

CALIFORNIA INSTITUTE OF TECHNOLOGY

Ph20 Assignment 7

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1 PARTS 1-3

On the two figures below the data from 2011 is plotted of distance modulus and luminosity distance against redshift.

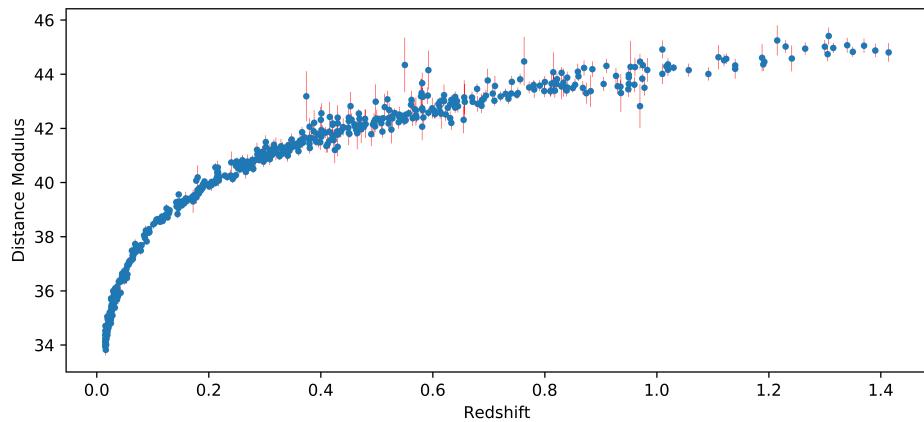


Figure 1.1: Distance modulus against redshift

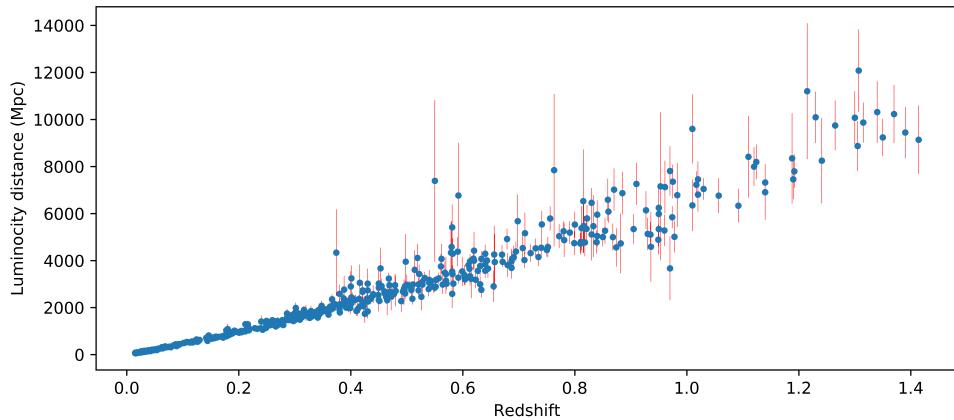


Figure 1.2: Luminosity distance against redshift

2 PART 4

Choosing low redshift events ($z < 0.05$) it can be seen that they can be approximated by a linear regime. This means that computing the gradient of this straight line can be useful in order to obtain Hubble's constant. This was calculated and found to be $H_0 = 68.508$.

