Analyzing Quasar Sight-Lines

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1 Introduction

Lyman Limit Systems (LLS) are pockets of dense clouds in the intergalactic medium where the number density of hydrogen (NH_I) integrated along the Line of Sight (LOS) is between 10^{17} cm $^{-2} < NH_I < 10^{20}$ cm $^{-2}$. We will define a pre-LLS to be a dense cloud of gas with density contrast $\delta > 10^2$, that has not been ionized yet. The aim of this report is to analyze the distribution of pre-LLS.

2 Methods

We will first analyze the number density of LLS as a function of the distance from a quasar. To do this, a halo was chosen from the simulation. From the halo 10 000 sight-lines were drawn in random directions. Each of the sight-lines had a length of 10 cMpc. For the sight-lines that extended beyond the boundary of the box, we looped them around to be inside the box. For example, if the end of a LOS is given by the cell numbers (1025, 0, 2) the new end of the LOS will be (1, 0, 2) so that it remains in the simulation box. Once this was done, the density contrast of the cells along the LOS was recorded. Cells that had a density contrast greater than 10^2 were determined to be pre-LLS. Then, the distance of the pre-LLS from the quasar was calculated. Note that many of the sight-lines that were drawn did not include any LLS so these were discarded from the analysis.

Now, we will analyze how the density contrast changes along LOSs. To do this, we found the density contrast as a function of the distance from the quasar. Then, the peaks $\Delta_{\max}$ were found.

3 Results

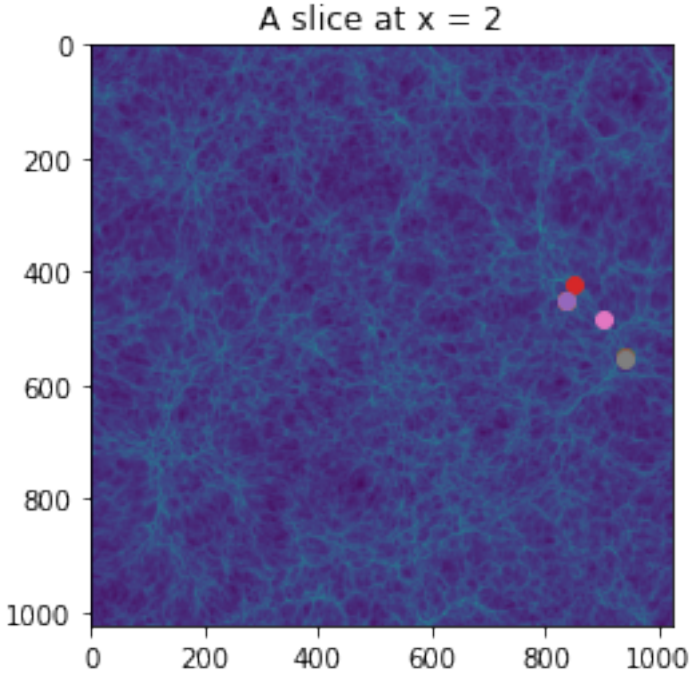

Figure 1: An image of a slice at x = 2 of Δ. The points represent the positions of the pre-LLS in this slice.

