# QSO ABSORPTION LINES AND THE GAS AND STAR CONTENT OF HIGH REDSHIFT GALAXIES

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**ABSTRACT.** We present a unified model for the detailed chemical evolution of individual elements from $^{12}C$ to $^{56}Fe$ and the photometric properties of galaxies via spectral evolutionary synthesis. Observations of narrow, heavy - element QSO absorption lines show an increase in the number of $MgII$ systems per redshift interval for redshifts $0 < z_r \lesssim 1.5$ and a decrease in the number of $CIV$ systems for $1.3 \lesssim z_r \lesssim 4.1$. Both can be understood in terms of our galaxy evolution model accounting for SNI contributions which at the same time gives information about the structure of the Universe and about the IMF and star formation history in the intervening absorber galaxies. The spectrophotometric aspect of our unified model predicts spectral and photometric properties of these galaxies testable by optical identifications.

**RESULTS.** The abundances of both $^{24}Mg(z_r)$ and $^{12}C(z_r)$ trace the evolution of the global metallicity $Z(z_r)$ within the statistical error bars of the observational data, despite the partly different nucleosynthesis sites of these elements. Our model agrees well with the $MgII$ & $CIV$ observations of Steidel et al. (1989) and Steidel (1990) for $(H_0,\ q_0,\ z_{form}) = (50,\ 0.5,\ 5)$. This shows that the metallicity maximum at some redshift $1.1 \lesssim z_r \lesssim 1.5$ should be real. The $CIV$ data trace the chemical enrichment process while in $MgII$ a heavy element dilution effect is seen for $z_r \lesssim 1.4$ caused by the large number of low mass stars ($\sim 1\ M_\odot$) dying at late epochs giving back unenriched gas only. The constraints on the cosmological parameters, $50 \lesssim H_0 \lesssim 70$, $\Omega_0 \simeq 1$, $\Lambda_0 = 0$, and $5 \lesssim z_{form} < 10$, are consistent with those obtained from comparison of our spectrophotometric results with observations of high redshift galaxies ($z_r \lesssim 2$).
For the heavy element dilution effect to show up the gas content must be $<$ 10 %, the SFR must have been declining strongly enough with time : $\Psi \sim e^{-t/t_*}$ with $t_* \sim 1.0 \pm 0.2 Gyr$ and the IMF must be steep enough at high masses (of a Scalo rather than a Salpeter form) in the (halos of the) intervening galaxies. These results are independent of the cosmological model, the most distant galaxies seen in $CIV$ absorption at redshifts $z_r \sim 4.1$ have evolutionary ages of only $\sim 1\ Gyr$.

Fritze - v. Alvensleben, U., Krüger, H., Fricke, K. J., Loose, H.-H. 1989, A&A **224**, L1
Fritze - v. Alvensleben, U., Krüger, H., Fricke, K. J. 1991, A&A **246**, L59
Steidel, C. C. 1990, Ap. J. Suppl. **72**, 1
Steidel, C. C., Sargent, W. L. W., Boksenberg, A. 1988, Ap. J. Letters **333**, L5

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