Optical properties and spatial distribution of MgII absorbers from SDSS image stacking

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See also: *Zibetti et al. 2005, ApJL, 631:105L*
Zibetti et al. 2007, ApJ, 658:161

HI Survival Through Cosmic Times
10.-15. June 2007 – Abbazia di Spineto (*Italia*)

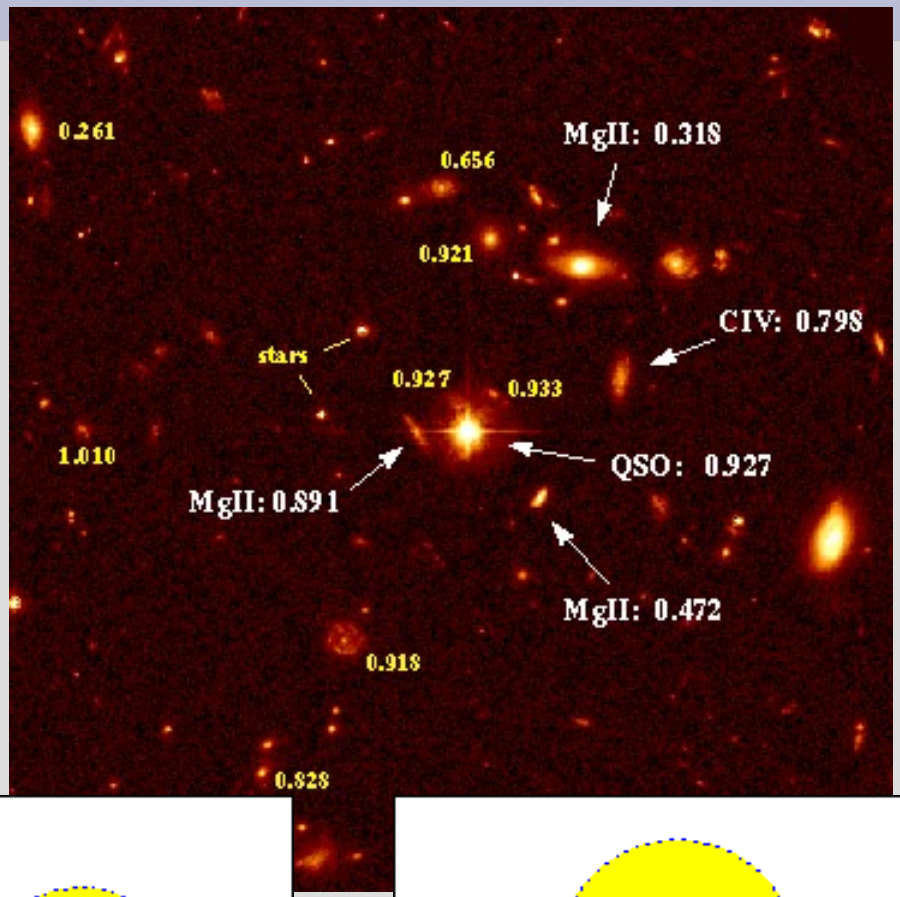
Motivations

- MgII as low-ionization gas (and HI) tracer (eg previous talk by Daniel Nestor)
- What's the origin of this gas?
- What's the link between galaxies and absorbing gas?
- Physical scenario that brings together galaxy evolution, SFH, gas consumption and feed-back processes

