Problem Set 3

8.952 Fall 2004

1. Work out the classic cosmic tests (luminousity distance, angle distance, source counts) for the $k \neq$ FRW universe, for small z. Then determine how to measure the (spatial) curvature of the Universe.

2. Calculate the drag on charged particles moving throught the μ-wave background. How does this affect the growth of small inhomogeneities by gravitational attraction?

3. What owuld be the qualitative effect of the following on light nuclear abundances? Say whether $\frac{d}{p}$ and $\frac{He}{p}$ would go up, go down, or remain pretty constant in response to:

   (a) Larger $\frac{n_b}{n_\gamma}$

   (b) G_F smaller (weak interaction slower)

   (c) more neutrino species

   (d) G_N larger (gravity stronger)

   (e) α smaller

   (f) α_S smaller

   (g) m_μ, m_d, m_e, m_s vary: optional– this could be a research project.
   What are the anthropic implications– how sensitive is the existence of life as we know it to all of these factors?