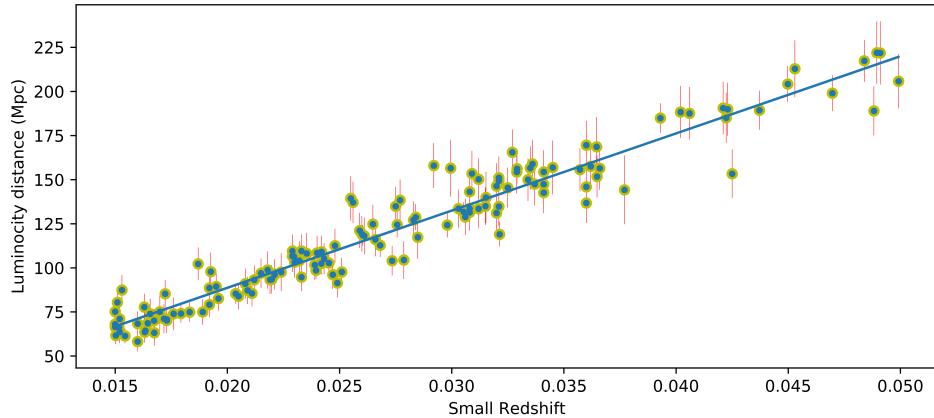


Figure 2.1: Luminosity distance against redshift for $z < 0.05$

3 PART 5

Of course, the linear regime is not accurate enough to provide a reliable Hubble constant so the model is altered and a non-linear regime is plotted for all observed red-shifts. Computing the Hubble's constant with this way gives $H_0 = 60.191$, with $q = 0.286$.

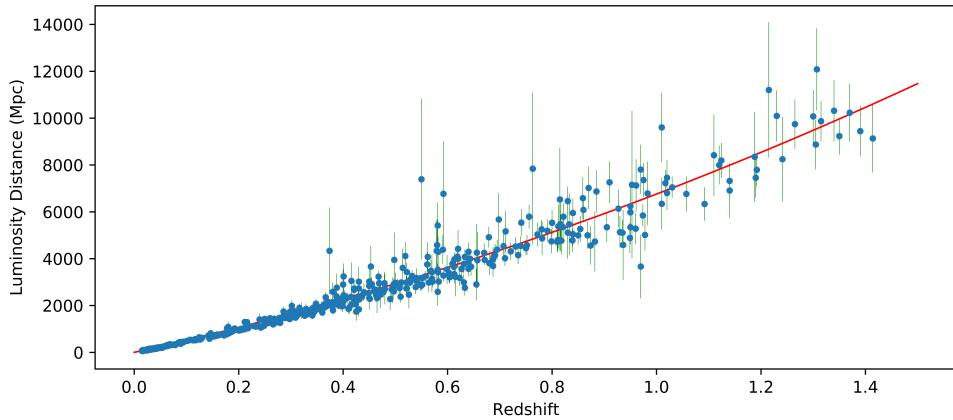


Figure 3.1: Luminosity distance against redshift in the non-linear regime

4 PARTS 6,7,8

Using the FLRW metric expression for the luminosity distance the Hubble's constant was found to be $H_0 = 62.119$. Ω_M was found to be 0.38 which means that $\Omega_\Lambda > 0$ with a statistical significance of 13.57, so universe is expanding and accelerating. From the figure below it can be seen that there is a small decrease of the linear fit curve at large redshifts.

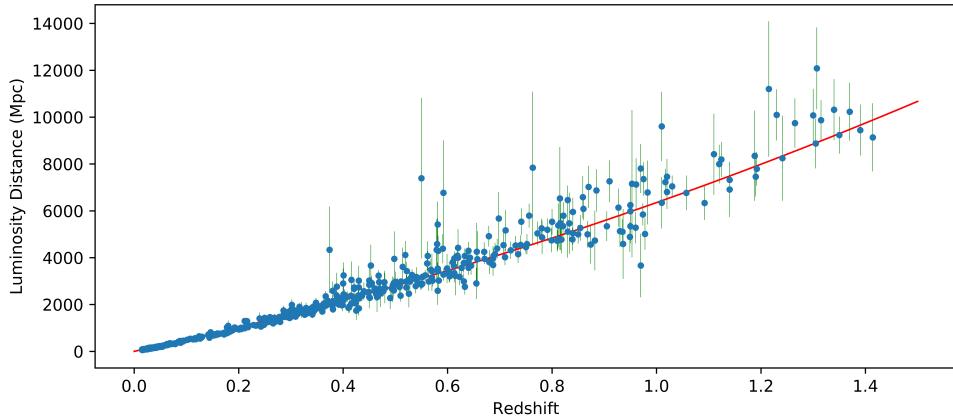


Figure 4.1: Luminosity distance against redshift in the non-linear regime corrected by FLRW metric