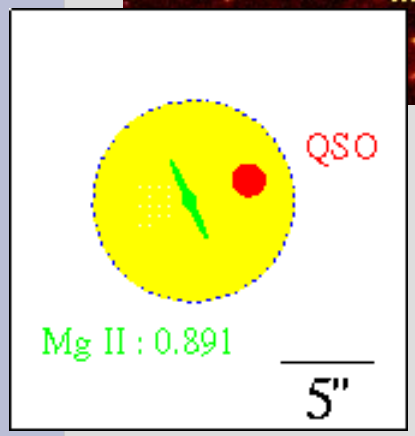
Aims

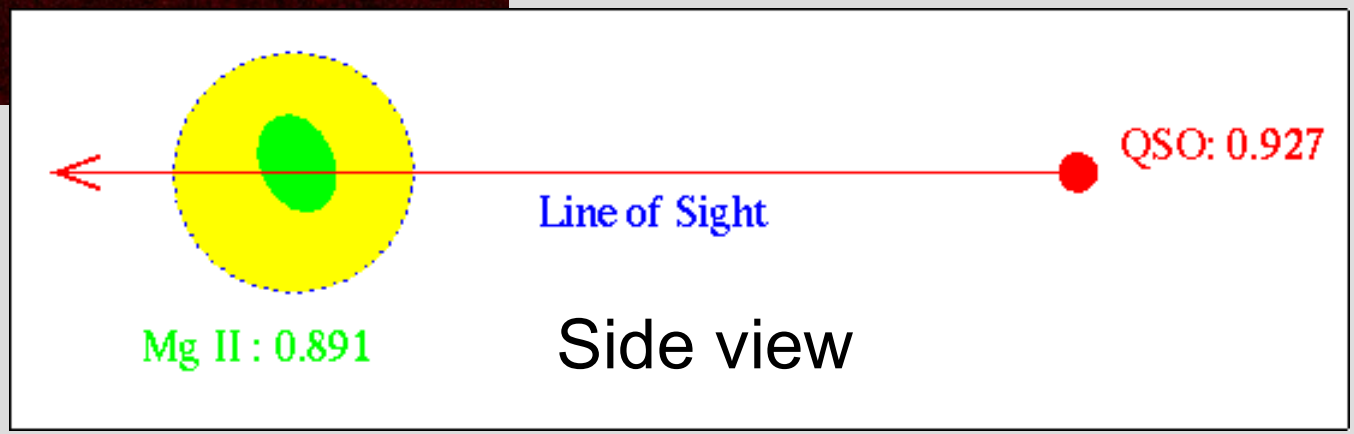
- Measure the correlation of gas and light (galaxies)
- Distribution of the impact parameter of absorbing gas around galaxies
- Which galaxies (luminosity, SED) are associated to which absorbers (strength, impact parameter, species)?
- How do these properties evolve with redshift?

The game of associating absorbers with galaxies



- Deep imaging
- Deep spectroscopy
- Very expensive
- Limited field and luminosity
- Small samples so far (<100 pairs)

