# MgII transverse absorbers



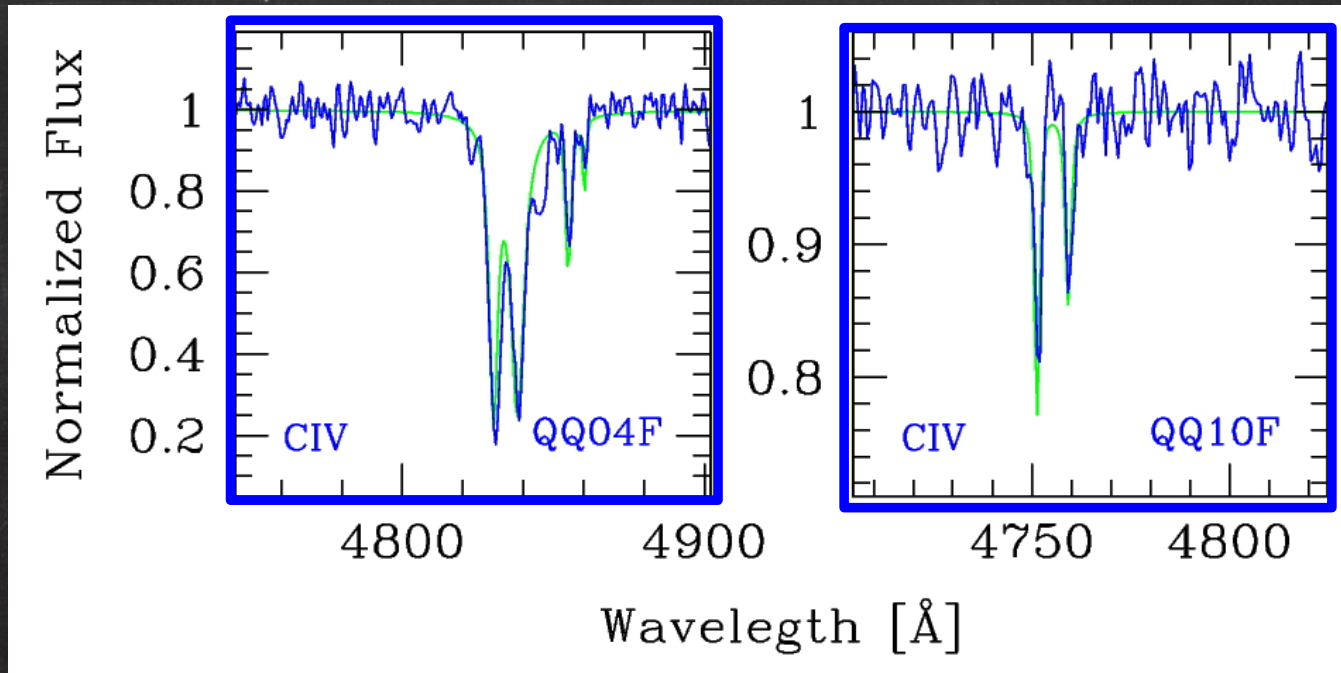
# the role of mass



SIMPLE MODEL:  
EW scales with stellar  
mass

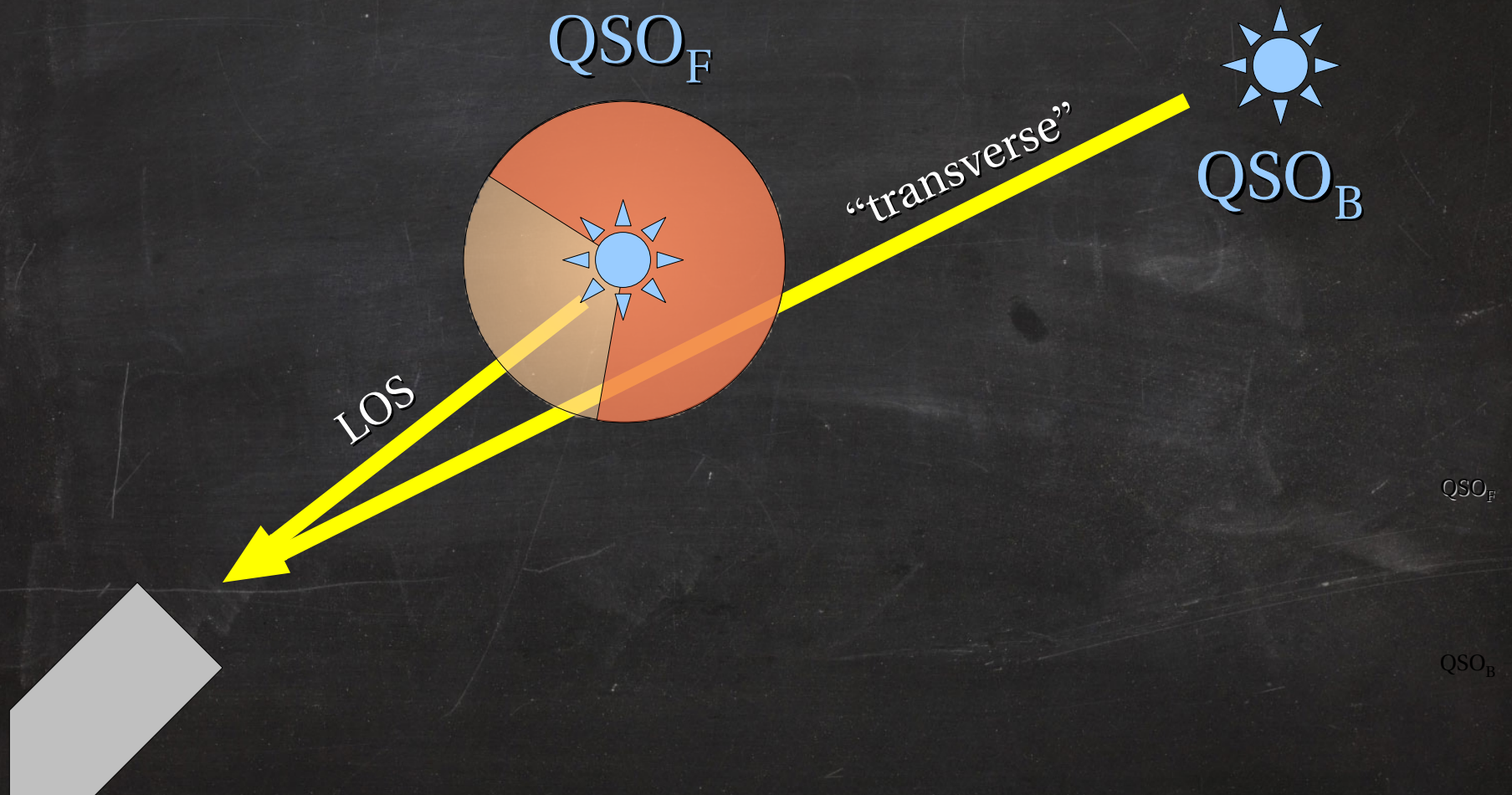
# LOS ABSORBERS

# LOS absorbers

