In the name of God

Department of Physics
Shahid Beheshti University

ADVANCED TOPICS IN MODERN COSMOLOGY

Exercise Set 14

(Date Due: 1393/02/30)

1. Solve problem 7.8 (Physical Foundation of Cosmology, V. Mukhanov)

2. Solve problem 7.9 (Physical Foundation of Cosmology, V. Mukhanov)

3. Plot the metric fluctuation for Ultra-relativistic matter as:

$$\Phi_{\mathbf{k}} = \eta^{\nu}\left[C_1 J_{\nu}\left(\sqrt{w}k\eta\right) + C_2 Y_{\nu}\left(\sqrt{w}k\eta\right)\right]$$

where, $\nu \equiv \frac{1}{2}\left(\frac{5+3w}{1+3w}\right)$ and C_1, C_2 are the integration constant. Use different values for w.

4. Using the conserved value which is so-called $\zeta = \frac{2}{3}\frac{\mathcal{H}^{-1}\Phi'+\Phi}{1+w} + \Phi$,show that:

$$\Phi_f = \left(\frac{1+w_f}{1+w_i}\right)\left(\frac{5+3w_i}{5+3w_f}\right)\Phi_i$$

Good luck, Movahed