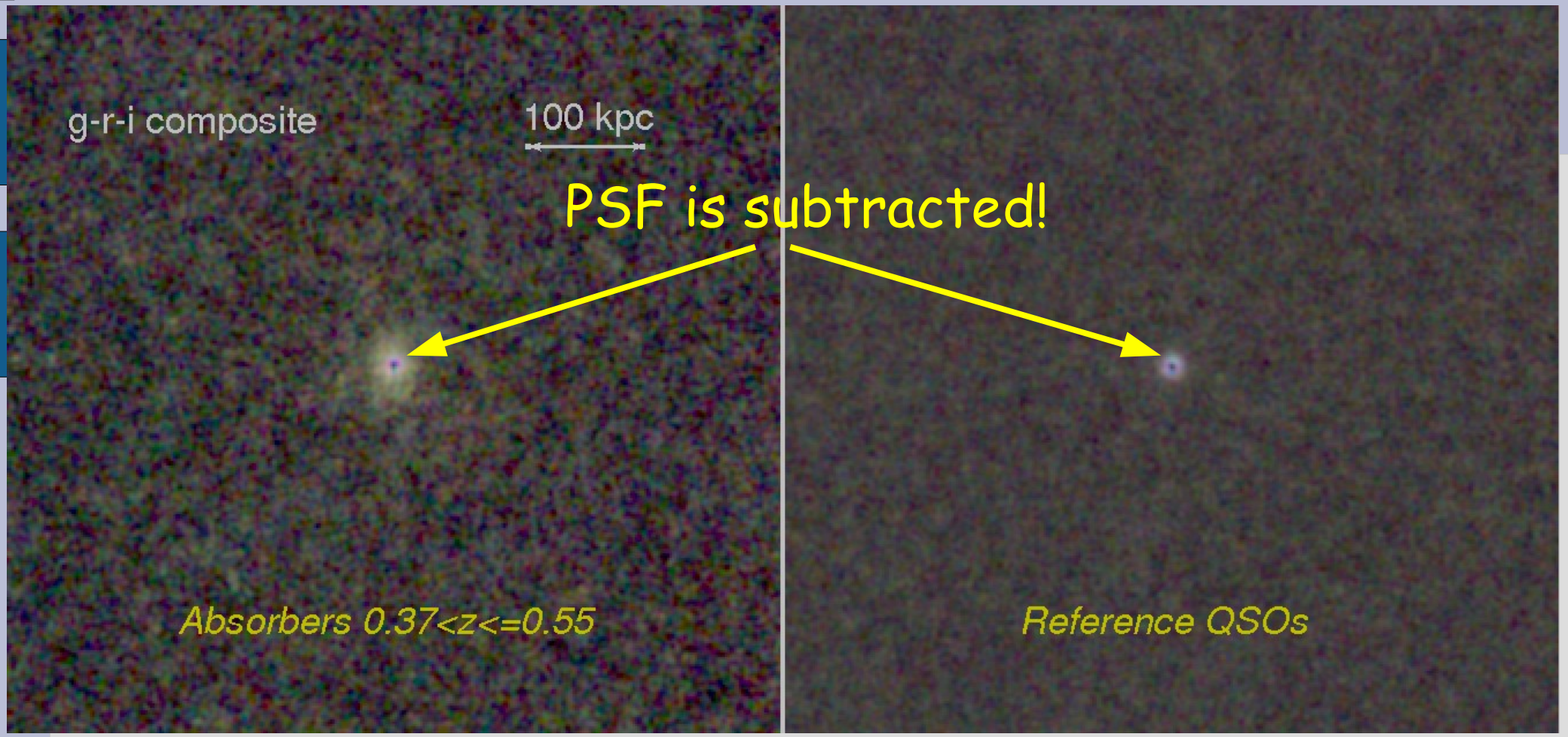




The STACKING approach

- Absorbers ↔ Galaxies
- Along **absorbed** lines of sight more galaxies than along **random** l.o.s.
- Too noisy to be seen in small samples
- Need large statistical sample, with **several hundreds** l.o.s.
- Stack images of QSOs with and w/o absorbers → measure **light excess** and its **distribution**
- *No priors, no luminosity cuts, little spatial limitations, BUT only light-weighted average quantities*

Pictorial result



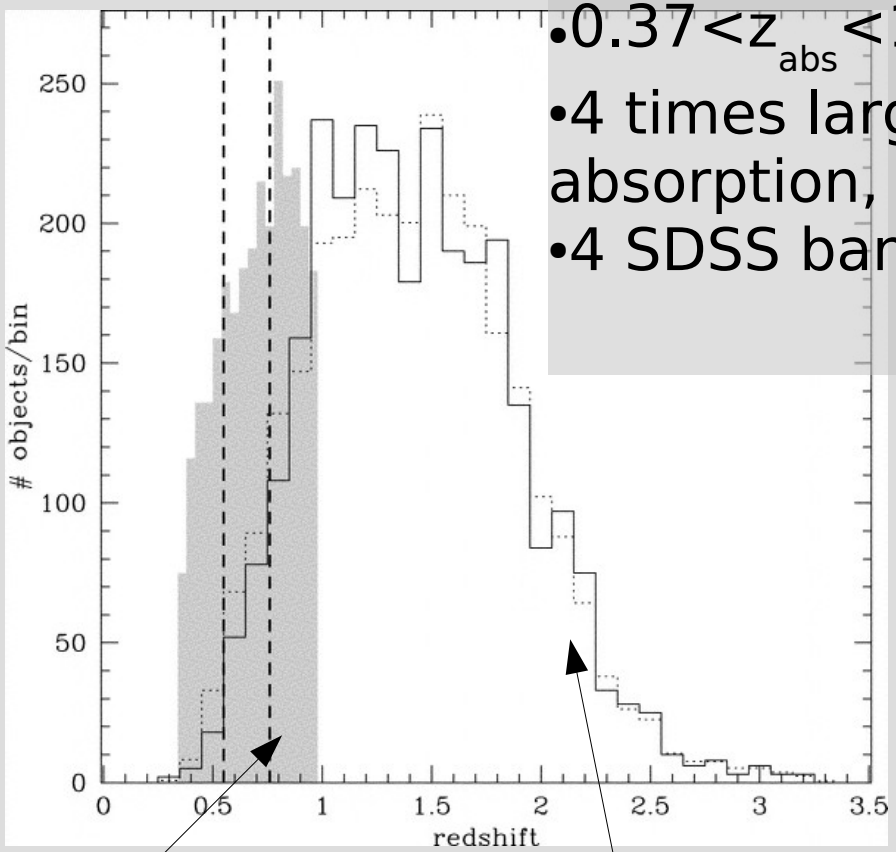
~600 QSOs

4x bigger sample! Noise/2

- Note: image processing is complex and includes QSO-PSF subtraction and masks!

