Homework 4, due 10/5/04

8. In a flux-limited sample, the spectra of the sources satisfy

$$L \propto \nu^{-\alpha} \quad .$$

   a. Assuming that the sources are unlimited in redshift and have a fixed commoving density, i.e.,

$$\phi(t_1, L) = \left(R_0 / \ R_1\right)^3 \phi(t_0, L)$$

      find the leading deviation of the number counts from the Euclidean limit in a Friedman as a function of L. First do the case $\Omega_0 = 1$ and then try to generalize to arbitrary Ω_0.

   b. Plot the results of a. for a specific luminosity function, say, the one in Ex. 1.

9. The surface brightness of all sources up to redshift z is given by

$$\sigma(< z) = \int_{t_z}^{t_0} \left(\frac{R_1}{R_0}\right)^4 j(t_1) dt_1 \quad ,$$

   where $j(t_1) = \left(L / \ 4\pi\right)\phi(t_1, L) dL$ is the emissivity of the galaxies (luminosity per unit volume per steradian). Show that the relativistic correction resolves Olbers' paradox.

10. Work out the luminosity distance as a function of redshift for a standard candle in a flat universe with a nonzero cosmological constant.