

Ast/Phys 5022
Fall 2008
Problem Set #4 (due Oct 23)

1. Our Universe consists of matter/dust, cosmological constant, and radiation. Today's values for the contributions of these components to the total energy density content are (approximately): $\Omega_r = 8.5 \cdot 10^{-5}$, $\Omega_m = 0.3$, and $\Omega_\Lambda = 0.7$.

(a) Calculate the scale factor a and the corresponding redshift z of the epoch when matter and radiation contributed equally to the energy density of the universe.

(b) Calculate the scale factor a and the corresponding redshift z of the epoch when matter/dust and cosmological constant contributed equally to the energy density of the universe.

2. When discussing particle and event horizons, we saw that the redshift of a given object, as seen by us, will change with cosmic time. Assuming that neither the object nor we move from our respective coordinate locations, calculate the redshift of an object, z , which is currently seen by us at $z_0 = 1$, at a later cosmic time, t , such that $t/t_0 = 100$, and t_0 is the present age of the Universe. Assume that the global geometry is flat, and $\Omega_m = 1$.