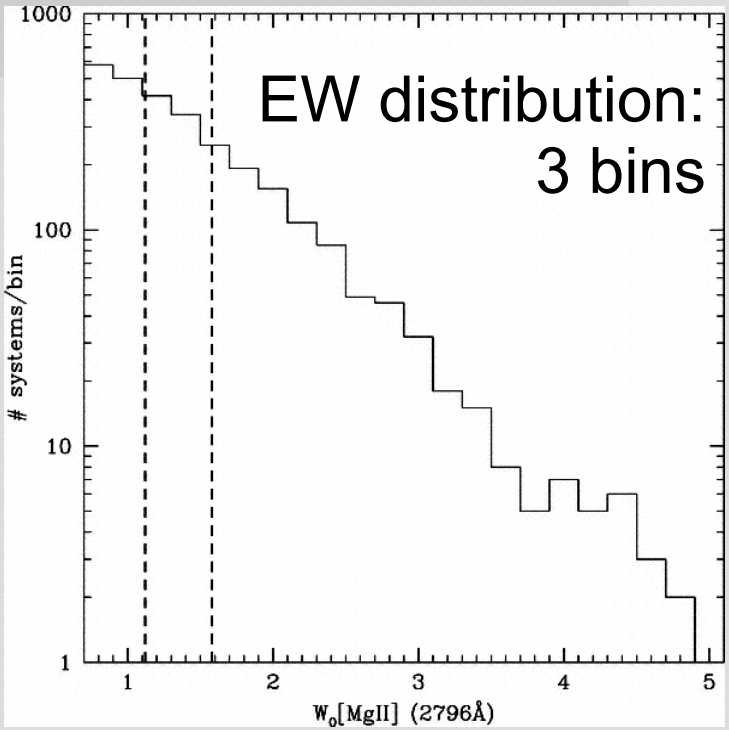
The SDSS sample

- Nestor et al. (2005), DR4
- 2844 single-MgII absorbers W0>0.8Å
- $0.37<z_{abs}<1.00$
- 4 times larger reference sample (no absorption, match z, mag, S/N)
- 4 SDSS bands: colors/SED



