335.16. Spectroscopic Observation of Emission Line Galaxies at $z \sim 1$ with the Sloan Telescope : Implications for Future Surveys

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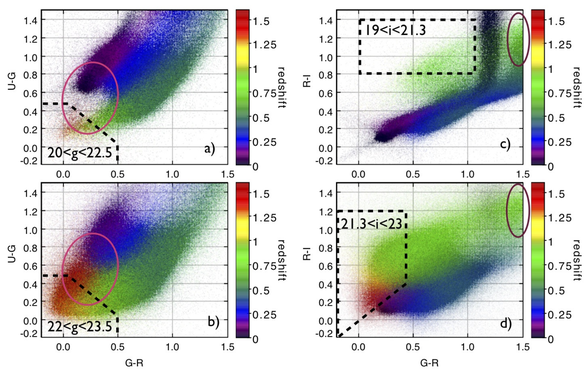
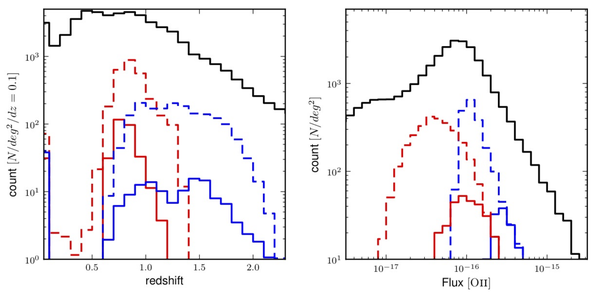
Abstract

We observed emission line galaxies (ELG) in the redshift range $[0.6, 1.6]$ with the 2.5m Sloan telescope spectrograph (Gunn et al. 2006). We explored different color selections using the SDSS or CFHT-LS photometry *u, g, r, i* bands to select ELGs in different redshift bins. For this survey, the typical 5 sigma flux detection limit of the [OII] emission line is $5 \times 10^{-17} \mathrm{erg\,s^{-1}\,cm^{-2}}$. We assembled a dataset of about one thousand ELG spectra. The highest redshift confirmed by the detection of the [OII] doublet is 1.622. These results combined with simulations confirm the feasibility of massive ELG surveys for a first BAO measurement in the redshift window $[0.6 - 1.6]$ using BOSS spectrograph, giving the strongest support to the eBOSS and the BigBOSS projects observation strategy regarding ELGs.

Color Selections



a) *u-g* vs *g-r*, *ugr* selection for $20 < g < 22.5$. The $z < 2.2$ QSO locus is represented by the red oval. Stars in black. About 200 targets per deg^2.**b)** *ugr* selection for $22.5 < g < 23.5$. Star contamination is low. About 1800 targets per deg^2.**c)** *r-i* vs *g-r*, *gri* selection for $19 < i < 21.3$. Stellar sequence in black. The red oval represents SDSS LRG zone of selection. About 350 targets per deg^2.**d)** *gri* selection for $21.3 < i < 23$, About 3300 targets per deg^2.