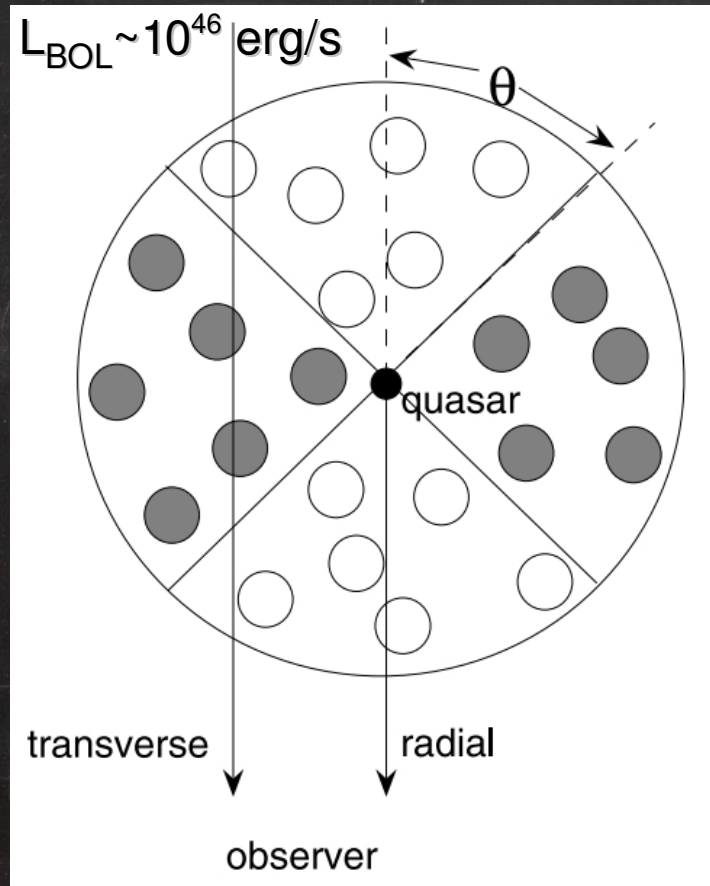


**0/10 for Mg II**      **2/3 for CIV**

# LOS absorbers

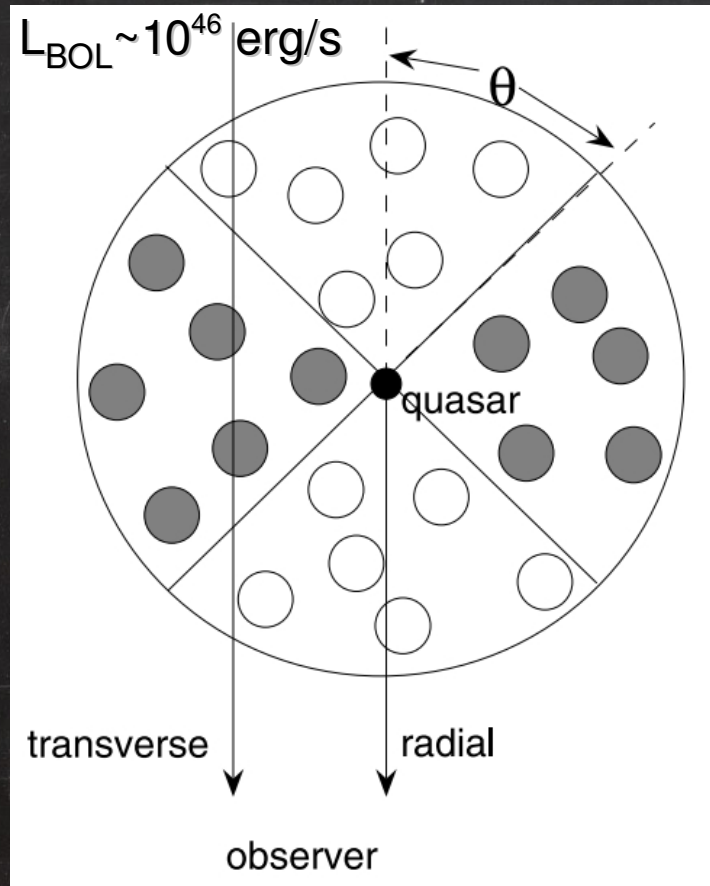


# non-isotropic emission?



- LOS MgII photoionized by QSO emission
- LOS CIV "survive"

# non-isotropic emission?



QSOs INFLUENCE  
THE ENVIRONMENT  
AS FAR AS  $\sim 100$  kpc (at least)

# conclusions

- QSO HALOS ~ GALAXY HALOS
- ABSORBER DISTRIBUTION IS NOT HOMOGENEOUS