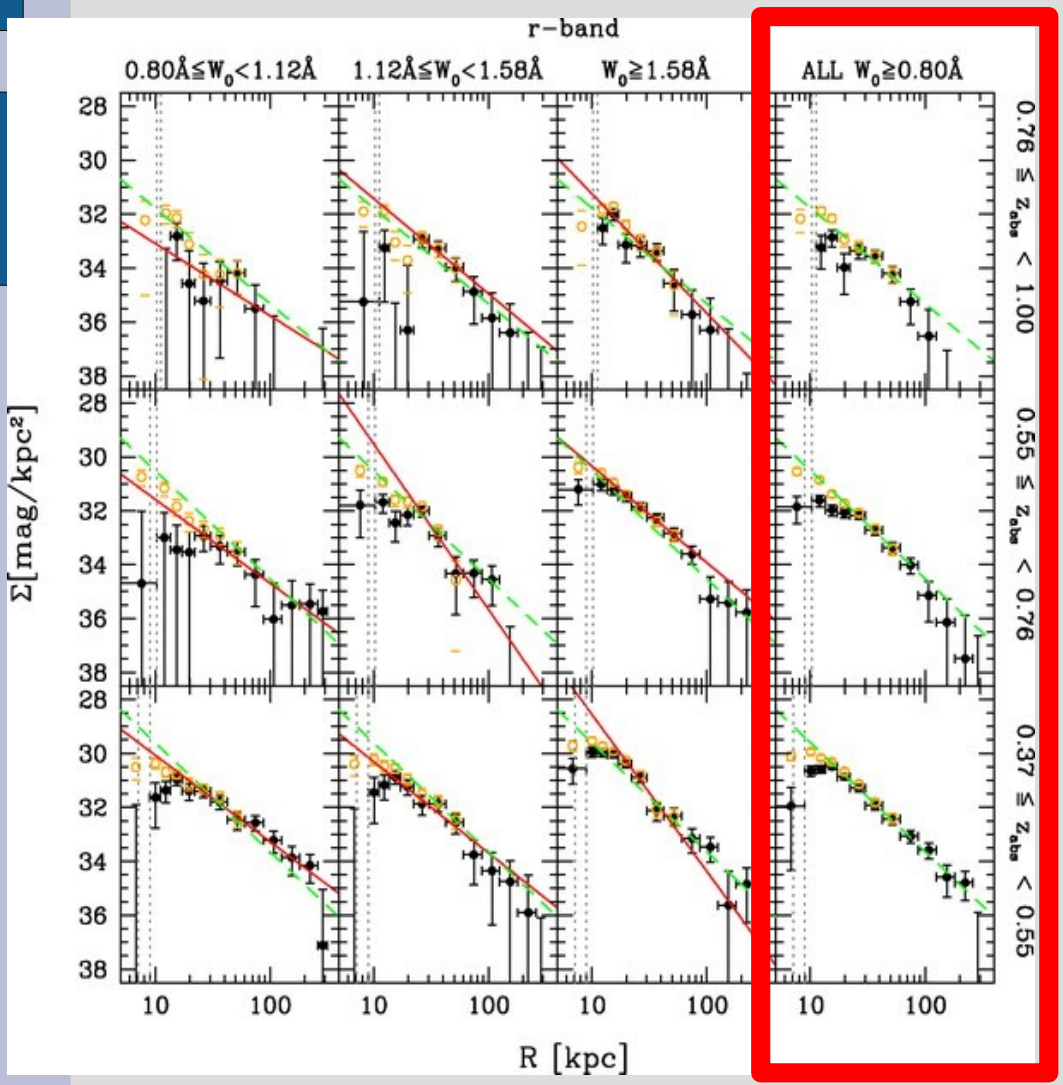
z_{abs} distr:3 bins

z_{QSO} distribution

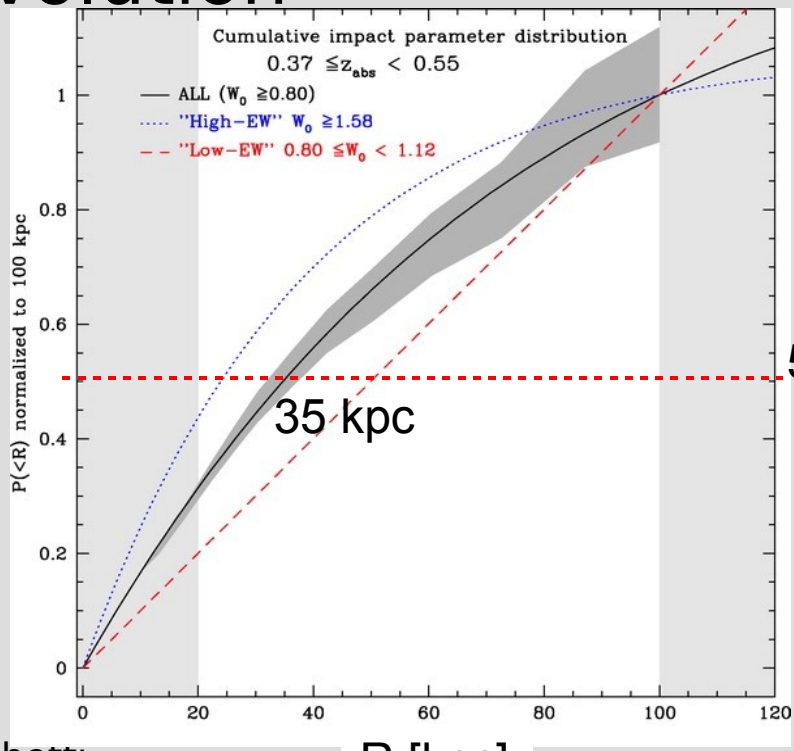


1. Impact parameter distribution (LIGHT-WEIGHTED)

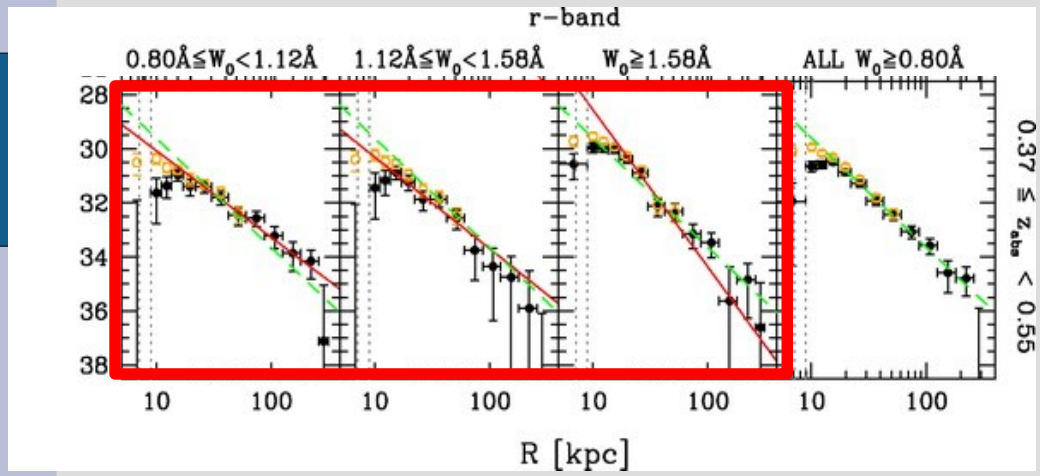
- Light up to ~200 kpc
- ~powerlaw (-1.5)
- 50% of the light within ~35 kpc
- No evidence for redshift evolution