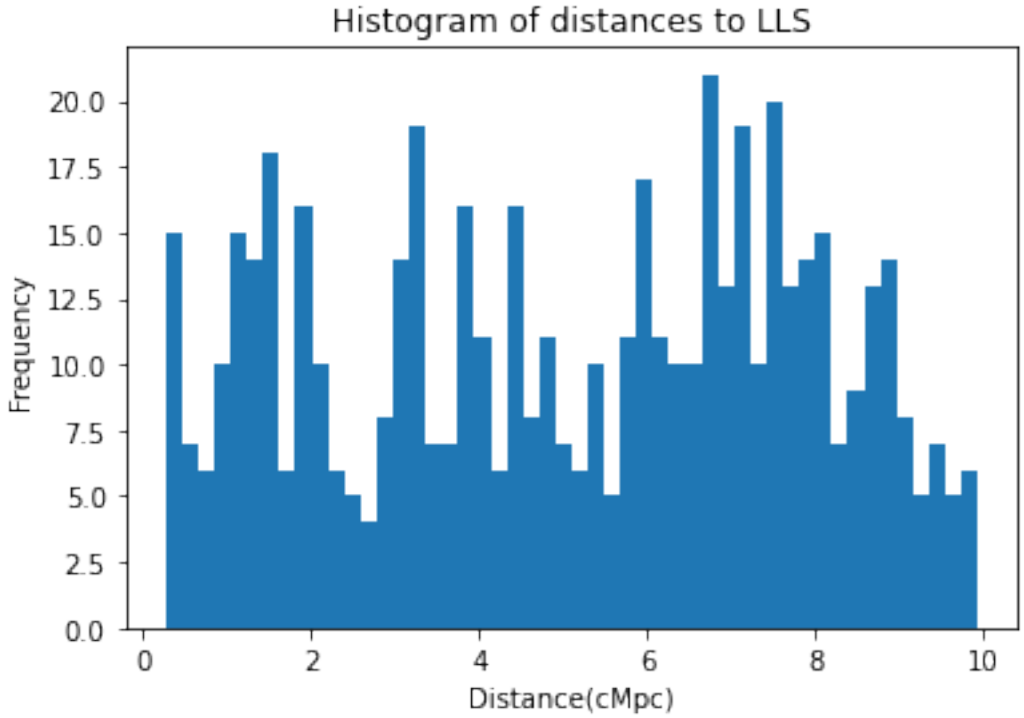

Figure 2: A histogram of the number of pre-LLS as a function of the distance from the quasar

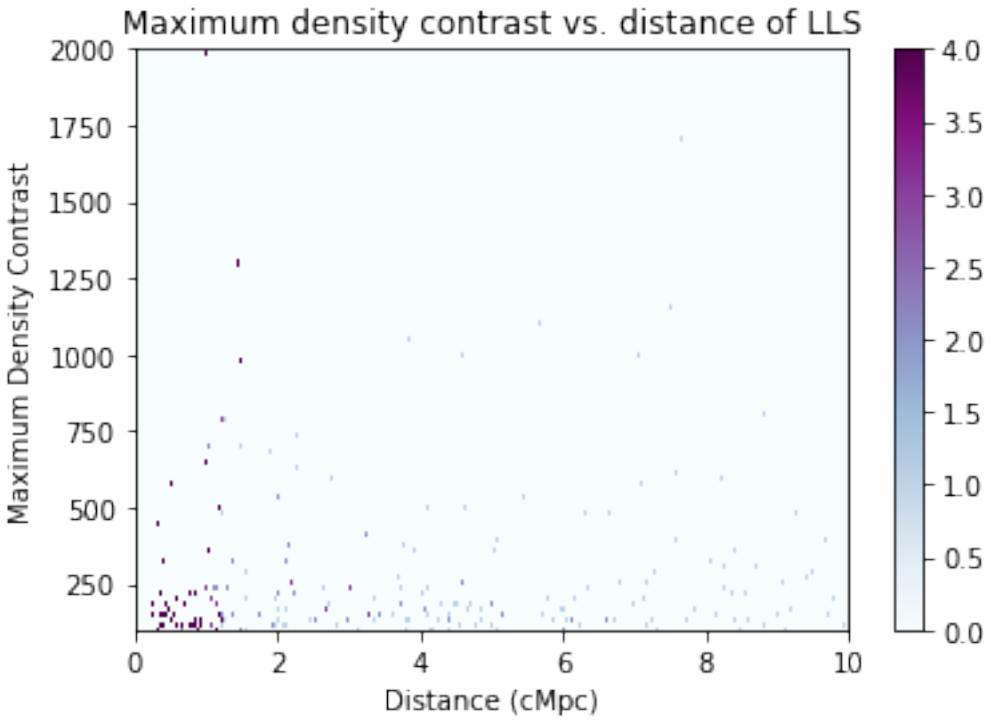

Figure 3: A 2D histogram of the density contrast maxima and the distance from the quasar