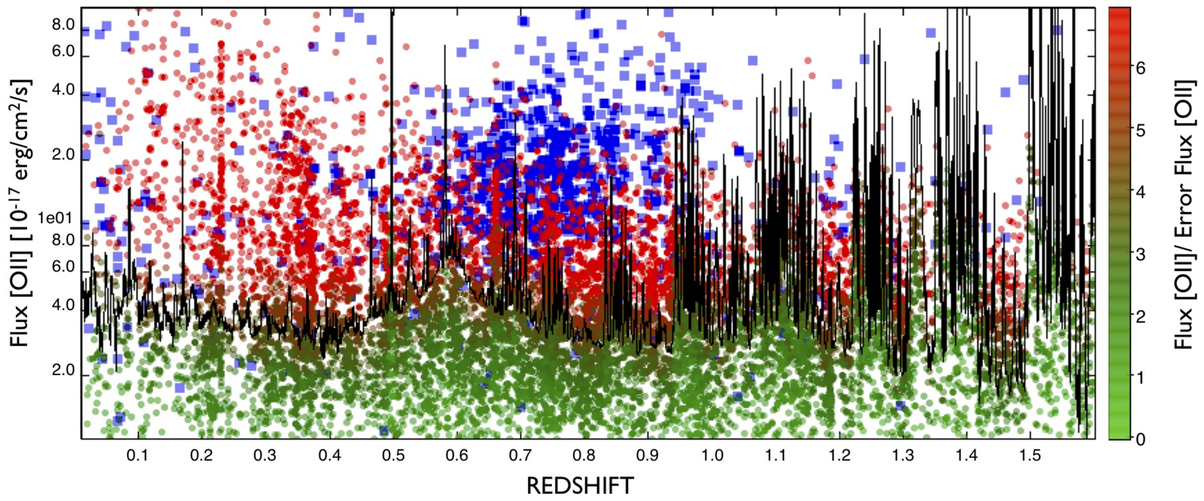


Left. Photometric redshift distribution from the CFHT-LS catalogue. Black solid line: limited to $i < 24$ (photometric redshifts limit). The *ugr* selection is more spread in redshift than the *gri* that is more concentrated.**Right.** Expected [OII] flux distribution from the CMC simulation (Zoubian et al. in preparation).
The *ugr* selects stronger emitters than the *gri* selection.

Targets were selected in the CFHT-LS catalogs (Coupon et al. 2009; Ilbert et al. 2009) and observed 2010 and 2011. The spectra were analyzed with PlateFit VIMOS (Lamareille et al. 2009) and Portsmouth Spectroscopic Pipeline (Thomas et al. 2011).

