PGF5299: Physical Cosmology II

Problem Set 1

(Due August 30, 2019)

1) Dodelson 7.2. Make a plot comparing the Transfer Function computed in this problem to a) the BBKS Transfer Function and to b) the CAMB Transfer Function at the same cosmology. Use log scale and appropriate ranges.

2) Growth Function: Use a numerical differential equation solver to **numerically** evolve Eq. 7.73 (or Eq. 7.74) in Dodelson's book, obtaining the growth function $D(a)$ as a function of scale factor (or redshift). Normalize your numerical $D(a)$ such that it is equal to a at early times ($a \ll 1$) and plot your numerical results in the same range and scale as shown in Dodelson's Fig. 7.12. Next obtain another estimation of $D(a)$ by performing the integral in Eq. 7.77 and plot these results in the same plot as the previous calculation. Do both types of calculations for $w = -1$ and two flat models with $(\Omega_{\rm m}, \Omega_\Lambda)$=(1.0,0.0), (0.3,0.7) and an open model with $(\Omega_{\rm m}, \Omega_\Lambda)$=(0.3,0.0). Show all cases in the same plot for comparison, using different colors for the differential equation solver (blue) and integration method (red) and different line types (solid, dashed, dotted) to differentiate the models.

How do both your results compare to each other? And to Dodelson's Figure?

3) Dodelson 7.7