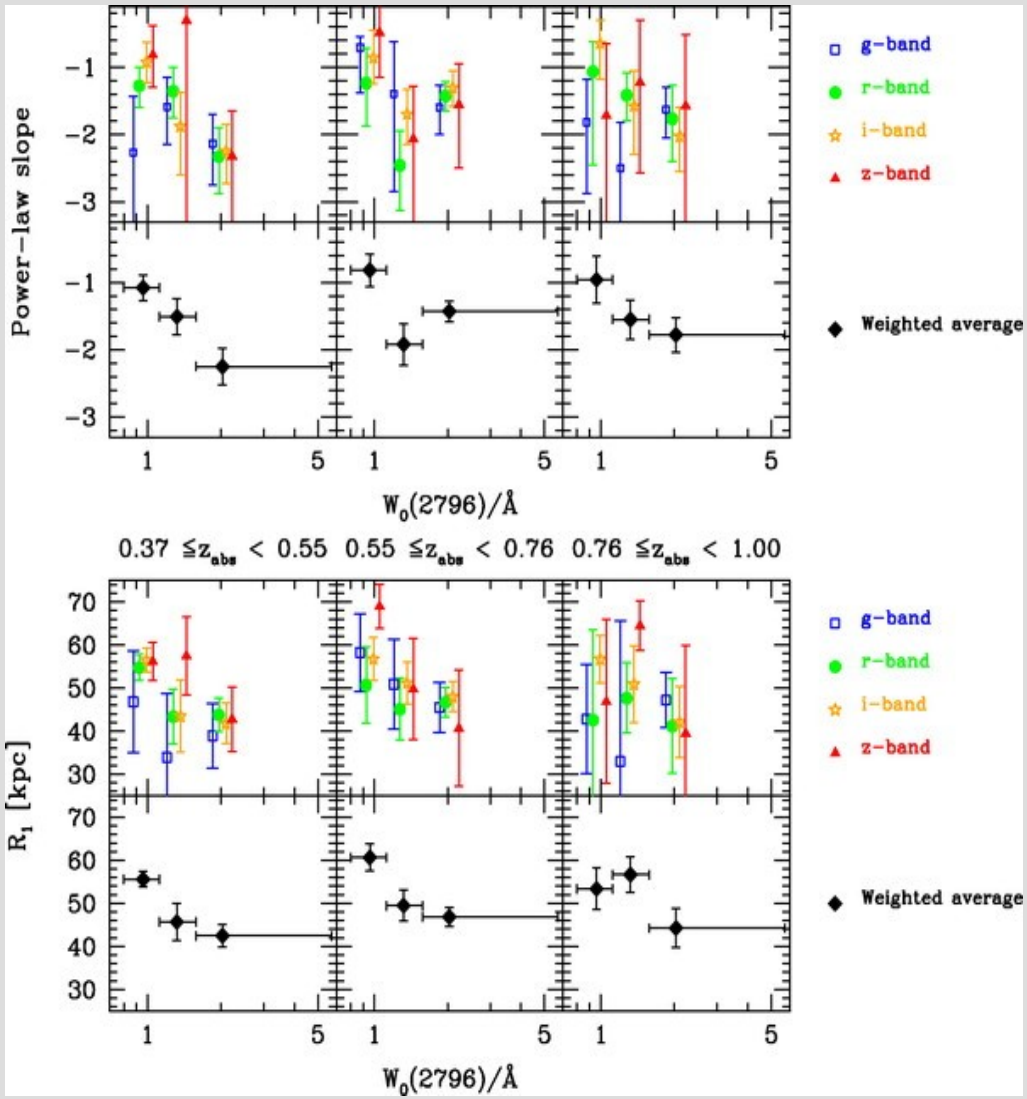
z increases →



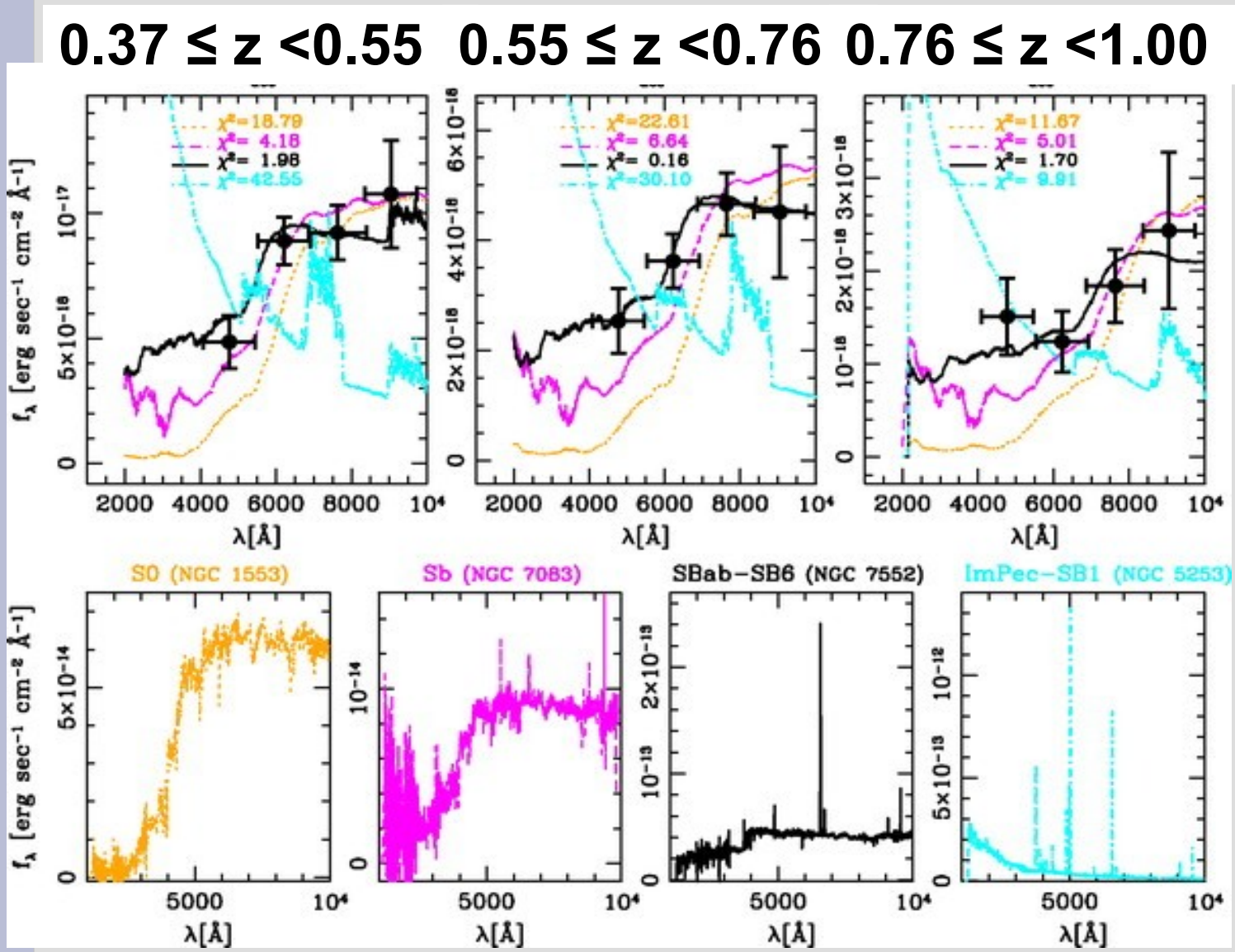
2. anti-correlation
abs. strength vs <impact parameter>



- Stronger absorbers lay closer to galaxies
  (on average, luminosity weighted)



