ASTR 5460, Fall 2013: Homework 5

Michael S. Brotherton, Instructor, Due Thursday Oct. 15th

Problems 1-4: Do problems 6.1, 6.2, 6.3, and 6.7 from Ryden.

5. In Ryden's problem 5.2, you looked at dz/dt_0. We will examine this in more detail and consider the problem from an observer's perspective. Read Loeb (1998), which is on the website, and fill in his missing steps to go from equation 1 to equation 3 (and correct the error in equation 3!). Keep in mind that we're looking for small changes and that a series expansion is in order, and that some terms can be neglected. Using the current Benchmark cosmology as described by Ryden, given a timespan of ten years, what kind of changes in redshift would you see for a quasar at $z = 2$. Express the answer in km/s (as in equation 3 of Loeb). Comment on Loeb's argument that this would be measureable using Keck and 100 quasars over a decade.

Note: High-redshift quasars show an absorption line phenomenon called the Lyman alpha forest. Light from distant quasars passes through intergalactic gas and through gas clouds associated with foreground galaxies on its way to our telescopes. When the spectra of these quasars is obtained, absorption lines from these gas clouds is present. The primary line observed is from neutral hydrogen, Lyman alpha, at 1216 Å, and there may be hundreds of these lines present in a high-z quasar spectrum. Because the redshifts of these gas clouds differ, the lines are spread out into a "forest." These absorption lines provide the ideal test for measuring dz/dt, since many measurements can be made for each quasar, multiplying the power of each observation. Think about how many lines can be distinguished per resolution element and what sort of wavelength change can be detected between two observations. Also think about how multiple observations can beat down the noise of a measurement. Also consider general redshift bins since the forest will span a range of redshifts.