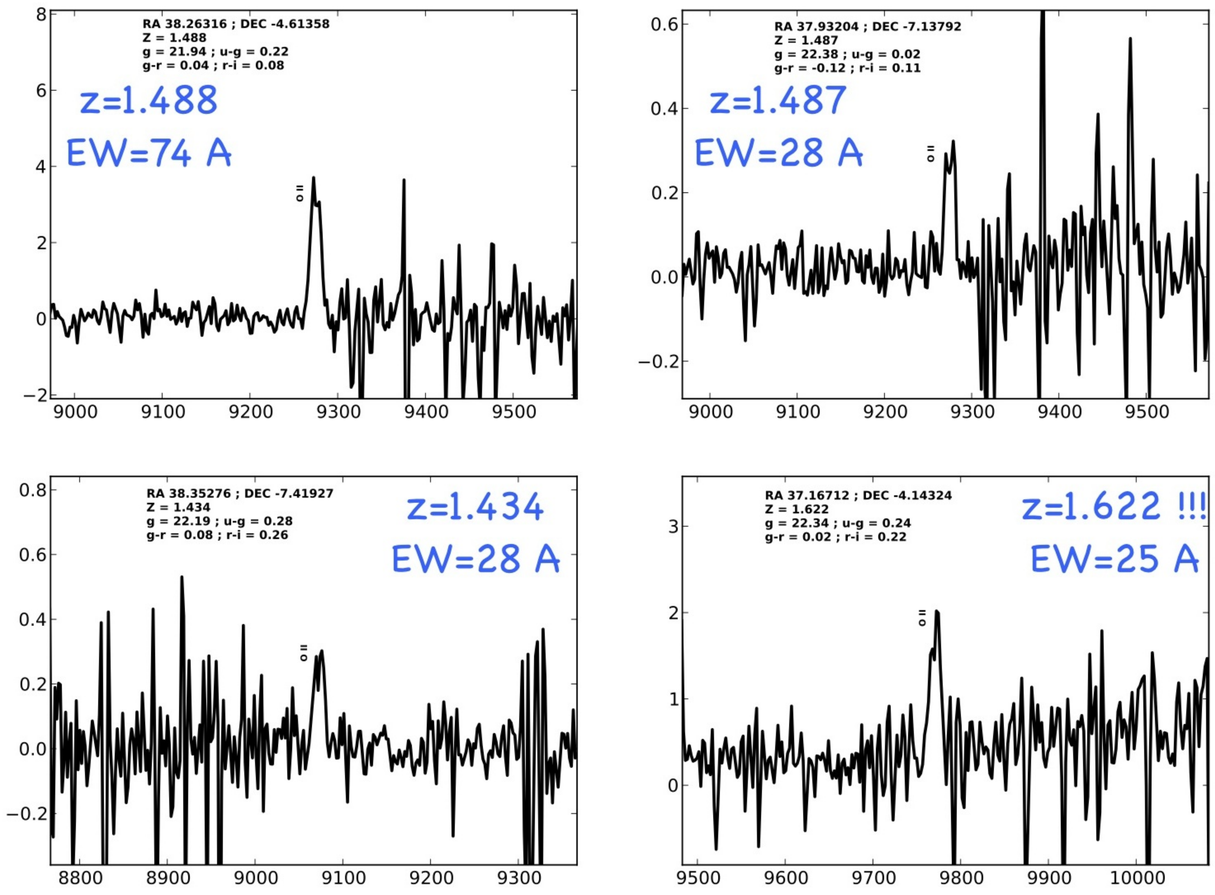
Detection Limit

The typical 5 sigma flux detection limit of the resolved [OII] emission line, necessary to assign a reliable redshift, is $5 \times 10^{-17} \mathrm{erg\,s^{-1}\,cm^{-2}}$. For $z >\sim 1.0$ [OII] is the only emission available. Thus, because of the strong OH sky line, the flux limit to reach 5σ is a function of wavelength. At $z >\sim 1.0$, 5σ detections are in $[4 \times 10^{-17} \mathrm{erg\,s^{-1}\,cm^{-2}}$ - $2 \times 10^{-16} \mathrm{erg\,s^{-1}\,cm^{-2}}]$.
The Figure shows the flux in [OII] vs. redshift. The simulated galaxies are in green and red, the observations in blue. To compare to the main source of noise, is shown in black the sky flux vs. its wavelength divided by 3727 observed a typical night at the APO observatory. The 5σ detections follow the sky. This is scaled to an observation of 1 hour on the 2.5m *Sloan* Telescope.
These observations thus strongly support the forecasts about selection made with the simulations (see poster 335.13 about target selection).



ELG spectra

Sample of the most distant observed galaxies within one hour at *Sloan* Telescope using SDSS-III BOSS spectrograph.



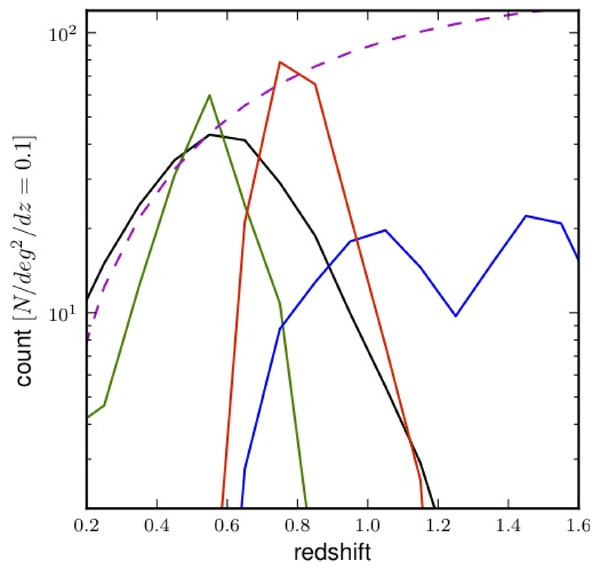
Selection efficiency

selection	reliable z	ELG, $z > 0.6$	QSOs
a)	80	32	10
b)	86.7	58.9	17.1
c)	75	58	1
d)	78.4	73.2	1.3
WiggleZ	60	35	-
BOSS	95	95	-
VIPERS	80	70	-

Removing the low redshift galaxies before observation, inspection of the images boosts *gri* CFHTLS efficiency from 73.2% to 75% and *ugr* CFHTLS efficiency from 58.9% to 65% (and still 17% of QSOs with $1 < z < 2$).

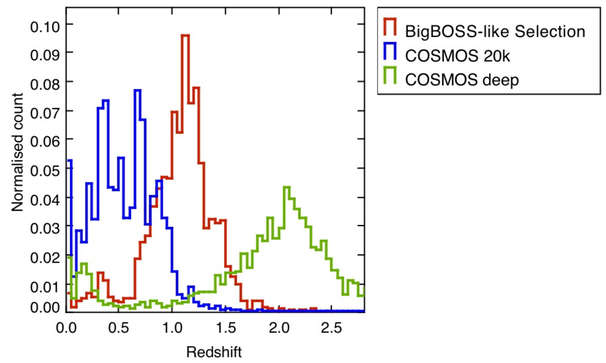
Redshift Distribution

Blue : b). Red: d). Green : BOSS. Black : WiggleZ. Dashed : constant density of $3 \times 10^{-4} \mathrm{h^3\,Mpc^{-3}}$.



Next Observations

Winter 2011/2012. VLT/FORS2 observation targeting $\approx$ 2000 ELGs with $1 < z < 1.6$ in the COSMOS field. This should probe the [OII] luminosity function of BigBOSS-like selected galaxies. The BigBOSS target selection is described on the poster 335.13.



Conclusion

Color selections are efficient to build a sample of tracers for BAO analysis made of ELGs in the redshift range $[0.6, 1.6]$. Furthermore, the ancillary BOSS observations confirm the predictions about target selection made by simulations. Finally, the efficiency of the selection criterion is directly related to the quality of the targeting photometric data and this is a critical limit for future major spectroscopic survey.

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