3. Luminosity and average SED vs redshift

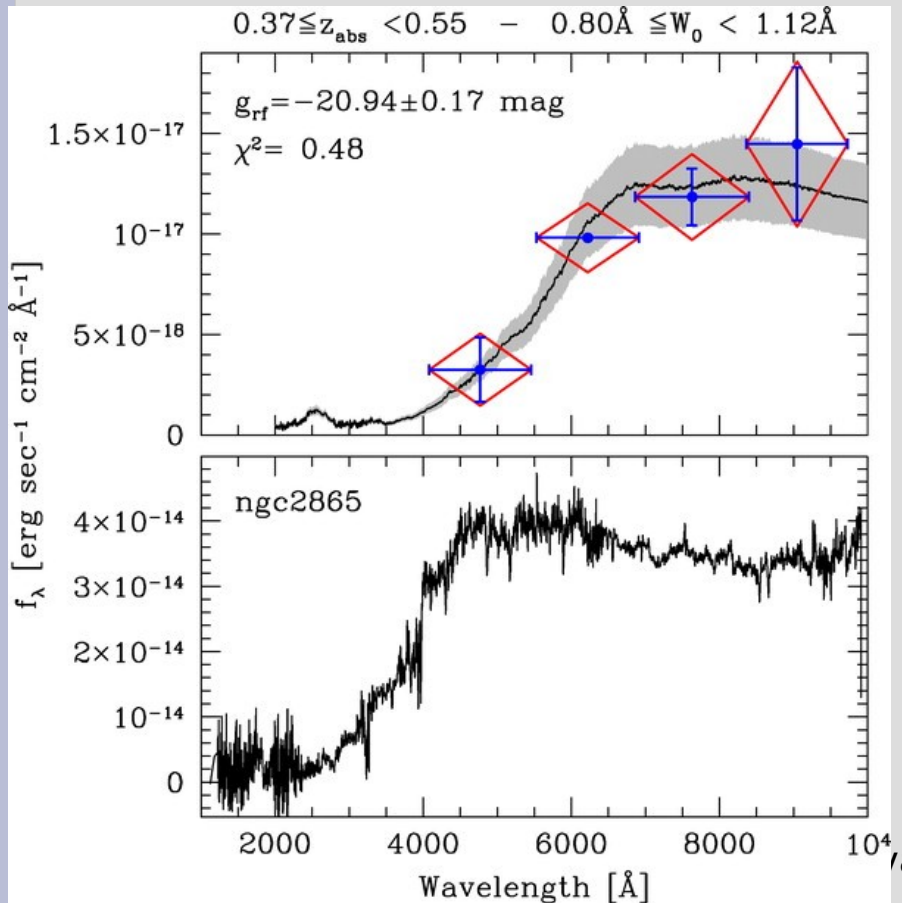


- **Average SED: intermediate type, non-evolving**
- Average luminosity: **~0.5 L***
- Absolute magnitude brighter at higher z (-20.65 → -21.19 M_g): ***downsizing***

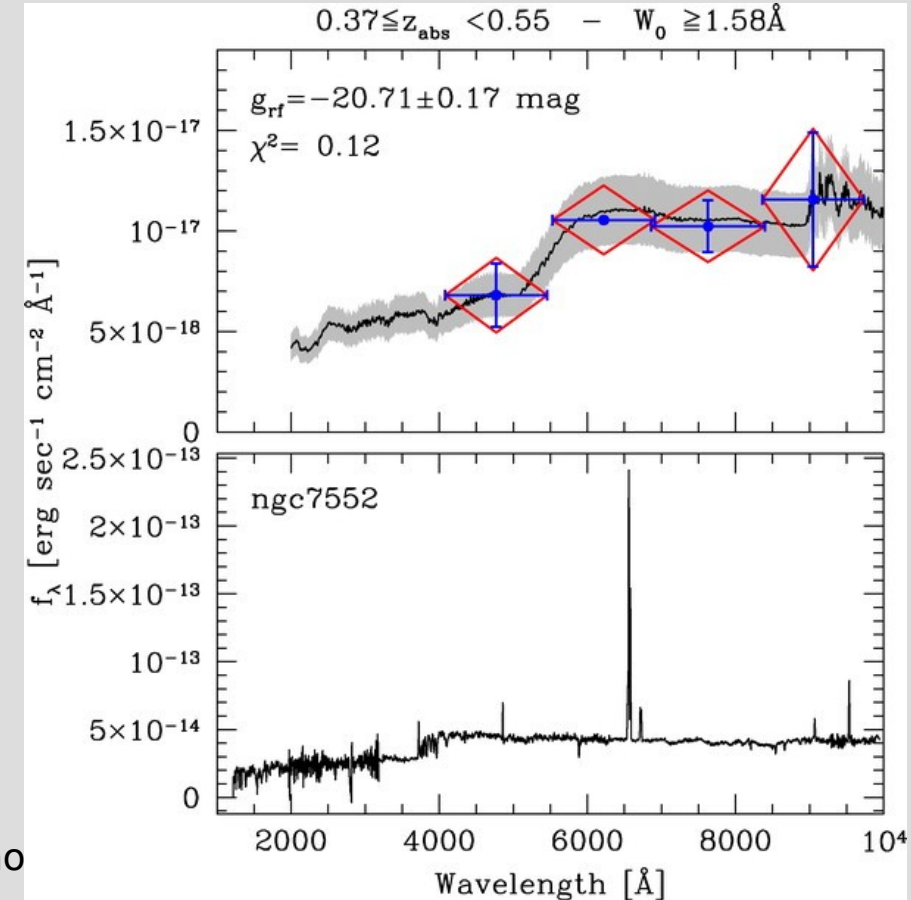
4. Correlation absorption strength vs SED type

- Stronger absorbers are linked to bluer, more star forming SEDs

Low Equivalent Width



High Equivalent Width



A possible physical interpretation of strong MgII absorbers