THE FOREST OF ABSORPTION LINES IN QSO SPECTRA – – A KEY TO THE LARGE SCALE STRUCTURE DEVELOPMENT?

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ABSTRACT. For six published high resolution QSO spectra a correlation analysis of unidentified absorption lines is performed. The two-point correlation functions typically show some quasiperiodic structure. The results allow for the interpretation that absorbing clouds lie in sheetlike structures as predicted by the pancake theory.

1. Motivation

In recent years new observational facilities provided a lot of high resolution QSO spectra which shed light upon the nature of the emission region of the quasar as well upon foreground absorbing matter. Our interest concerns the nature and the distribution of the intervening matter. The most spectra show, besides a small number of identified absorption line systems, a large number of unidentified absorption lines shortward of the Ly emission line. The most of them represent probably Lyα absorption lines stemming from HI clouds on the line of sight to the QSO. Nowadays indications on a strong clustering of the absorption systems containing metal lines has been found in a large sample of data (Crotts 1985). On the other hand, the absence of a positive correlation of the positions of unidentified lines at small wavelength differences (Sargent et al. 1980) raised some debate. Furthermore, contrary to the hypothesis of Oort (1981) no cross-correlation of the absorbers in a close QSO pair has been detected (Sargent et al. 1982).
A connection between the observed superclustering and the distribution of absorbing matter follows quite naturally within the pancake theory (adiabatic theory) of the formation of the large-scale structure (Doroshkevich 1984). Contrary to earlier claims, the number density of absorbers proves to be compatible with the present spacing between superclusters (Doroshkevich and Mücket 1985).

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We performed a correlation analysis of 6 recently published high resolution spectra and made comparisons with corresponding Monte-Carlo-simulations.

2. Results

The two-point correlation functions typically show some quasiperiodic structures which are expected for absorption clouds being collected in sheetlike structures. All correlation functions are constructed along the null geodesic to the quasars, cutting the absorbing matter in the redshift range z = 2 ... 3. The redshift differences are transformed into comoving distances $s_o = r_o H_o/c$, using cosmological models with density parameters $\Omega_o \triangleq 1$ and $\Omega = 0.2$. The open model provides more convincing results in the collection of different correlation data.

Quasars with small angular separations on the plane of the sky deserve special attention, for the cross-correlation function is not influenced by effects of finite spectroscopic resolution. The distribution of nearest neighbours along both light rays show some fine structure at $\Delta s_o = 7\ 10^{-4}$ (See Fig. 1; the broken line shows the Poisson distribution corrected for the finite spectroscopic resolution.)

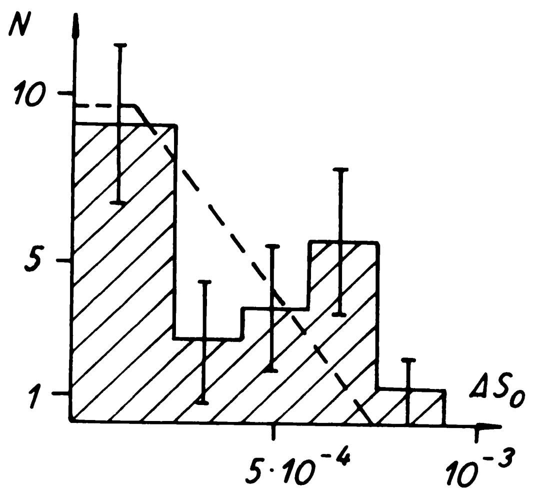

Figure 1. The number of nearest neighbours of Ly absorbers in the double QSO 1623 + 268/269

A collection of significant peak positions in the two-point correlation function of five QSO's is given in Fig. 2.(The data are from Atwood et al. (1985), Sargent et al. (1982) and Carlswell et al. (1982, 1984).) As a measure of reliability of the signal the ratios of peak hights to the normal deviation is given on the ordinate (for coinciding separations the reliabilities are summed up). The open bars result from less certain features, not visible in the correlation functions of each choosen bin width. The shadded first bars are seen only in the cross-correlation function of the double QSO. The data allow the interpretation that the absorption

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clouds lie in sheetlike structures and have an inner velocity dispersion of about 150 km/s, while the sheets are separated on the line of sight by $\Delta s_0 = (3 \ldots 5)\, 10^{-3}$. This is comparable with the spacing of superclusters in our neighbourhood ($\Delta s_0 = 10^{-2}$). The results are in favour of early beginning of the pancake formation which should be underlined by further observational data.

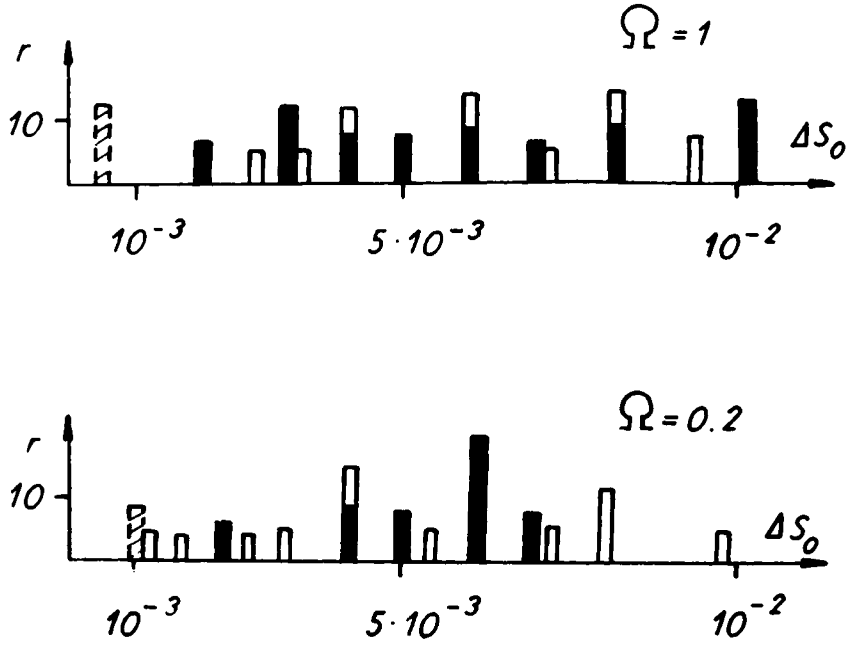

Figure 2. A collection of significant peak positions in the two-point correlation function of five QSO's

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