COSMOLOGY: AST 625

Home work 1

There are three cosmological models. In all the models, matter is non-relativistic. (1) Flat universe with $\Omega_{\rm matter,0} = 0.3$. (2) Open Universe with $\Omega_{\rm vac,0} = 0$, $\Omega_{\rm matter,0} = 0.3$. (3) Open Universe with $\Omega_{\rm matter,0} = 0.3$, $\Omega_{\rm vac,0} = 0.3$. The Hubble constant at present is the same for all the models.

(a) Which model is older?

(b) Make a plot of the look-back-time and the age of the Universe for the same three cases for $z = 0 - 20$. The Hubble constant at present is $h = 0.7$. For comparison also show the look-back-time and the age for a flat universe with no vacuum energy.

(c) Make a plot of $\Omega_{\rm matter}(1+z)$, $\Omega_{\rm curv}(1+z)$, and $\Omega_{\rm vac}(1+z)$

(d) What is the temperature of CMB in the models at $z = 1000$?

(e) What is the physical density of matter in the models at $z = 100$. Give the answer in units of hydrogen atoms per cm^3. The Hubble constant at present is $h = 0.7$.

(f) What is the Hubble constant at $z = 2$? The Hubble constant at present is $h = 0.7$.