1 Problem 1: Conformal Time and Horizons

• Assume the universe today is flat with both matter ($\Omega_m$) and a cosmological constant ($\Omega_\Lambda$). (a) Compute the conformal age or horizon of the universe and plot your result for $H_0/\eta_0$ as a function of $\Omega_m$. [numerically integrate for a few values and sketch the behavior] (b) What is the current horizon size for a universe with $\Omega_m = 1/3$ and $h = 1/\sqrt{2}$? (c) What is the mass contained within the current horizon in solar masses. If all objects were $10^{13} h^{-1} M_\odot$ in mass, how many are in the observable universe.

• Evaluate the conformal age as a function of the scale factor in the above cosmology. What happens when $a \rightarrow \infty$. Comment on the implications for establishing causal contact between observers currently separated by much more than a Hubble length.