EXTENDED EMISSION FROM A DAMPED ABSORBER AT Z=1.93 : THE SIZE OF A DLA

Johan U. Fynbo[1,2], Palle Møller[2,3], Stephen J. Warren[4]

[1] *Institute of Physics and Astronomy, University of Århus, DK-8000, Denmark*
[2] *Space Telescope Science Institute, 3700 San Martin Drive, Baltimore, MD 21218, USA*
[3] *on assignment from the Space Science Department of ESA*
[4] *Blackett Laboratory, Imperial College of Science Technology and Medicine, Prince Consort Rd, London SW7 2BZ, UK*

1 Introduction

At present about 100 confirmed DLAs are listed in the literature [1], [2]. Spectroscopic work on the underlying quasars has provided detailed information about metallicities, dust content, and gas dynamics of the DLA clouds, but we know very little about their sizes and morphologies. In particular we do not know whether DLAs are e.g. large spiral disks in formation or small galaxy subunits. The obvious way to resolve this long standing controversy is through imaging. By performing narrow band imaging in a filter tuned to Lyα at the redshift of the absorber we can circumvent the problem of the strong emission from the QSO. Due to the damped absorption line the QSO emission will be almost completely absent in the narrow band image making the DLA itself, if it is a Lyα emitter, stand out clearly.

Much telescope time has gone into the narrow band imaging of DLAs over the past decade, but resulting in only a single confirmed detection so far [3], [4]. In addition a spectroscopically confirmed broad band detection [5] and purely spectroscopic detections of Lyα emission have been reported [6].

2 The DLA towards Q0151+048A

In the spectrum of the A component of the physical QSO pair Q0151+048 (z_A=1.922, z_B=1.937) obtained with the ESO NTT 3.5m telescope, we detected an emission line in the bottom of the damped Lyα absorption line (z_{DLA}=1.9342) [7]. Here we report on imaging done with the Nordic Optical Telescope through a narrow band filter tuned to that emission line. The left panel in Fig. 1 shows the result of 17 hours of imaging in the narrow band. Point spread functions (PSFs) of the two quasars (their positions marked by "+") have been subtracted, and extended line emission from the DLA covering 6x3 arcsec^2 is clearly detected. The measured flux of Lyα emission from the DLA is 1.88(4) x 10^{-15} erg cm^{-2} s^{-1}.

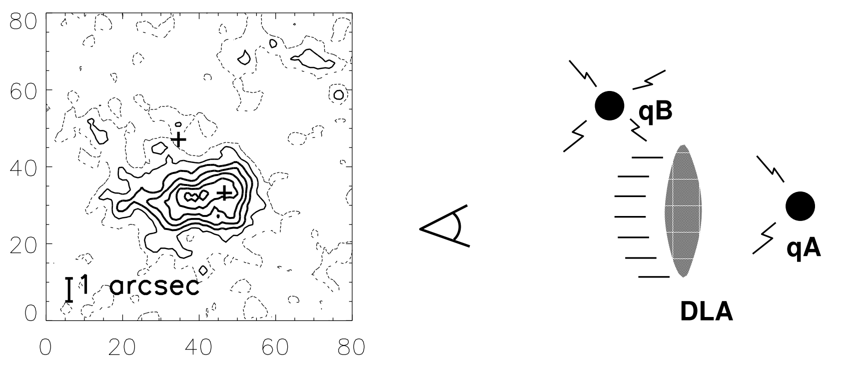

Figure 1: Left : A region of 14×14 arcsec surrounding the QSO pair after subtraction of the two QSO PSFs. Seen is emission extending over 6x3 arcsec^2. Right : the suggested geometry of the the DLA and the two QSOs.

3 Discussion

Assuming q_0=0.5, H_0 = 100h km s^{-1} Mpc^{-1} and $\Lambda = 0$ the measured flux corresponds to a Lyα luminosity of 1.19(3)x10^{43}h^{-2} ergs s^{-1}. This is an order of magnitude higher than what is emitted from DLAs previously detected. This suggests that the source of ionization might be different for this DLA. The right panel in Fig. 1 shows the suggested geometry of the system. We suggest that qB is ionizing the side of the DLA facing us. To derive the maximum distance between qB and the DLA under this hypothesis we assume that the spectrum of qB can be modelled by a power law $f_\nu \propto \nu^{-\alpha}$ and that 68% of all photons below the Lyman limit produce a Lyα photon. These assumptions result in a upper limit of 40h^{-1}kpc for the distance between qB and the DLA.

In this interpretation we see the irradiated face, and thus the full outline, of the DLA which in the assumed cosmology is 24x12h^{-2} kpc^2.

References

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