Expanding universe II

- Schneider, Section 4.3: Consequences of the Friedman expansion

3. Homework

Adopt the cosmological parameters as given in eq. 4.35 in Schneider.

1) What is the luminosity distance for objects at a redshift of z=1 and 2? Why is the ratio of the distances different from 2?

2) Plot the angular size versus redshift (up to z=10) for a galaxy with a size of 10 kpc. Also give the lines of code in the report. At what redshift(s) subtend(s) a galaxy of 10 kpc 1.5 arcsec on the sky?

3) Have a look at Bouwens et al. Nature **469,** 504-507 (2011)
http://www.strw.leidenuniv.nl/~bouwens/z=10/nature09717_proof1.pdf

- How old do you calculate the universe was at z=10? Is the number different from the one quoted in the paper? and if so why?
- Why is this an important result?

Hint for 1, 2, 3 : use IDL routines as given in http://idlastro.gsfc.nasa.gov/
or use http://www.astro.ucla.edu/~wright/CosmoCalc.html

4) The deceleration parameter is defined as: $q_0 := \ddot{a}a/\dot{a}^2$. Following Schneider, p. 153 derive $q_0 = \Omega_m/2 - \Omega_\Lambda$.

5) Following Schneider 4.3.4 and starting from eq. 4.31, derive that for an Einstein - de Sitter Universe the age of the universe is: $t=2/(3H_0)$. Taking a $H_0 = 72$ km/s/Mpc, what is the resulting age? What is the problem with this age?